Response of Sakkoti Date Palms to Foliar Application of Royal Jelly, Silicon and Vitamins B

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ABSTRACT: This investigation was established during 2011 and 2012 seasons to test the effect of spraying royal jelly at 0.025 to 0.1 %, potassium silicate at 0.05 to 0.2 % and vitamins B (B_1 at 250 ppm + B_6 at 100 ppm and B_{12} at 250 ppm) either singly or in all possible combinations on growth, leaf content of N, P, K and Mg, yield as well as physical and chemical characteristics of Sakkoti date palm fruits. Single and combined applications of royal jelly, silicon and vitamins B were very effective in enhancing growth, nutrients namely N, P, K and Mg in the leaves, yield and fruit quality in relative to the check treatment. Using royal jelly was superior than using silicon in this respect. Combined application was preferable than using each compound alone in enhancing fruiting. Carrying out four sprays of a mixture containing royal jelly at 0.05 %, potassium silicate at 0.1 % and vitamins B (B_1 at 250 ppm, B_6 at 100 ppm and B_{12} at 250 ppm) gave the best results with regard to yield and fruit quality of Sakkoti date palms.
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1. Introduction

Nowadays, many effects had been established for finding out the best horticultural practices that are responsible for enhancing yield and fruit quality of the prime date palm cv. Sakkoti. Previous studies emphasized the beneficial effects of using vitamins B, silicon and royal jelly on horticultural crops **(Heyl, 1951; Oretili, 1987 and Epstein, 1999).**

Recently, it was suggested that all vitamins participate in plant growth and production. Most essential physiological processes such as photosynthesis, biosyntheses of all organic foods, enzymes formation, cell division as well as uptake of water and nutrients greatly depended on the occurrence of vitamins B. These vitamins with their antioxidative characters play an important role in plant defense against oxidative stress induced by all chemicals. They also responsible for enhancing the secretion and the biosynthesis of natural hormones **(Robinson, 1973 and Samiullah *et al*., 1988).**

Although, silicon is the most abundant element both on the surface of the earth and in the soil, it has not yet been listed among the essential elements for higher plants. The beneficial effect of silicon on mitigating various abiotic stresses is attributed to its, effect on stimulating of antioxidant systems in plants **(Epstein and Bloom, 2003).**

Rare literatures are available about the impact of royal jelly on horticultural crops. It is secreted from the heads of queen bees. It is synthesized from pollens, water and honey mixed with saliva, hormones and vitamins. It contains 65.3 % water and 34.7 % dry matter. The dry matter portion composes from 48.2 % proteins, 37.8 % carbohydrates, 10.4 % lipids and 2 % ash. It is also contains vitamins B_1, B_2, B_5, B_6, B_8 and B_9 as well as vitamin C. It contains at least 17 amino acids, different nutrients (K, Mg, Ca, Fe, P, S, Mn and Si) and gonadotophic and sex hormones **(Heyl, 1951 and Nation and Robinson, 1971).**

Remarkable promotion on growth, nutritional status, yield and fruit quality of horticultural crops was observed to using vitamins B **(Gobara, 2004; Ragab, 2004; Gamal, 2006; Badran and Ahmed, 2009; Eshmawy, 2010; Madian and Refaai, 2011; Ahmed *et al*., 2011; Hegab and Hegab, 2011 and Ahmed *et al*., 2012);** silicon **(Matichenkov *et al*., 2000; Neumann and Zur- nieden, 2011; Kanto, 2002; Ma and Takahashi, 2002 and Gad El-Kareem, 2012)** and royal jelly **(Townsend and Lucas, 1966; El- Maziny and Hassan, 1990 and El-Shaikh, 2010)**.

The target of this study was elucidating the beneficial effects of using vitamins B, silicon and royal jelly on fruiting of Sakkoti date palms.

2. Materials and Methods

This study was carried out 2011 and 2012 seasons in a private orchard situated at Kom Ombo district, Aswan Governorate on 30 palms 25- years old Sakkoti date palms. Soil texture is silty clay and the palms are planted at 7 × 7 meters apart. The selected palms were irrigated through surface system. Pruning was carried out to maintain leaf bunch ratio at 8: 1 (according to **Al- Baker, 1972)**. Number of female spathes per each palm was adjusted to ten spathes. Artificial pollination was achieved by inserting five male strands into the female bunch using known high activating pollen source throughout 2 – 3 days after female spathe craking followed by bagging **(Shaheen, 1986 and Omar, 2007)**. Each selected palm received the common horticultural practices that are already applied in the orchard except those dealing with using royal jelly, silicon and vitamins B.

This study included the following twenty treatments from two factors (A & B). The first factor (A) consisted from ten treatments from single and combined applications of royal jelly and silicon arranged as follows:

a_1- Control.
a_2- Spraying royal jelly at 0.025 %.
a_3-Spraying royal jelly at 0.05 %.
a_4-Spraying royal jelly at 0.1 %.
a_5-Spraying potassium silicate at 0.05 %.
a_6-Spraying potassium silicate at 0.1 %.
a_7-Spraying potassium silicate at 0.2 %.
a_8-Spraying royal jelly + potassium silicate at mid. conc.
a_9-Spraying royal jelly + potassium silicate at low conc.
a_{10}-Spraying royal jelly + potassium silicate at high conc.

While, the second factor (B) comprised from two treatments of vitamins B namely b_1) Nil and b_2) Application of vitamins B namely thiamine (B_1) at 250 ppm + pyridoxine (B_6) at 100 ppm + cyanocobalamine (B_{12}) at 250 ppm.

Each treatment was replicated three times, one palm per each. Royal jelly was stored at 0 ° C just after taking from bee hive. It was dissolved in cold water before application to prevent degradation. Royal jelly, potassium silicate (25 % SiO_2 and 10 % K_2O) and vitamins B were sprayed four times at growth start, just after fruit setting and at one month intervals. Triton B as a wetting agent was added at 0.05 % to all spraying solutions. Untreated palms were sprayed with water containing Triton B. Randomized complete block design in split plot arrangement was followed. The ten treatments from single and combined applications of royal jelly and silicon occupied the main plots and the two treatments of vitamins B ranked the subplots.

During both seasons, the following parameters were carried out:-

1) Total surface area/ palm (m^2) (**Ahmed and Morsy, 1999**).
2) Total chlorophylls (a + b) as (mg/ 100 g F.W) **(Wettstein, 1957).**
3) Percentages of N, P, K and Mg in the dried leaves according to **Chapman and Pratt (1975).**
4) Percentages of total carbohydrates in the dried leaves according to the procedures that outlined in **A.O.A.C (1995).**
5) Bunch weight (kg.).
6) Yield/ palm (kg.) at the first week of September.
7) Some physical and chemical characteristics of the fruits namely fruit weight (g.), total soluble solids %, total and reducing sugars % **(A.O.A.C., 1995)**, total acidity % (as g malic acid/ 100 g pulp) according to **A.O.A.C., (1995)**; fibre crude % and total soluble tannins % **(A.O.A.C., 1995).**

All the obtained data were tabulated and subjected to the proper statistical analysis using new L.S.D at 5 % according to **Mead *et al*., (1993).**

3. Results and Discussion

1) Growth and leaf chemical composition:

It is clear from the data in Tables (1 & 2) that single and combined applications of royal jelly at 0.025 to 0.1 % and silicon at 0.05 to 0.2 % significantly improved the total surface area per palm, total chlorophylls as well as percentages of N, P, K, Mg and total carbohydrates in leaves relative to the check treatment. The promotion was associated with increasing concentrations of royal jelly and silicon. Using royal jelly was superior than using silicon in this respect. Combined application of royal jelly and silicon was preferable than using each compound alone in this respect. Increasing concentrations of each compound from the medium to the higher failed significantly to show measurable effect on these parameters.

Spraying B vitamins (B_1 + B_6 + B_{12}) significantly stimulated total surface area per palm as well as total chlorophylls and percentages of N, P, K Mg and total carbohydrates in the leaves rather than the check treatment.

Spraying royal jelly at 0.05 %, silicon at 0.1 % and B vitamins (B_1 at 250 ppm, B_6 at 100 ppm and B_{12} at 250 ppm) gave the maximum values. These results were true during both seasons.

These results are in harmony with those obtained by **El- Shaikh (2010)** who worked on royal jelly; **Gad El- Kareem (2012)** who worked on silicon and **Ahmed *et al*., (2012)** who worked on vitamins B.

2) Bunch weight and yield per palm:

It is worth to mention from the data in Tables (2 & 3) that foliar application of royal jelly and silicon either singly or in combinations significantly was followed by improving bunch weight and yield/ palm comparing with non- application. Increasing concentrations of both substances was followed by a gradual promotion on bunch weight and yield per palm. Increasing concentrations from 0.05 to 0.1 % of royal jelly as well as silicon from 0.1 to 0.2 % had no significant promotion on bunch weight and yield per palm. Spraying royal jelly was preferable than using silicon in this connection. Using both substances together was beneficial than using each material alone in this respect.

Treating Sakkoti date palms with vitamins B significantly resulted in improving bunch weight and yield per palm in relative to untreating the palms.

The maximum bunch weight (12.7 and 13.8 kg) and yield per palm (127.0 and 138.0 kg) from economical point of view were recorded on the palms that received four sprays of a mixture containing royal jelly at 0.05 % + silicon at 0.1 % and vitamins B (B_1 at 250 ppm + B_6 at 100 ppm + B_{12} at 250 ppm) during both seasons, respectively.

These results are in harmony with those obtained by **El- Shaikh (2010)** who worked on royal jelly; **Gad El- Kareem (2012)** who worked on silicon and **Ahmed *et al*., (2012)** who worked on vitamins B.

3) Physical and chemical characteristics of the fruits:

It is obvious from the data in Tables (3 & 4) that supplying the palms via leaves with royal jelly and/ or silicon significantly effective in improving fruit weight, total soluble solids as well as total and reducing sugars % and reducing total acidity %, crude fibre % and total soluble tannins comparing with the control treatment. Spraying royal jelly was favourable than using silicon on improving fruit quality. Combined application of royal jelly and silicon was essential in improving fruit quality rather than using each compound alone. There was a gradual promotion on fruit quality with increasing concentrations of each substance. No significant differences on these quality parameters were observed among the higher two concentrations of each material.

Spraying B vitamins was significantly very effective in enhancing fruit quality rather than the check treatment.

The best results with regard to quality of the fruits were observed with using the three materials together (royal jelly at 0.05 % + silicon at 0.1 % + vitamins B_1 at 250 ppm + B_6 at 100 ppm + B_{12} at 250 ppm. These results were true during both seasons.

These results are in harmony with those obtained by **El- Shaikh (2010)** who worked on royal jelly; **Gad El- Kareem (2012)** who worked on silicon and **Ahmed *et al*., (2012)** who worked on vitamins B.

The previous positive action of the investigated materials on fruiting of Sakkoti date palms was attributed to the following topics:

1) The beneficial effects of vitamins B on enhancing photosynthesis and organic foods, cell division, natural hormones and uptake of water and nutrients and increasing of the tolerance of palms to stress **(Samiullah *et al*., 1988).**
2) The beneficial of silicon on stimulating antioxidant systems in plants consequently increasing the resistance of plants to unsuitable conditions **(Epstein and Bloom, 2003).**
3) The higher own content of royal jelly from vitamins, hormones, nutrients and amino acids **(Nation and Robinson, 1971).**

As a conclusion, supplying Sakkoti date palms four times with a mixture containing royal jelly at 0.05 %, silicon at 0.1 % and vitamins B (B_1 at 250 ppm + B_6 at 100 ppm + B_{12} at 250 ppm) is suggested for promoting yield and fruit quality.

Table (1): Effect of spraying royal jelly, silicon and vitamins B on total surface area per palm, total chlorophylls and N and P % of Sakkoti date palms during 2011 and 2012 seasons.

Treatment (A)	Total surface area/ palm (m^2)						Total chlorophylls (mg/ 100 g. F.W)					
	2011			2012			2011			2012		
	Vitamin B treatments (B)											
	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)
Control	14.9	16.1	15.5	14.4	15.6	15.0	23.3	24.5	23.9	24.0	25.2	24.6
Royal jelly at 0.025 %	18.6	19.8	19.2	18.1	19.3	18.7	27.1	28.3	27.7	27.8	29.0	28.4
Royal jelly at 0.05 %	19.7	20.8	20.3	19.2	20.3	19.8	28.4	29.7	29.1	29.1	30.4	29.8
Royal jelly at 0.1 %	19.8	20.9	20.4	19.3	20.4	19.9	29.0	30.3	29.7	29.8	31.0	30.4
Silicon (Si) at 0.05 %	16.1	17.3	16.7	15.6	16.8	16.2	24.5	25.8	25.2	25.2	26.5	25.9
Silicon at 0.1 %	17.4	18.7	18.1	16.9	18.2	17.6	25.7	26.9	26.3	26.3	27.6	27.0
Silicon at 0.2 %	17.5	18.6	18.1	17.0	18.1	17.6	26.0	27.3	26.7	26.8	28.0	27.4
Royal jelly + Si at low Conc.	21.0	22.3	21.7	20.5	21.8	21.2	30.0	31.3	30.7	30.7	32.0	31.4
Royal jelly + Si at med. Conc.	22.2	23.5	22.9	21.7	23.0	22.4	31.1	32.5	31.8	31.8	33.2	32.5
Royal jelly + Si at high Conc.	22.5	23.7	23.1	21.8	23.2	22.5	31.2	23.5	31.9	31.9	33.3	32.7
Mean (B)	**18.0**	**20.2**		**18.5**	**19.7**		**27.6**	**18.9**		**28.3**	**29.6**	

New L.S.D at 0.05	A 1.0	B 1.1	AB 3.5	A 1.0	B 1.1	AB 3.5	A 0.9	B 1.0	AB 3.2	A 1.0	B 1.0	AB 3.2
character	**Leaf N %**						**Leaf P %**					
Control	1.72	1.80	1.76	1.76	1.86	1.81	0.11	0.14	0.13	0.11	0.14	0.13
Royal jelly at 0.025 %	1.97	2.06	2.02	2.01	2.11	2.06	0.22	0.25	0.24	0.22	0.25	0.24
Royal jelly at 0.05 %	2.06	2.15	2.11	2.10	2.20	2.15	0.26	0.30	0.28	0.28	0.31	0.30
Royal jelly at 0.1 %	2.07	2.17	2.12	2.10	2.21	2.16	0.27	0.30	0.29	0.29	0.31	0.30
Silicon (Si) at 0.05 %	1.79	1.89	1.84	1.84	1.94	1.89	0.14	0.17	0.16	0.14	0.17	0.16
Silicon at 0.1 %	1.89	1.99	1.94	1.95	2.06	2.01	0.17	0.20	0.19	0.18	0.21	0.20
Silicon at 0.2 %	1.90	1.99	1.95	1.95	2.07	2.01	0.17	0.20	0.19	0.18	0.21	0.20
Royal jelly + Si at low Conc.	2.14	2.25	2.20	2.20	2.31	2.26	0.31	0.36	0.34	0.35	0.38	0.37
Royal jelly + Si at med. Conc.	2.21	2.32	2.27	2.28	2.39	2.34	0.35	0.41	0.38	0.40	0.43	0.42
Royal jelly + Si at high Conc.	2.22	2.33	2.28	2.29	2.40	2.35	0.35	0.41	0.38	0.41	0.44	0.43
Mean (B)	**20**	**21.0**		**20.5**	**21.6**		**0.24**	**0.27**		**0.26**	**0.29**	
New L.S.D at 0.05	**A 0.06**	**B 0.05**	**AB 0.16**	**A 0.05**	**B 0.05**	**AB 0.16**	**A 0.20**	**B 0.27**	**AB 0.09**	**A 0.02**	**B 0.03**	**AB 0.09**

Table (2): Effect of spraying royal jelly, silicon and vitamins B on percentages of K, Mg and carbohydrates in the leaves and bunch weight (kg.) of Sakkoti date palms during 2011 and 2012 seasons.

Treatment (A)	Leaf K %						Leaf Mg %					
	2011			2012			2011			2012		
	Vitamin B treatments (B)											
	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)
Control	1.45	1.51	1.48	1.51	1.58	1.55	0.25	0.33	0.29	0.29	0.39	0.34
Royal jelly at 0.025 %	1.60	1.65	1.63	1.65	1.73	1.69	0.37	0.45	0.41	0.45	0.54	0.50
Royal jelly at 0.05 %	1.65	1.71	1.68	1.70	1.78	1.74	0.41	0.50	0.46	0.51	0.61	0.56
Royal jelly at 0.1 %	1.66	1.71	1.69	1.72	1.80	1.76	0.41	0.51	0.46	0.52	0.61	0.57
Silicon (Si) at 0.05 %	1.50	1.56	1.53	1.55	1.63	1.59	0.29	0.38	0.34	0.34	0.44	0.39
Silicon at 0.1 %	1.55	1.62	1.59	1.60	1.69	1.65	0.32	0.41	0.37	0.40	0.50	0.45
Silicon at 0.2 %	1.56	1.63	1.60	1.61	1.70	1.66	0.33	0.42	0.38	0.41	0.51	0.46
Royal jelly + Si at low Conc.	1.71	1.78	1.75	1.76	1.85	1.81	0.45	0.55	0.50	0.60	0.69	0.65
Royal jelly + Si at med. Conc.	1.75	1.82	1.79	1.82	1.91	1.87	0.52	0.62	0.57	0.66	0.75	0.70
Royal jelly + Si at high Conc.	1.76	1.83	1.80	1.82	1.92	1.87	0.53	0.63	0.58	0.67	0.75	0.71
Mean (B)	**1.62**	**1.68**		**1.67**	**1.76**		**0.39**	**0.48**		**0.49**	**0.58**	
New L.S.D at 0.05	**A 0.04**	**B 0.04**	**AB 0.13**	**A 0.05**	**B 0.05**	**AB 0.16**	**A 0.02**	**B 0.03**	**AB 0.09**	**A 0.02**	**B 0.03**	**AB 0.09**
character	**Total carbohydrates %**						**Bunch weight (kg.)**					
Control	16.0	16.9	16.5	16.3	17.0	16.7	8.5	9.1	8.8	8.9	9.9	9.4
Royal jelly at 0.025 %	18.0	19.0	18.5	18.3	19.0	18.7	10.3	11.0	10.7	10.8	11.9	11.4
Royal jelly at 0.05 %	18.5	19.4	19.0	18.7	19.4	19.1	11.0	11.6	11.3	11.5	12.5	12.0
Royal jelly at 0.1 %	18.6	19.7	19.2	18.8	19.5	19.2	11.0	11.7	11.4	11.6	12.6	12.1
Silicon (Si) at 0.05	16.6	17.7	17.2	16.8	17.5	17.2	9.0	9.7	9.4	9.6	10.7	10.2

%												
Silicon at 0.1 %	17.2	18.3	17.8	17.5	18.2	17.9	9.6	10.3	10.0	10.2	11.2	10.7
Silicon at 0.2 %	17.3	18.3	17.8	17.5	18.2	17.9	9.7	10.3	10.0	10.3	11.2	10.8
Royal jelly + Si at low Conc.	19.1	20.1	19.6	19.3	20.0	19.7	11.5	12.2	11.9	12.2	13.2	12.7
Royal jelly + Si at med. Conc.	19.7	20.8	20.3	20.0	20.8	20.4	12.0	12.7	12.4	12.8	13.8	13.3
Royal jelly + Si at high Conc.	19.8	20.9	20.4	20.0	20.9	20.5	12.1	12.7	12.4	13.0	14.0	13.5
Mean (B)	**18.1**	**19.1**		**18.3**	**19.1**		**10.5**	**11.1**		**11.1**	**12.1**	
New L.S.D at 0.05	**A 0.5**	**B 0.6**	**AB 1.9**	**A 0.4**	**B 0.5**	**AB 1.6**	**A 0.4**	**B 0.5**	**AB 1.6**	**A 0.4**	**B 0.4**	**AB 1.3**

Table (3): Effect of spraying royal jelly, silicon and vitamins B on yield as well as some physical and chemical characters of the fruits of Sakkoti date palms during 2011 and 2012 seasons.

Treatment (A)	**Yield/ palm (kg.)**						**Fruit weight (g.)**					
	2011			**2012**			**2011**			**2012**		
	Vitamin B treatments (B)											
	Nil	**$B_1+B_6+B_{12}$**	**Mean (A)**	**Nil**	**$B_1+B_6+B_{12}$**	**Mean (A)**	**Nil**	**$B_1+B_6+B_{12}$**	**Mean (A)**	**Nil**	**$B_1+B_6+B_{12}$**	**Mean (A)**
Control	85.0	91.0	88.0	89.0	99.0	94.0	10.0	10.5	10.3	10.3	10.8	10.6
Royal jelly at 0.025 %	103.0	110.0	106.5	108.0	119.0	113.5	11.5	12.0	11.8	11.8	12.3	12.1
Royal jelly at 0.05 %	110.0	116.0	113.0	115.0	125.0	120.0	12.0	12.6	12.3	12.3	12.8	12.6
Royal jelly at 0.1 %	110.0	117.0	113.5	116.0	126.0	121.0	12.0	12.6	12.3	12.4	12.8	12.6
Silicon (Si) at 0.05 %	90.0	97.0	93.5	96.0	107.0	101.5	10.4	11.0	10.7	10.8	11.3	11.1
Silicon at 0.1 %	96.0	103.0	99.5	102.0	112.0	107.0	10.8	11.7	11.3	11.2	11.8	11.5
Silicon at 0.2 %	97.0	103.0	100.0	103.0	112.0	107.5	10.9	11.8	11.4	11.3	11.9	11.5
Royal jelly + Si at low Conc.	115.0	122.0	118.5	122.0	132.0	127.0	12.6	13.3	13.1	12.9	13.4	13.2
Royal jelly + Si at med. Conc.	120.0	127.0	123.5	128.0	138.0	133.0	13.2	14.0	13.6	13.5	14.1	13.8
Royal jelly + Si at high Conc.	121.0	127.0	124.0	130.0	140.0	135.0	13.3	14.1	13.7	13.9	14.2	13.9
Mean (B)	**104.7**	**111.3**		**110.9**	**121.0**		**11.7**	**12.4**		**12.0**	**12.5**	
New L.S.D at 0.05	**A 1.9**	**B 2.0**	**AB 6.3**	**A 3.0**	**B 3.0**	**AB 9.5**	**A 0.3**	**B 0.4**	**AB 0.9**	**A 0.3**	**B 0.4**	**AB 0.9**
character	**T.S.S %**						**Total sugars %**					
Control	69.0	69.2	69.1	70.0	70.5	70.3	60.1	60.5	60.3	61.0	61.5	61.3
Royal jelly at 0.025 %	71.0	72.0	72.0	71.9	72.3	72.1	63.9	64.8	64.4	64.8	65.8	65.3
Royal jelly at 0.05 %	73.0	73.1	73.1	72.7	73.0	72.9	64.4	65.3	64.9	65.3	66.3	65.8
Royal jelly at 0.1 %	73.1	73.1	73.1	72.8	73.1	73.0	64.5	65.5	65.0	65.4	66.5	66.0
Silicon (Si) at 0.05 %	69.7	70.0	69.9	70.5	71.0	70.8	60.7	61.6	61.2	61.6	62.6	62.1
Silicon at 0.1 %	70.6	70.9	70.8	71.0	71.6	71.3	61.9	62.8	62.4	62.8	63.7	63.3
Silicon at 0.2 %	70.7	71.0	70.9	71.1	71.7	71.4	62.0	62.9	62.5	62.9	63.8	63.4
Royal jelly + Si at low Conc.	73.7	74.0	73.9	74.1	71.9	74.5	65.8	66.7	66.3	66.7	67.8	67.3
Royal jelly + Si at med. Conc.	74.4	74.6	74.5	75.1	76.9	76.0	66.8	67.7	67.3	67.7	68.8	68.3
Royal jelly + Si at high Conc.	74.5	74.7	74.6	75.2	77.0	76.1	67.0	67.9	67.5	67.8	68.8	68.3
Mean (B)	**72.1**	**72.3**		**72.4**	**73.2**		**63.7**	**64.6**		**65.1**	**65.6**	
New L.S.D at 0.05	**A 0.4**	**B 0.5**	**AB 1.6**	**A 0.4**	**B 0.5**	**AB 1.6**	**A 0.3**	**B 0.4**	**AB 1.3**	**A 0.3**	**B 0.4**	**AB 1.3**

Table (4): Effect of spraying royal jelly, silicon and vitamins B on some chemical characteristics of the fruits of Sakkoti date palms during 2011 and 2012 seasons.

Treatment (A)	Reducing sugars %						Total acidity %					
	2011			2012			2011			2012		
	Vitamin B treatments (B)											
	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)	Nil	$B_1+B_6+B_{12}$	Mean (A)
Control	12.9	13.4	13.2	13.1	13.2	13.2	0.389	0.380	0.385	0.385	0.376	0.381
Royal jelly at 0.025 %	14.1	14.6	14.4	14.7	15.2	15.0	0.281	0.250	0.266	0.277	0.245	0.261
Royal jelly at 0.05 %	14.5	15.0	14.8	15.2	15.7	15.5	0.250	0.220	0.235	0.245	0.215	0.230
Royal jelly at 0.1 %	14.5	15.1	14.8	15.3	15.8	15.6	0.248	0.216	0.232	0.241	0.211	0.226
Silicon (Si) at 0.05 %	13.4	14.0	13.7	13.5	14.0	13.8	0.360	0.330	0.345	0.355	0.325	0.340
Silicon at 0.1 %	13.7	14.3	14.0	14.0	14.5	14.3	0.329	0.297	0.313	0.325	0.292	0.309
Silicon at 0.2 %	13.8	14.3	14.1	14.1	14.6	14.4	0.319	0.289	0.304	0.315	0.285	0.300
Royal jelly + Si at low Conc.	14.8	15.3	15.1	15.9	16.4	16.2	0.215	0.184	0.200	0.210	0.180	0.195
Royal jelly + Si at med. Conc.	15.2	15.8	15.5	16.5	17.1	16.8	0.185	0.155	0.170	0.180	0.150	0.165
Royal jelly + Si at high Conc.	15.3	15.9	15.6	16.5	17.1	16.8	0.184	0.151	0.168	0.177	0.148	0.163
Mean (B)	**14.2**	**14.8**		**14.9**	**15.4**		**0.276**	**0.247**		**0.271**	**0.243**	
New L.S.D at 0.05	**A 0.3**	**B 0.4**	**AB 1.3**	**A 0.3**	**B 0.4**	**AB 1.3**	**A 0.020**	**B 0.030**	**AB 0.095**	**A 0.020**	**B 0.30**	**AB 0.95**
character	**Fibre crude %**						**Total soluble tannins %**					
Control	2.33	2.30	2.32	2.40	2.33	1.37	0.71	0.70	0.71	0.70	0.69	0.70
Royal jelly at 0.025 %	2.11	2.00	2.06	2.00	1.90	1.95	0.57	0.52	0.55	0.55	0.50	0.53
Royal jelly at 0.05 %	1.97	1.86	1.92	1.85	1.75	1.80	0.52	0.47	0.50	0.51	0.46	0.49
Royal jelly at 0.1 %	1.96	1.84	1.90	1.83	1.72	1.78	0.51	0.46	0.49	0.50	0.46	0.48
Silicon (Si) at 0.05 %	2.28	2.17	2.23	2.11	2.00	2.06	0.66	0.61	0.64	0.67	0.62	0.65
Silicon at 0.1 %	2.23	2.11	2.17	2.00	1.90	1.95	0.62	0.57	0.60	0.62	0.57	0.60
Silicon at 0.2 %	2.22	2.10	2.16	1.99	1.89	1.94	0.61	0.55	0.58	0.61	0.55	0.58
Royal jelly + Si at low Conc.	1.55	1.40	1.48	1.30	1.20	1.25	0.47	0.42	0.45	0.45	0.40	0.43
Royal jelly + Si at med. Conc.	1.40	1.30	1.35	1.20	1.10	1.15	0.41	0.35	0.38	0.40	0.34	0.37
Royal jelly + Si at high Conc.	1.39	1.29	1.34	1.18	1.07	1.13	0.40	0.34	0.37	0.39	0.33	0.36
Mean (B)	**1.94**	**1.84**		**1..84**	**1.69**		**0.55**	**0.50**		**0.54**	**0.49**	
New L.S.D at 0.05	**A 0.03**	**B 0.04**	**AB 0.13**	**A 0.03**	**B 0.04**	**AB 0.13**	**A 0.03**	**B 0.04**	**AB 0.13**	**A 0.03**	**B 0.04**	**AB 0.13**

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