

## ORIGINAL ARTICLES

### Yield and fruit quality of Amhat date palms as affected by spraying some vitamins

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#### ABSTRACT

Inflorescences of Amhat date palms were sprayed with a commercial product namely Vitamin-x contains 9% mixture of some vitamins i.e. Thiamine (Vita. B<sub>1</sub>), Riboflavin (Vita. B<sub>2</sub>), Nicotinic acid, Piyrodexine, Piyrodexal, Pirodexamine, Biotin and Ascorbic acid (Vita. C), also 4% potassium oxide. Inflorescences were sprayed with Vitamin-x at 1% once at the pollination time, or twice at the pollination time then one month later, or three times at pollination time then one month later followed by the third one, a month before harvest time. Results indicated that Vitamin-x treatments had a positive effect on fruit set, yield, fruit physical and chemical characteristics of Amhat date palms, especially when sprayed three times which considered the promising treatment under such conditions.

**Key words:** Amhat date palm, Vitamins, fruit set, yield, fruit characteristics

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#### Introduction

Date palm (*Phoenix dactylifera* L.) is one of the ancient domestic fruit trees in the Middle East and their fruits play an important role in the nutrition pattern of many people. In Egypt, date palm ranked the third crop after orange and grape. Amhat is one of the most important cultivars of soft dates in Egypt. Because of date palm can grow and produce under a wide range of soil and climatic conditions, growers have mistakenly believed that it does not require much attention. While, the successful orchard management practices are directed toward obtaining a suitable yield with good fruit quality. One of the best tools for date palm reproductive potential studies is direct application of vitamins on inflorescences and fruits.

Recently, it was suggested that all vitamins participate in plant growth and development. Most studies showed that most essential physiological processes such as photosynthesis building of all organic foods and enzymes, nutrient and water uptake and cell division depended more or less on the availability of vitamins (Robinson, 1973).

Vitamins with their antioxidative properties play an important role in plant defense against oxidative stress induced by all chemicals. The beneficial effect of vitamins was attributed to their positive action on enhancing cell division and various growth factors, such as cytokinins and gibberellins (Oertili, 1987; Samiullah *et al.*, 1988; Bertschinger and Stadter, 1997).

Ascorbic acid foliar application was reported to induce many stimulating effects of growth and some physiological activities of different plants.

Kamiya *et al.* (1984) stated that "the physiological effects of ascorbic acid included: stimulation of lipase, catalase and peroxides isoenzymes activities". In addition, ascorbic acid revealed an effect on the metabolism of gibberellic acid.

Previous studies showed that vitamins and ascorbic acid were responsible for enhancing growth and fruiting of different fruit crops. Ahmed *et al.* (1998); Hegab (2000); Ahmed (2001); Ahmed *et al.* (2001); Ragab (2002); Ahmed *et al.* (2003); Gobara (2004); Mostafa (2004); Gamal (2006); Badran and Ahmed (2009); Yousef *et al.* (2009); Zagzoug (2009); Masoud and El-Sahrawy (2012).

Potassium plays an important regulatory role in many physiological and biochemical processes of plant. In this respect, Desouky *et al.* (2007) found that spraying Barhee date palms with potassium sulphate up to 4% increased yield and improved fruit chemical properties, also Khayyat *et al.* (2007) indicated that spraying Shahany date palm with 2% potassium sulphate improved yield. On the other hand, spraying Zaghloul date palm with 3% was the recommended than 1 or 3% concentration Hegab *et al.* (2011).

The target of this investigation was examining the effect of single application of Vitamin-x at different times on yield and fruit quality of Amhat date palm.

#### Material and Methods

The present study was carried out during two successive seasons (2010 and 2011) on 30 years old Amhat date palm cultivar grown on sandy loam soil, at a private orchard located at El-Badrashin district, Giza

governorate, Egypt. The experimental palms were healthy, nearly uniform in vigor as possible and subjected to the same cultural practices commonly adopted in the orchard. The number of bunches per palm was adjusted to 8 bunches nearly equal in size by removing excess number from the latest and earliest small ones. The pollination was achieved by hand using active pollen grains from the same parent in both seasons. Inflorescences of twelve palms were selected and divided into four treatments in three replicates (each as one palm) and arranged in randomized complete block design as the following.

- 1- Control.
- 2- Spraying Vitamin-x at 1% once.
- 3- Spraying Vitamin-x at 1% twice.
- 4- Spraying Vitamin-x at 1% three times.

Vitamin-x is a commercial product contains 9% mixture of some vitamins i.e. Thiamine (Vita. B<sub>1</sub>), Riboflavin (Vita. B<sub>2</sub>), Nicotinic acid, Piyrodexine, Piyrodexal, Pirodexamine, Biotin and Ascorbic acid (Vita. C), also contains 4% potassium oxide.

Treatment that Vitamin-x sprayed as once was done at the pollination time, while treatment that sprayed twice was done at the pollination time then one month later. The treatment that sprayed three times was done at pollination time then one month later followed by the third one, a month before harvest time.

#### *Measurements:*

##### *Fruit set and retention percentage:*

At harvest time (First week of September), all bunches were picked then average bunch weight (kg) and total yield (kg) per each palm were recorded. Samples of fifty fruits from each palm were taken randomly to determine the following fruit physical and chemical characteristics:

- 1- Fruit weight (gm).
- 2- Fruit volume (cm<sup>3</sup>).
- 3- Fruit length (cm).
- 4- Fruit diameter (cm).
- 5- Fruit length/diameter ratio (L/D ratio).
- 6- Seed weight (gm).
- 7- Flesh weight (gm).
- 8- Flesh/seed ratio.
- 9- Fruit chemical properties namely, total soluble solids percentage, total acidity percentage (as malic acid), total and reducing sugars percentage, non-reducing sugars percentage and total tannins percentage were determined according to A.O.A.C. (1985).

#### *Statistical analysis:*

The obtained data were tabulated and statistically tested for analysis of variance using MSTAT (1998) and the significant differences among the various treatments were compared using LSD values at probability of 0.05 according to Waller and Duncan (1969).

## **Results and Discussion**

##### *Fruit set and retention percentage:*

It's clear from the data presented in Table (1) that foliar application of Vitamin-x at 1% during pollination time significantly increased fruit set compared with the control. Moreover, double or triple applications of Vitamin-x were preferable in enhancing percentage of fruit set. The maximum values of fruit set in the two seasons (79 – 80%) were recorded on palms received three sprays. The untreated palms (control) gave the minimum values (69 – 69.6%) in both studied seasons, respectively.

Regarding the percentage of fruit retention, the data listed in the same Table indicted that all treatments significantly increased fruit retention compared with the control during both seasons of the study. In this respect, the best results were obtained from spraying Vitamin-x twice followed by spraying it three times then spraying the same material ones. These results are in harmony with those results obtained by Ahmed, *et al.* (2007) on Sewy date palms, Desouky *et al.* (2007) on Barhee date palms, Khayyat *et al.* (2007) on Shahany date palm and Fekry (2011) on Red Roomy grape.

### Yield and bunch weight:

Data in Table (1) clearly show that all used treatments significantly increased both yield and bunch weight of Amhat date palm compared with the control. Also, there is a liner relationship between repeating foliar sprays of Vitamin-x and yield and bunch weight in both seasons of the study. In this respect, the best results were obtained from palms sprayed with Vitamin-x at 1% three times, which gave (16.0 – 16.33 kg) for bunch weight and (128 – 130 kg) for total yield per palm in the first and second seasons, respectively.

**Table 1:** Fruit set, fruit retention, bunch weight and yield of Amhat date palm as affected by spraying Vitamin-x treatments during 2010 and 2011 seasons.

Treatments	Fruit set %		Fruit retention %		Bunch weight (kg)		Yield/palm (kg)	
	2010	2011	2010	2011	2010	2011	2010	2011
Control	69.0 b	69.6 c	36.3 c	41.0 d	10.6 c	11.8 d	85.2 c	94.6 d
Spray vita. (x) once	70.0 b	71.6 c	38.0 c	44.3 c	12.6 b	13.6 c	101.2 b	109.2 c
Spray vita. (x) twice	75.0 a	76.0 b	45.3 a	50.0 a	13.6 b	14.6 b	109.2 b	117.2 b
Spray vita. (x) three times	79.0 a	80.0a	43.0 b	46.6 b	16.0 a	16.3 a	128.0 a	130.6 a
Significance	S	S	S	S	S	S	S	S

Columns having the same letter (s) are not significantly differed

On the other side, control palms (untreated palms) produced significantly lower bunch weight and yield per palm since it recorded 10.66 – 11.83 kg for bunch weight and 85.28 – 94.64 kg for total yield per palm in the first and second seasons, respectively.

The abovementioned results are agree with those of Ahmed *et al.* (2007) on Sewy date palm, Desouky *et al.* (2007) on Barhee date palms and Khayyat *et al.* (2007) on Shahany date palm and Mosoud *et al.* (2012) on Washington navel orange.

### Fruit physical characteristics:

As for fruit weight, data in Table (2) clearly show that all used treatments increased palms fruit weight. This increment was significant with rebating spray of Vitamin-x. Fruits were picked from palms sprayed with Vitamin-x at 1% three times which recorded the heaviest fruit (10.1 - 9.83gm) during both seasons, respectively, followed by fruits that picked from palms sprayed twice with Vitamin-x at 1% which recorded 8.2 – 9.6 gm during the two seasons, respectively. On the other hand, fruit picked from untreated palms (control) gave the lowest fruit weight (6.5 – 6.7 gm) during the first and second seasons, respectively.

**Table 2:** Fruit physical characteristics of Amhat date palm as affected by spraying Vitamin-x treatments during 2010 and 2011 seasons.

Treatments	Fruit weight (gm)		Fruit volume (cm <sup>3</sup> )		Fruit shape index		Fruit length (cm)		Fruit diameter (cm)		L/D ratio		Flesh %		Seed %	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Control	6.5 d	6.7 c	6.0 c	6.6 c	1.05 b	1.01 a	2.9 c	3.1 c	1.7 c	1.9 c	1.7 a	1.6 b	79.2 d	82.2 b	20.8 a	17.8 a
Spray vita. (x) once	7.2 c	8.6 b	7.0 b	8.3 b	1.03 b	1.04 a	3.3 b	3.5 b	1.9 b	2.0 bc	1.7 a	1.7 ab	84.1 c	82.6 b	15.9 b	17.4 a
Spray vita. (x) twice	8.2 b	9.6 a	7.3 b	9.1 a	1.12 a	1.04 a	3.4 b	3.6 b	2.1 b	2.1 ab	1.6 a	1.6 b	86.1 b	84.1 ab	13.9 c	15.9 ab
Spray vita. (x) three times	10.1 a	9.8 a	8.8 a	9.4 a	1.14 a	1.14 a	4.1 a	4.1a	2.3 a	2.2 a	1.8 a	1.8 a	87.0 a	85.4 a	13.0 d	13.9 b
Significance	S	S	S	S	S	NS	S	S	S	S	NS	S	S	S	S	S

Columns having the same letter (s) are not significantly differed

Concerning fruit volume and shape, data in the same Table indicated that all used treatments significantly increased both fruit volume and shape. In another word, increasing number of Vitamin-x spray increased both fruit volume and shape. Therefore, the palms that sprayed three times with Vitamin-x at 1% produced higher values of fruit volume and shape which recorded 8.8 – 9.46 cm<sup>3</sup> for volume and 1.14 – 1.03 for the shape, while the control palms gave the lowest values for fruit volume (6.0 – 6.6 cm<sup>3</sup>) and shape index (1.05 - 1.01) during the two studied seasons, respectively.

Regarding fruit dimensions (length and diameter) and L/D ratio, results recorded in Table (2) showed that spraying Amhat date palms with Vitamin-x at 1% either ones, twice or three times improved fruit dimensions and L/D ratio compared with the control in both seasons, since spraying palms with Vitamin-x three times recorded the highest value of fruit dimensions followed by spraying twice compared with the control (untreated palms). Similar results were obtained in both seasons of the study.

As for flesh and seed percentage, it is clear from the recorded data in Table (2) that all used treatments were significantly effective in improving flesh percentage and decreasing seed percentage. In this respect, the highest value of flesh percentage was obtained from palms sprayed with Vitamin-x at 1% three times compared with the other treatments including the control. This was true in both studied seasons.

The lowest value for flesh percentage was recorded from fruits picked from untreated palms. Moreover, there are reflex relationship between Vitamin-x spray and decreasing seed percentage. In this concern, increasing number of Vitamin-x sprays, decreased seed percentage, since the highest value of seed percentage

was recorded from untreated palms (control), while the lowest value was resulted from fruits picked from palms sprayed with Vitamin-x three times.

#### Fruit chemical characteristics:

Data recorded in Table (3) show remarkable and significant improvement in fruit quality in terms of increasing total soluble solids, total and reducing also non-reducing sugars in response to foliar spray of Vitamin-x, also the using material decreased total acidity and soluble tannins content compared with untreated palms. Increasing frequency of Vitamin-x spray was followed by promotion in fruit quality gradually. The best results with regard to fruit quality were obtained with the spraying of Vitamin-x at 1% three times annually. Unfavorable effects of fruit quality were recorded on the untreated palms. Similar results were recorded in both studied seasons of the study.

**Table 3:** Chemical characteristics of Amhat date palm as affected by spraying Vitamin-x treatments during 2010 and 2011 seasons.

Treatments	TSS %		Acidity %		Sugars %						Tannins %	
	2010	2011	2010	2011	Non-reducing		Reducing		Total		2010	2011
					2010	2011	2010	2011	2010	2011		
Control	29.3 a	30.0 d	0.48 a	0.48 a	5.50 b	6.50 b	24.5 c	25.0 b	30.0 c	31.5 b	0.62 a	0.53 a
Spray vita. (x) once	32.6 a	32.6 c	0.49 ab	0.44 ab	6.16 ab	7.03 ab	26.5 b	25.3 b	32.6 b	32.3 b	0.52 b	0.54 a
Spray vita. (x) twice	32.3 a	35.0 b	0.41 b	0.41 b	6.66 a	7.06 ab	27.0 b	29.0 a	33.6 b	36.0 a	0.43 c	0.40 b
Spray vita. (x) three times	32.6 a	36.0 a	0.39 b	0.40 b	6.33 ab	7.46 a	29.6 a	29.1 a	36.0 a	36.6 a	0.43c	0.40 b
Significance	NS	S	S	S	S	S	S	S	S	S	S	S

Columns having the same letter (s) are not significantly differed

The previous results concerning physical and chemical characteristics are in agreement with those obtained by Ahmed *et al.* (2007) on Sewy date palm Desouky *et al.* (2007) on Barhee date palms and Khayyat *et al.* (2007) on Shahany date palm and Yousef *et al.* (2009) on Picaul olive.

From the abovementioned results, it could be concluded that, foliar spray of Vitamin-x at 1% three times (at the pollination time and one month later then one month before harvesting time) is the recommended treatment to obtain better yield with good quality of Amhat date palm.

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