

Response of Matured Tissue Cultured Bartemoda and Sakkoti Date Palms to Spraying Vitamins K, A & BFaissal F. Ahmed¹; Ahmed Y. Mohamed² Ali A. Gobara¹ and Samah, O.A. Osman²¹Hort. Dept. Fac. of Agric. Minia Univ. Egypt.²Tropical Fruits Dept. Hort. Res. Instit. ARC, Giza, EgyptE.mail: faissalfadel@yahoo.com

Abstract: This study was carried out during 2013 and 2014 seasons to test the beneficial effects of using vitamins K, B, A each at 50 ppm on yield and fruit quality of matured tissue cultured Sakkoti and Bartemoda date palms grown under Aswan conditions. The palms were sprayed four times at the first week of Feb April, June and August. Single and combined applications of vitamins K, A, B each at 50 ppm materially caused an obvious promotion on all vegetative growth characters, chlorophylls a & b, total chlorophylls, total carotenoids, total carbohydrates %, nutrients, flowering, fruit setting %, yield and fruit quality in both cvs. over the check treatment. The best vitamin in this respect was vitamin B followed by vitamin A and K. The studied vitamin treatments had pronounced effect on advancing harvesting date in both date palms cvs. Treating matured tissue cultured Sakkoti and Bartemoda date palms grown under Aswan conditions four times with a mixture of vitamins K, A, B each at 50 ppm proved to be very effective in improving yield and fruit quality.

[Faissal F. Ahmed; Ahmed Y. Mohamed Ali A. Gobara and Samah, O.A. Osman. **Response of matured tissue cultured bartemoda an sakkoti date palms to spraying vitamins k, a & b.** *World Rural Observ* 2015;7(3):33-41]. ISSN: 1944-6543 (Print); ISSN: 1944-6551 (Online). <http://www.sciencepub.net/rural>. 7

Keywords: Sakkoti and Bartemoda date palm cvs; vitamins, yield, fruit quality.

1- Introduction

Recently, it was suggested that vitamins participate a vital role in production of fruit crops. This is due to their important functions on enhancing the biosynthesis of natural hormones like GA₃, IAA and cytokinins, nutrient uptake, cell division, photosynthesis, building of proteins, plant pigments and the tolerance of the trees to all stresses (Samiullah *et al.*, 1988 and Singh *et al.*, 2001). Therefore, using vitamins as new techniques for promoting the yield of fruit crops is not surprised.

The results of Hamad (2004); Gamal (2006); Hamad (2008), Eshrawy (2010); Hegab and Hegab (2011); Ibrahim *et al.*(2013), Al- Wasfy (2013) ; Farag (2013) ; Hassan (2014) and Omar (2015) confirmed the beneficial effects on yield and fruit quality of using vitamins.

The target of this study was elucidating the beneficial effects of using vitamins K, A, B on yield and fruit quality of matured tissue cultured Sakkoti and Bartemoda date palms grown under Aswan conditions.

2- Material and methods

This study was conducted during 2013 and 2014 seasons in a private date palm orchard situated at Abo El- Resh village Aswan Governorate on 13 years old two dry date palm cvs Sakkoti and Bartemoda. These palms produced through tissue culture propagation by tip meristematic tissues. The selected palms are the same age, uniform in vigour, healthy, good physical conditions, free from insects, diseases and damages.

They planted at 7 x7 meters apart (86 palms/ for each cvs per fed.). The selected palms were irrigated with Nile water through surface irrigation system. The texture of the soil is silty clay.

Hand pollination of all the selected palms for both cvs was achieved by inserting five fresh male strands into the center of one female spathe using the same source of pollens to avoid residues of metaxenia. The pollen grains viability was tested before carrying out pollination. Pollination was carried out throughout two days after female spathes cracking at the day time of afternoon according to Omar (2007). To prevent contamination of the investigated pollens 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.

Physical and chemical properties of the experimental soil at 0.0- 90 cm depth are presented in Table (2) according to the produce of Wilde *et al.*(1985).

All the selected Sakkoti and Bartemoda date palms received a common horticultural practices that already applied in the orchard accept vitamin applications.

This experiment included the following eight treatments of vitamins for each date palm cvs.

1- Control (sprayed with Nile water palms)

- 2- Spraying the palms with vitamin K at 50 ppm.
- 3- Spraying the palms with vitamin A at 50 ppm.
- 4- Spraying the palms with vitamin B (B₁+ B₂+ B₆+ B₁₂) at 50 ppm.
- 5- Spraying the palms with vitamin K at 50 ppm + vitamin A at 50 ppm.
- 6- Spraying the palms with vitamin K at 50 ppm + B complex at 50 ppm.
- 7- Spraying the palms with vitamin A at 50 ppm + B complex at 50 ppm.
- 8- Spraying the palms with vitamin K at 50 ppm + A at 50ppm + B complex at 50 ppm.

Table (1): Analysis of the tested soil

Characters	Values
Practical size distribution	
Sand %	7.5
Silt %	61.0
Clay %	31.5
Texture	Silty clay
pH (1: 2.5 extract)	8.80
E.C. (1: 2.5 extract) mmhos / 1 cm / 25°C	0.75
Organic matter %	2.25
Total CaCO ₃	1.95
Available macronutrients (ppm)	
N	80.0
P	6.0
K	420.0
Ca	71.0
Mg	5.0
DPTA extractable available micronutrients (ppm)	
Zn	5.2
Fe	6.1
Mn	4.2
Cu	0.6

Each treatment was replicated three times, one palm per each. Therefore, twenty – four similar in vigour palms from each date palm cvs were selected for achieving of this study. Easily in water vitamins B (B₁ +B₂+ B₆ +B₁₂) as well as the soluble in oil vitamins namely K and A were sprayed four times during both seasons at growth start (1st week of Feb.) and at two month intervals (1st week of April, June and August). Both vitamins K & and A were solubilized in few drops of Ethyl alcohol before application. All vitamin solutions were subjected to triton B as a wetting agent at 0.05 % before spraying. The palms were sprayed till runoff (20 L vitamin solutions / palm. The control treatment was sprayed with Nile water containing Triton B.

During both seasons and in both date palm cvs Sakkoti and Bartemoda, the following measurements were recorded.

1-Vegetative growth characters namely length & width (cm.) and area of leaflet (cm²) (**Ahmed and Morsy, 1999**); length and area of leaf, number of leaflets / leaf percentage of area of rachis that occupied by leaflets in the leaf % , total surface area(cm²) per palm, number of spines / leaf and spine length (cm.)

2- Chlorophylls a & b , total chlorophylls, total carotenoids (as mg/ 100 g F.W.) , total carbohydrates (**Von- Wettstein , 1957 , Hiscox and Isralsta, 1979 and A.O.A.C., 2000**) and percentages of N, P, K, Mg and Ca in the leaves (**Chapman and Pratt, 1961 and Summer, 1985**).

3- Flowering and fruit setting characters namely girth and length of spathe, number of strands / spathe, number of flowers and fruits / strand and percentages of initial fruit setting and fruit retention.

4- Harvesting date, yield (kg.) per palm and bunch weight (kg.)

5- Physical and chemical characteristics of the fruits namely weight, volume, height and diameter of fruit, fruit shape index, flesh thickness, percentages of seeds and flesh, seed length, edible to non- edible portions, percentages of T.S.S., total , reducing and non-reducing sugars, total acidity, total fibre %, soluble tannins and fruit content of proteins , K and Mg (**Balbaa, 1981 and A.O.A.C., 2000**).

Statistical analysis was done using new L.S.D. at 5% (according to **Mead et al., 1993**).

3- Results and Discussion

1-Vegetative growth characters:

Vegetative growth characters namely length & width and area of leaflets, length and area of leaf, number of leaflets/ leaf , percentage of area in rachis occupied by leaflet in the leaf % , total surface area/ palm , number of spines/ leaf and spine length in both date palm cvs. were significantly enhanced in response to single and combined applications of vitamins K & A & B each at 50 ppm relative to the check treatment. The promotion was significantly associated with using vitamins K & A & B in ascending order. Combined application of these vitamins significantly was favourable than using each vitamin alone in promoting growth characters. The best results were obtained with using all vitamins together. The untreated palms produced the minimum values. These results were true in both date palm cvs and during the two seasons (Tables 2&3).

2-Leaf chemical composition:

It is clear from the data in Tables (4&5) that single and combined applications of vitamins K & A & B each at 50 ppm significantly enhanced chlorophylls a & b , total chlorophylls, total carotenoids, total carbohydrates and percentages of N, P, K, Mg and Ca in the leaves of both date palm cvs

Sakkoti and Bartemoda over the check treatment. Using vitamin B recorded the maximum values comparing with using vitamins A and K. Combined applications of these vitamins significantly were favourable than using each vitamin alone in enhancing pigments and nutrients in the leaves. The maximum values in both date palm cvs. were recorded on the palms that received all vitamins together. The untreated palms produced the lowest values. These results were true during both seasons.

3- Flowering, fruit setting, harvesting date, yield and bunch weight

It is clear from the data in Tables (6&7) that single and combined applications of vitamins K & A & B each at 50 ppm significantly enhanced girth and length of spathe, number of strands per spathe, number of flowers and fruits/strand, percentages of initial fruit setting and fruit retention, yield and bunch weight in both date palm cvs. over the check treatment. Harvesting date in Sakkoti and Bartemoda date palm cvs significantly advanced by all vitamin treatments over the check treatment. The best vitamin in this respect was vitamin B. The highest values of flowering, fruit setting, yield and bunch weight were

recorded on the palms that treated with all vitamins together. More advancement in harvesting date of both date palm cvs was recorded with using all vitamins together. These results were true during both seasons.

4-Fruit quality

Data in Tables (8 to 11) clearly show that single and combined applications of vitamins K & A & B each at 50 ppm significantly improved fruit quality of Sakkoti and Bartemoda date palms in terms of increasing weight, volume, height and diameter of fruit, flesh thickness, flesh %, edible to non edible portions, T.S.S.%, total – reducing and non reducing sugars %, proteins %, K and Mg in the fruit and decreasing seed length, seeds %, total acidity %, total soluble tannins % and crude fibre % relative to the control treatment. Fruits taken from the trees treated with vitamins tended to be oval. The best vitamin in this respect was vitamins B followed by A and K vitamins. The best results with regard to fruit quality were obtained due to treating the palms four times with all vitamins together. Unfavourable effects on fruit quality were attributed to the neglection of using any vitamins. These results were true during both seasons.

Table (2): Effect of single and combined applications of some vitamins on some vegetative growth characters of Sakkoti date palms during 2013 and 2014 seasons.

Vitamin treatments	Leaflet length (cm.)		Leaflet width(cm.)		Leaflet area (cm) ²		No. of leaflets / leaf		Leaf area (m) ²	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	41.1	42.0	3.91	4.00	69.7	72.5	166.2	167.6	1.16	1.22
2-Vitamin K at 50 ppm	42.3	43.2	4.00	4.11	72.9	76.0	169.0	169.9	1.23	1.29
3- Vitamin A at 50 ppm	44.1	45.0	4.09	4.20	77.0	80.2	171.0	171.8	1.32	1.38
4- Vitamins B at 50 ppm	45.0	46.0	4.19	4.30	80.1	83.5	174.0	175.0	1.39	1.46
5-Vitamin K + A	46.3	47.2	4.30	4.40	84.0	87.1	176.0	177.0	1.48	1.54
6- Vitamin K + B	47.9	49.9	4.41	4.53	88.4	93.9	179.0	178.6	1.58	1.68
7- Vitamin A + B	50.0	51.0	4.52	4.63	93.9	97.7	181.6	183.0	1.71	1.79
8- All vitamins	51.8	51.9	4.64	4.75	98.7	101.5	183.4	185.0	1.81	1.88
New L.S.D. at 5%	0.6	0.7	0.04	0.05	1.8	1.9	1.3	1.4	0.07	0.08
Character	Leaf length (cm.)		Length of rachis occupied by leaflet in leaf %		Total surface area / palm (m) ²		No. of spines / leaf		Spine length (cm)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	4.18	4.30	77.1	78.0	92.8	97.6	20.1	19.0	10.11	10.12
2-Vitamin K at 50 ppm	4.30	4.44	77.7	78.6	98.4	103.2	21.2	20.0	10.51	10.55
3- Vitamin A at 50 ppm	4.41	4.50	79.0	79.7	105.6	110.4	22.9	21.1	10.71	10.73
4- Vitamins B at 50 ppm	4.52	4.59	80.0	80.8	111.2	116.8	24.0	22.2	11.11	11.09
5-Vitamin K + A	4.69	4.61	81.0	82.3	118.4	123.2	25.9	23.9	11.41	11.40
6- Vitamin K + B	4.81	4.81	82.0	83.0	126.4	143.4	27.8	26.9	11.72	11.69
7- Vitamin A + B	4.91	5.00	83.7	84.7	136.8	143.2	29.0	28.9	11.90	11.99
8- All vitamins	5.00	5.19	84.3	85.9	144.8	150.4	31.0	30.8	12.17	12.30
New L.S.D. at 5%	0.06	0.05	0.4	0.3	3.1	3.4	1.0	1.0	0.20	0.2

Table (3): Effect of single and combined applications of some vitamins on some vegetative growth characters of Bartemoda date palms during 2013 and 2014 seasons.

Vitamin treatments	Leaflet length (cm.)		Leaflet width (cm.)		Leaflet area (cm) ²		No. of leaflets / leaf		Leaf area (m) ²	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	38.1	38.1	2.81	2.82	49.9	50.0	155.0	156.0	0.77	0.78
2-Vitamin K at 50 ppm	38.9	38.8	2.87	2.87	51.6	51.5	158.0	158.1	0.82	0.81
3- Vitamin A at 50 ppm	39.5	39.6	2.95	2.99	53.6	53.2	160.0	160.2	0.86	0.85
4- Vitamins B at 50 ppm	40.1	40.7	3.04	3.00	55.4	55.5	161.8	162.0	0.90	0.90
5-Vitamin K + A	40.6	41.5	3.10	3.07	56.9	57.4	163.0	165.0	0.94	0.95
6- Vitamin K + B	41.2	42.1	3.17	3.14	58.6	59.2	163.0	1167.3	0.97	0.99
7- Vitamin A + B	42.0	42.8	3.25	3.21	60.8	61.1	166.8	169.2	1.01	1.03
8- All vitamins	42.5	43.5	3.32	3.26	62.5	62.8	169.0	171.2	1.06	1.08
New L.S.D. at 5%	0.5	0.6	0.04	0.04	1.1	1.2	1.7	2.0	0.04	0.03
Character	Leaf length (cm.)		Length of rachis occupied by leaflet in leaf %		Total surface area / palm (m ²)		No. of spines / leaf		Spine length (cm)	
1-Control	3.11	3.06	75.0	74.2	61.6	62.4	18.1	18.0	9.10	9.12
2-Vitamin K at 50 ppm	3.20	3.22	75.3	74.6	65.6	64.8	19.1	19.0	9.41	9.52
3- Vitamin A at 50 ppm	3.27	3.30	75.8	75.0	68.8	68.0	20.2	20.1	9.84	9.79
4- Vitamins B at 50 ppm	3.33	3.27	76.2	75.5	72.0	72.0	21.4	21.2	10.15	10.00
5-Vitamin K + A	3.41	3.35	76.8	76.0	75.2	76.0	22.5	22.3	10.50	10.40
6- Vitamin K + B	3.50	3.41	77.2	76.4	77.6	79.2	23.6	23.4	10.85	10.70
7- Vitamin A + B	3.60	3.50	77.6	77.0	80.8	82.4	24.7	24.5	11.06	10.99
8- All vitamins	3.77	3.57	78.0	78.0	84.8	86.4	25.8	25.7	11.46	11.31
New L.S.D. at 5%	0.06	0.06	0.4	0.3	1.9	2.0	1.0	1.0	0.17	0.18

Table (4): Effect of single and combined applications of some vitamins on the leaf pigments as well as percentages of total carbohydrates N, P, K, Mg and Ca in the leaves of Sakkoti date palms during 2013 and 2014 seasons.

Vitamin treatments	Chlorophyll a (mg/ 100 g F.W.)		Chlorophyll b (mg/ 100 g F.W.)		Total chlorophylls (mg/ 100 g F.W.)		Total carotenoids (mg/ 100 g F.W.)		Total carbohydrates %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	11.2	10.9	3.1	3.3	14.3	14.2	2.8	2.7	14.0	13.9
2-Vitamin K at 50 ppm	11.6	11.1	3.5	3.6	15.1	14.7	3.1	3.0	14.4	14.3
3- Vitamin A at 50 ppm	12.3	11.6	4.0	4.0	16.3	15.6	3.5	3.3	14.9	14.6
4- Vitamins B at 50 ppm	13.0	12.1	4.4	4.3	17.4	16.4	3.9	3.6	15.5	15.0
5-Vitamin K + A	13.4	12.9	4.8	4.6	18.2	17.5	4.3	4.0	16.0	15.4
6- Vitamin K + B	14.0	13.6	5.2	5.0	19.2	18.6	4.6	4.3	16.4	15.9
7- Vitamin A + B	14.4	14.0	5.5	5.3	19.9	19.3	5.0	4.6	16.7	16.3
8- All vitamins	14.9	14.5	5.8	5.6	20.7	20.1	5.4	5.0	17.0	16.9
New L.S.D. at 5%	0.4	0.4	0.3	0.3	0.5	0.5	0.3	0.3	0.3	0.3
Character	Leaf N %		Leaf P %		Leaf K %		Leaf Mg %		Leaf Ca %	
1-Control	1.61	1.67	0.15	0.16	1.17	1.19	0.55	0.60	2.11	2.19
2-Vitamin K at 50 ppm	1.69	1.73	0.18	0.19	1.23	1.24	0.60	0.64	2.20	2.29
3- Vitamin A at 50 ppm	1.76	1.80	0.20	0.21	1.31	1.30	0.64	0.68	2.30	2.39
4- Vitamins B at 50 ppm	1.83	1.85	0.23	0.24	1.40	1.39	0.67	0.72	2.41	2.50
5-Vitamin K + A	1.91	1.91	0.26	0.27	1.47	1.49	0.71	0.75	2.51	2.58
6- Vitamin K + B	2.00	1.99	0.29	0.30	1.55	1.56	0.76	0.79	2.59	2.66
7- Vitamin A + B	2.07	2.04	0.33	0.33	1.60	1.66	0.79	0.80	2.69	2.75
8- All vitamins	2.15	2.11	0.36	0.35	1.66	1.71	0.84	0.83	2.81	2.83
New L.S.D. at 5%	0.06	0.05	0.02	0.02	0.05	0.05	0.03	0.03	0.08	0.08

Table (5): Effect of single and combined applications of some vitamins on the leaf pigments as well as percentages of total carbohydrates N, P, K, Mg and Ca in the leaves of Bartemoda date palms during 2013 and 2014 seasons.

Vitamin treatments	Chlorophyll a (mg/ 100 g F.W.)		Chlorophyll b (mg/ 100 g F.W.)		Total chlorophylls (mg/ 100 g F.W.)		Total carotenoids (mg/ 100 g F.W.)		Total carbohydrates %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	9.1	9.4	2.7	2.8	11.8	12.2	2.4	2.3	13.8	14.0
2-Vitamin K at 50 ppm	9.7	10.0	3.1	3.1	12.8	13.1	2.7	2.6	14.4	14.5
3- Vitamin A at 50 ppm	10.5	10.6	3.4	3.4	13.9	14.0	3.1	3.0	15.0	15.1
4- Vitamins B at 50 ppm	11.2	11.2	3.7	3.8	14.9	15.0	3.4	3.3	15.6	15.6
5-Vitamin K + A	11.7	12.0	4.0	4.1	15.7	16.1	3.7	3.6	16.0	16.1
6- Vitamin K + B	12.2	12.5	4.3	4.5	16.5	17.0	4.0	4.1	16.5	16.6
7- Vitamin A + B	13.0	13.0	4.6	4.8	17.6	17.8	4.3	4.4	17.0	17.2
8- All vitamins	13.5	13.5	5.0	5.2	18.5	18.7	4.6	4.8	17.5	17.7
New L.S.D. at 5%	0.5	0.5	0.3	0.3	0.5	0.5	0.3	0.3	0.4	0.4
Character	Leaf N %		Leaf P %		Leaf K %		Leaf Mg %		Leaf Ca %	
1-Control	1.66	1.71	0.16	0.15	1.11	1.13	0.41	0.42	2.09	2.05
2-Vitamin K at 50 ppm	1.72	1.77	0.18	0.17	1.17	1.18	0.44	0.47	2.19	2.17
3- Vitamin A at 50 ppm	1.80	1.83	0.21	0.20	1.22	1.24	0.48	0.50	2.30	2.31
4- Vitamins B at 50 ppm	1.86	1.90	0.23	0.23	1.27	1.30	0.52	0.53	2.41	2.44
5-Vitamin K + A	1.92	1.96	0.26	0.26	1.33	1.36	0.56	0.57	2.51	2.55
6- Vitamin K + B	1.97	2.02	0.30	0.29	1.38	1.42	0.60	0.61	2.62	2.66
7- Vitamin A + B	2.03	2.08	0.32	0.32	1.44	1.50	0.65	0.64	2.73	2.77
8- All vitamins	2.10	2.14	0.35	0.35	1.52	1.56	0.71	0.69	2.87	2.89
New L.S.D. at 5%	0.05	0.06	0.02	0.02	0.05	0.05	0.03	0.03	0.10	0.10

Table (6): Effect of single and combined applications of some vitamins on behaviour of flowering and fruit setting , harvesting date, yield and bunch weight of Sakkoti date palms during 2013 and 2014 seasons.

Vitamin treatments	Spathe girth (cm.)		Spathe length (cm.)		No. of strands / spathe		No. of flowers / strand		No. of fruits / strand	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	19.2	19.0	50.0	51.0	71.0	71.5	40.0	44.0	24.0	26.0
2-Vitamin K at 50 ppm	19.7	19.5	51.0	51.6	72.3	72.7	42.0	47.0	26.0	30.0
3- Vitamin A at 50 ppm	20.2	20.0	52.9	52.2	73.5	74.0	45.0	50.0	31.0	36.0
4- Vitamins B at 50 ppm	20.7	20.6	54.0	53.0	74.6	75.5	48.0	52.0	35.0	42.0
5-Vitamin K + A	21.5	21.3	54.5	54.0	75.9	76.7	51.0	53.0	40.0	45.0
6- Vitamin K + B	22.3	22.0	55.0	54.5	77.0	77.9	53.0	55.0	46.0	49.0
7- Vitamin A + B	23.3	22.6	56.0	55.9	78.9	79.0	55.0	57.0	52.0	52.0
8- All vitamins	24.0	23.4	56.6	57.0	80.0	80.0	57.0	59.0	53.0	55.0
New L.S.D. at 5%	0.4	0.4	0.5	0.6	1.0	1.0	2.0	2.0	2.0	2.0
Character	Initial fruit setting %		Fruit retention %		Harvesting date		Yield/ palm (kg.)		Bunch weight (kg.)	
1-Control	60.0	59.1	31.0	30.3	30 Sept	29Sept	75.0	79.0	7.5	7.8
2-Vitamin K at 50 ppm	61.9	63.8	31.7	31.2	27 Sept	24 Sept	83.0	89.0	8.3	8.9
3- Vitamin A at 50 ppm	68.9	72.0	32.8	32.4	24 Sept	20 Sept	90.0	100.0	9.0	10.0
4- Vitamins B at 50 ppm	72.9	80.8	33.9	33.9	20 Sept	18 Sept	99.0	111.0	9.9	11.1
5-Vitamin K + A	78.4	84.9	35.0	35.2	14 Sept	13 Sept	110.0	121.0	11.0	12.1
6- Vitamin K + B	86.8	89.1	36.0	36.3	11 Sept	10 Sept	119.0	133.0	11.9	13.3
7- Vitamin A + B	96.1	91.2	36.7	37.1	9 Sept	8 Sept	129.0	135.0	12.9	13.5
8- All vitamins	96.5	93.2	37.3	38.0	S Sept	5 Sept	133.0	138.0	13.3	13.8
New L.S.D. at 5%	0.5	0.5	0.6	0.6	-	-	2.1	2.2	0.7	0.8

Table (7): Effect of single and combined applications of some vitamins on behaviour of flowering and fruit setting , harvesting date, yield and bunch weight of Bartemoda date palms during 2013 and 2014 seasons.

Vitamin treatments	Spathe girth (cm.)		Spathe length (cm.)		No. of strands / spathe		No. of flowers / strand		No. of fruits / strand	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	18.8	18.9	45.0	46.0	73.0	74.0	38.0	38.0	21.0	20.0
2-Vitamin K at 50 ppm	19.7	20.0	45.6	46.7	75.0	76.0	39.5	39.7	22.2	22.0
3- Vitamin A at 50 ppm	20.8	21.1	46.2	47.5	77.6	79.0	42.0	41.8	24.0	23.5
4- Vitamins B at 50 ppm	21.9	22.2	47.0	48.1	80.0	81.0	43.5	42.9	25.5	25.0
5-Vitamin K + A	22.9	23.2	47.8	48.8	82.5	83.0	45.0	44.0	27.0	26.5
6- Vitamin K + B	24.0	24.4	48.9	49.6	85.0	86.0	46.0	45.0	28.0	28.0
7- Vitamin A + B	24.5	24.9	50.0	50.7	87.0	89.0	47.8	46.2	29.5	29.5
8- All vitamins	24.9	25.5	50.9	51.9	90.0	91.9	48.9	47.4	30.6	32.3
New L.S.D. at 5%	0.5	0.4	0.6	0.6	2.0	2.0	1.0	1.0	1.0	1.0

Character	Initial fruit setting %		Fruit retention %		Harvesting date		Yield/ palm (kg.)		Bunch weight (kg.)	
1-Control	55.3	52.6	29.2	29.0	6Oct.	8 Oct.	71.0	76.0	7.1	7.6
2-Vitamin K at 50 ppm	56.2	55.4	29.8	30.0	4 Oct.	3 Oct.	80.0	85.0	8.0	8.5
3- Vitamin A at 50 ppm	57.1	56.2	30.5	30.5	1 Oct.	1 Oct.	88.0	93.0	8.8	9.3
4- Vitamins B at 50 ppm	58.6	58.3	31.2	31.2	29 Sept	28Sept	98.0	100.0	9.8	10.0
5-Vitamin K + A	60.0	60.2	32.0	32.6	27 Sept	26 Sept	109.0	110.0	10.9	11.0
6- Vitamin K + B	60.9	62.2	32.6	33.7	25 Sept	24 Sept	119.0	118.0	11.9	11.8
7- Vitamin A + B	61.7	65.4	33.3	34.9	22 Sept	20 Sept	128.0	129.0	12.8	12.9
8- All vitamins	62.6	68.1	35.0	36.0	16 Sept.	16 Sept.	132.0	134.0	13.2	13.4
New L.S.D. at 5%	0.8	0.7	0.6	0.6	-	-	2.0	2.0	0.8	0.8

Table (8): Effect of single and combined applications of some vitamins on some physical characters of the fruits of Sakkoti date palms during 2013 and 2014 seasons.

Vitamin treatments	Fruit weight (g.)		Fruit volume (cm) ³		Fruit height (cm.)		Fruit diameter (cm.)		Fruit shape index	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	8.11	8.05	8.31	8.25	4.26	4.20	1.69	1.61	2.52	2.61
2-Vitamin K at 50 ppm	8.25	8.21	8.45	8.41	4.36	4.30	1.79	1.70	2.44	2.53
3- Vitamin A at 50 ppm	8.41	8.36	8.62	8.56	4.45	4.41	1.89	1.79	2.35	2.46
4- Vitamins B at 50 ppm	8.56	8.50	8.76	8.70	4.55	4.52	1.96	1.88	2.32	2.40
5-Vitamin K + A	8.72	8.66	8.92	8.86	4.66	4.63	2.04	1.96	2.28	2.36
6- Vitamin K + B	8.88	8.81	9.08	9.01	4.75	4.73	2.11	2.04	2.25	2.32
7- Vitamin A + B	9.00	8.96	9.19	8.16	4.84	4.84	2.18	2.13	2.22	2.27
8- All vitamins	9.13	9.17	9.33	9.37	5.00	4.99	2.25	2.20	2.22	2.27
New L.S.D. at 5%	0.12	0.13	0.13	0.13	0.8	0.09	0.07	0.08	0.07	0.07

Character	Flesh thickness (cm)		Seed length (cm)		Seed weight %		Flesh weight %		Edible / non edible portions	
1-Control	0.35	0.36	2.95	2.76	17.2	17.8	82.8	82.2	4.81	4.62
2-Vitamin K at 50 ppm	0.38	0.39	2.90	2.90	16.8	17.2	83.2	82.2	4.95	4.78
3- Vitamin A at 50 ppm	0.40	0.40	2.87	2.88	16.0	16.4	84.0	83.6	5.25	5.10
4- Vitamins B at 50 ppm	0.42	0.42	2.84	2.84	15.6	15.5	84.4	83.5	5.41	5.45
5-Vitamin K + A	0.43	0.43	2.80	2.80	15.0	15.0	85.0	84.5	5.67	5.67
6- Vitamin K + B	0.44	0.44	2.77	2.77	14.6	14.5	85.4	85.0	5.85	5.90
7- Vitamin A + B	0.46	0.46	2.74	2.75	14.1	14.0	85.9	85.5	6.09	6.14
8- All vitamins	0.47	0.47	2.72	2.71	13.7	13.7	86.3	86.0	6.30	6.30
New L.S.D. at 5%	0.2	0.02	0.02	0.02	0.3	0.3	0.4	0.4	0.09	0.10

Table (9): Effect of single and combined applications of some vitamins on some physical characters of the fruits of Bartemoda date palms during 2013 and 2014 seasons.

Vitamin treatments	Fruit weight (g.)		Fruit volume (cm) ³		Fruit height (cm.)		Fruit diameter (cm.)		Fruit shape index	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	11.80	11.79	12.01	12.00	4.56	4.55	1.92	1.91	2.38	2.38
2-Vitamin K at 50 ppm	11.95	11.90	12.16	12.20	4.68	4.87	1.99	1.99	2.35	2.35
3- Vitamin A at 50 ppm	12.05	11.99	12.31	12.40	4.76	4.78	2.08	2.10	2.29	2.28
4- Vitamins B at 50 ppm	12.17	12.14	12.45	12.63	4.88	4.88	2.17	2.18	2.25	2.24
5-Vitamin K + A	12.30	12.28	12.60	12.71	4.94	4.99	2.26	2.27	2.19	2.90
6- Vitamin K + B	12.45	12.43	12.71	12.84	5.06	5.14	2.34	2.42	2.16	2.12
7- Vitamin A + B	12.57	12.56	12.85	12.99	5.17	5.25	2.42	2.50	2.14	2.10
8- All vitamins	12.71	12.72	13.00	13.11	2.29	5.36	2.50	2.59	2.12	2.07
New L.S.D. at 5%	0.4	0.12	0.12	0.12	0.11	0.11	0.07	0.08	0.02	0.02
Character	Flesh thickness		Seed length cm		Seed weight %		Flesh weight %		Edible / non edible	
1-Control	0.40	0.40	2.66	2.60	13.0	12.9	87.0	87.1	6.94	6.75
2-Vitamin K at 50 ppm	0.42	0.41	2.61	2.57	12.6	12.5	87.4	87.5	6.99	7.00
3- Vitamin A at 50 ppm	0.44	0.42	2.55	2.55	12.2	12.0	87.8	88.0	7.20	7.33
4- Vitamins B at 50 ppm	0.46	0.44	2.50	2.47	11.9	11.7	88.1	88.3	7.40	7.55
5-Vitamin K + A	0.47	0.45	2.47	2.44	11.5	11.3	88.5	88.7	7.70	7.85
6- Vitamin K + B	0.49	0.46	2.41	2.40	11.0	10.8	89.0	89.2	8.00	8.26
7- Vitamin A + B	0.50	0.49	2.39	2.37	10.6	10.4	89.4	89.6	8.43	8.62
8- All vitamins	0.52	0.51	2.30	2.28	10.2	10.1	89.8	89.9	8.80	8.90
New L.S.D. at 5%	0.02	0.02	0.03	0.03	0.4	0.4	0.5	0.5	0.06	0.06

Table (10): Effect of single and combined applications of some vitamins on some chemical characteristics of the fruits of Sakkoti date palms during 2013 and 2014 seasons.

Vitamin treatments	T.S.S. %		Total sugars %		Reducing sugars %		Non reducing sugars %		Total acidity %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	71.0	71.7	59.3	60.0	11.5	12.0	47.8	48.0	0.299	0.300
2-Vitamin K at 50 ppm	71.5	72.2	60.0	60.8	11.7	12.1	48.3	48.7	0.270	0.280
3- Vitamin A at 50 ppm	72.1	72.7	60.9	61.4	11.9	11.9	49.0	49.5	0.249	0.261
4- Vitamins B at 50 ppm	73.0	73.1	61.8	62.0	12.1	11.9	49.7	50.1	0.227	0.240
5-Vitamin K + A	74.0	74.1	62.3	62.5	11.8	11.5	50.5	51.0	0.209	0.221
6- Vitamin K + B	74.5	75.0	63.0	63.1	12.0	11.2	51.0	51.9	0.190	0.201
7- Vitamin A + B	75.1	75.6	63.4	63.9	11.7	10.8	51.7	53.1	0.171	0.180
8- All vitamins	76.3	76.4	63.7	64.3	11.1	10.3	52.6	54.0	0.152	0.162
New L.S.D. at 5%	0.4	0.4	0.3	0.3	NS	NS	0.4	0.4	0.017	0.016
Character	Crude fibre %		Soluble tannins %		Fruit proteins %		Fruit K %		Fruit Mg %	
1-Control	1.90	1.88	0.65	0.70	0.69	0.75	0.88	0.90	0.99	1.00
2-Vitamin K at 50 ppm	1.81	1.76	0.63	0.66	0.75	0.82	0.91	0.95	1.03	1.03
3- Vitamin A at 50 ppm	1.74	1.67	0.59	0.60	0.83	0.90	0.96	0.99	1.10	1.10
4- Vitamins B at 50 ppm	1.65	1.57	0.57	0.56	0.88	0.96	1.00	1.05	1.16	1.15
5-Vitamin K + A	1.51	1.48	0.55	0.54	0.94	1.03	1.05	1.10	1.20	1.21
6- Vitamin K + B	1.31	1.40	0.50	0.47	1.00	1.11	1.11	1.15	1.26	1.27
7- Vitamin A + B	1.21	1.22	0.47	0.44	1.06	1.17	1.14	1.21	1.32	1.31
8- All vitamins	1.01	1.03	0.42	0.41	1.12	1.24	1.17	1.26	1.36	1.35
New L.S.D. at 5%	0.08	0.08	0.02	0.02	0.05	0.06	0.03	0.04	0.03	0.03

Table (11): Effect of single and combined applications of some vitamins on some vitamins on some chemical characteristics of the fruits of Bartemoda date palms during 2013 and 2014 seasons.

Vitamin treatments	T.S.S. %		Total sugars %		Reducing sugars %		Non reducing sugars %		Total acidity %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Control	70.3	71.0	66.3	67.3	16.8	16.8	49.5	50.5	0.215	0.220
2-Vitamin K at 50 ppm	71.0	71.6	67.0	67.9	16.8	16.9	50.2	51.0	0.194	0.203
3- Vitamin A at 50 ppm	71.7	72.3	67.9	68.5	16.9	16.8	51.0	51.6	0.174	0.190
4- Vitamins B at 50 ppm	72.5	73.0	69.0	69.0	17.4	16.8	51.6	52.2	0.154	0.171
5-Vitamin K + A	73.0	73.7	69.5	69.7	17.3	16.7	52.2	53.0	0.134	0.145
6- Vitamin K + B	73.6	74.5	70.0	70.5	17.0	16.8	53.0	53.7	0.130	0.130
7- Vitamin A + B	74.5	74.9	70.6	71.2	16.7	16.9	53.9	54.3	0.127	0.124
8- All vitamins	75.0	75.5	71.0	72.0	16.0	16.9	55.0	55.1	0.109	0.110
New L.S.D. at 5%	0.4	0.4	0.3	0.3	NS	NS	0.3	0.3	0.019	0.018
Character	Crude fibre %		Soluble tannins %		Fruit proteins %		Fruit K %		Fruit Mg %	
1-Control	1.71	1.69	0.71	0.72	0.52	0.55	0.88	0.91	1.00	1.00
2-Vitamin K at 50 ppm	1.61	1.60	0.67	0.69	0.56	0.60	0.93	0.95	1.05	1.06
3- Vitamin A at 50 ppm	1.55	1.54	0.60	0.66	0.60	0.64	1.00	1.01	1.10	1.11
4- Vitamins B at 50 ppm	1.49	1.47	0.56	0.62	0.64	0.68	1.05	1.07	1.16	1.16
5-Vitamin K + A	1.40	1.38	0.51	0.47	0.68	0.72	1.10	1.12	1.22	1.20
6- Vitamin K + B	1.29	1.29	0.46	0.43	0.74	0.75	1.16	1.17	1.30	1.24
7- Vitamin A + B	1.19	1.17	0.42	0.37	0.77	0.79	1.22	1.23	1.33	1.29
8- All vitamins	1.11	1.09	0.38	0.35	0.81	0.83	1.27	1.30	1.37	1.35
New L.S.D. at 5%	0.05	0.05	0.03	0.03	0.03	0.03	0.4	0.04	0.03	0.03

4- Discussion

The previous positive action of vitamins on growth palm nutritional status, yield and fruit quality might be attributed to their great advantages in enhancing cell divisions, the biosynthesis of GA₃, IAA, cytokinins, plant pigments, amino acids, proteins, nutrient uptake and photosynthesis. (Samiullah *et al.*, 1988). The great benefits of vitamins on increasing the tolerance of plants to all stresses give another explanation (Singh *et al.*, 2001).

These results are in agreement with those obtained by Hamad (2004); Gamal (2006); Hamad (2008); Eshmawy (2010); Hegab and Hgab (2011); Ibrahim *et al.* (2013); Farage (2013); Al- Wasfy (2013) and Omar (2015).

Conclusion

Treating matured tissue cultured Sakkoti and Bartemoda date palms grown under Aswan region conditions with a mixture of vitamins K & A & B each at 50 ppm four times at the first week of Feb, April, June and August was responsible for promoting yield and fruit quality.

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7/27/2015