Yield and Fruit Quality of Amhat Date Palm as Affected by Potassium and Some Vitamins Foliar Sprays

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Abstract:- **Inflorescences of Amhat date palms were sprayed with commercial product namely Vitamin-x contains 9 % mixture of some vitamins and 4% potassium oxide.**

Inflorescences were sprayed with vitamin-x at 2% 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 and finally at one month before harvest time).

Results clear that vitamin–x treatments had a positive effect on fruit set, fruit retention, bunch weight, yield per palm, fruit physical and chemical characteristics of Amhat date palms. The promising treatment was foliar spray with vitamin–x three times, followed by foliar spray twice.

Key words**: Amhat date palms, vitamins, fruit set, retention, yield and fruit quality.**

I. INTRODUCTION

Date palm is one of the ancient domestic fruit trees in the Middle East countries and their fruits play an important role in the nutrition's patterns of many people. Egypt is considered among the top ten date producers, **FAO (2014**).

Amhat is one of the most important soft date cultivars in Egypt. Recently, it is suggested that all vitamins participate in plant growth and development. Most studies showed that the essential physiological process such as photosynthesis building of all organic foods and enzymes, nutrients and water uptake, also cell division depend more or less on the availability of vitamins (**Robinson, 1973**).

Antioxdative properties of some vitamins 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 cytokines and gibberellins (**Oertili 1997; Samiullah *et al*., 1988; Bertschinger and Stadter, 1997**).

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

Ramiyo *et al*. (1984) stated that "the physiological effects of ascorbic acid induced 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 some vitamins including 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-Aml *et al*., 2009; Zagzog 2009; Hegab *et al.* (2011); Masoud and El-Sahrawy 2012 and Dorria *et al*., 2012).**

Potassium plays an important regulators role in many physiological and biochemical process of the 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 palms with 2 % potassium sulphate improved yield. Also, spraying Zaghloul date palm with 3% was the recommended than 1% or 3% concentration (**Hagab *et al.*, 2011**).

The objective of this study is to evaluate the effect of inflorescences sprays with 2% vitamin–x for different times on fruit set, yield and fruit quality of Amhat date palms.

II. MATERIALS AND METHODS

The present study was conducted during two successive seasons (2016 and 2017) on 20 years old Amhat date palms grown on sandy loam soil, at a private orchard located at El-Badrashin distract, Giza Governorate, Egypt.

The selected palms were healthy, nearly uniform in growth vigor and fruiting and received regular horticultural practices. Moreover, date palm thinned as rate of one bunch per eight leaves (8-1 leaf/ bunch ratio). 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 a randomized complete block design as following.

1. untreated palms (control)

2. Spraying vitamin-x at 2 % once
3. Spraying vitamin-x at 2 % twice
4. Spraying vitamin-x at 2 % three times

Vitamin-x is commercial product contains 9% mixture of some vitamins i.e., thiamine (Vit. B_1), Riboflavin (Vit.B_2), Nicotinic acid, Pyridoxine, Piyrodexal, Pirodexamine, Biotin and ascorbic acid (Vit. C) and 4% potassium oxide.

Inflorescences were sprayed with vitamin-x at 2% 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 and finally at one month before harvest time).

Measurements:

Fruit set percentage and fruit retention

The number of set fruits was recorded, and fruit set percentage was calculated according to **El-Mkhtoum (1981**).

$$\text{Fruit set \%} = \frac{\text{Number of fruits setting on the strand}}{\text{Total number of flowers per strand}} \times 100$$

$$\text{Fruit retention \%} = \frac{\text{Total number of retained fruits /bunch}}{\text{Total nodes number per bunch}} \times 100$$

Fruits were picked during the second week of September at mature stage. Twenty fruits were randomly selected from each bunch, to determine both physical and chemical properties.

- Fruit physical properties
- Fruit weight (gm)
- Fruit length (cm)
- Fruit diameter (cm)
- Pulp weight (gm)
- Seed weight (gm)
- Fruit chemical properties
- Total soluble solids
- Total acidity (%)

Reducing, non-reducing and total sugars percentages were determined according to the method described by **Forsee (1938**).

Total tannins % was determined according to **A.O.A.C. (1995**)

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**).

III. RESULTS AND DISCUSSION

Fruit set and retention percentages

Results in Table (1) show generally that foliar spray with vitamin–x at 2% during pollination time significantly increased fruit set and fruit retention percentage as compared with untreated palms (control) in both seasons of the study.

In this concern, foliar spray with 2% vitamin-x twice or three times were preferable enhancing fruit set and fruit retention percentage in the two studied seasons. The highest values of fruit set in the two seasons (80.3-79.7%) were recorded from palms received vitamin–x at 2% for three times. The lowest fruit set 69-70% was obtained from untreated palms in the 1st and 2nd seasons, respectively.

In case of fruit retention percentage the best results were recorded due to foliar spray with vitamin-x at 2% for three times, since it recorded 56.66% in the first season and 51.66% in the second one. The lowest fruit retention (36-40%) was recorded from the untreated palms in the first and second seasons, respectively.

The great decline in flowers and fruits dropping percentage could be due to the role of antioxidant vitamins in activation growth and nutritional status of the palms consequently the positive effect on enhancing fruit set and yield per palm.

These results are in harmony with those obtained by **Ahmed *et al.* (2007)** on Sewy date palms, **Desouky *et al.* (2007)** on Barhee date palm, **Khayyat *et al.* (2007)** on Shahony date palm.

Bunch weight and yield per palm

Results in Table (1) clear that, all foliar spray treatments with vitamin–x at 2% (one, twice or three times) significantly increased bunch weight (kg) and yield/ palm as kg of Amhat date palm comparing with untreated palms in both seasons of the study.

The highest bunch weight (kg) was obtained from trees sprayed with vitamin–x at 2% three times, since it recorded 14.66 and 15.33 kg in the first and second seasons, respectively. Also, the same treatment recorded 117.3 and 122.67 kg for total yield/ palm in both seasons, respectively. While, the untreated palms gave the lowest bunch weight and yield per palm as kg, since it recorded 10.66 and 11.66 kg for bunch weight and 85.3 and 93.3 kg for the total yield/ palm in the two studied seasons, respectively. The obtained results are agreed with those of **Ahmed *et al.* (2007)** on Sewy date palms, **Desouky *et al.* (2007)** on Barhee date palm, **and Mosoud *et al.* (2012)** on Washington navel orange**.**

Table (1): Effect of foliar spray with some vitamins on yield components fruit set, retention, bunch weight and total yield of Amhat date palm

Treatments	Fruit set (%)	Fruit retention (%)	Bunch weight (kg)	Yield / palm (kg)
	2016 season			
Control	69.00 D	36.00 D	10.66 D	85.33 D
Spray vitamin-x 2% once	75.00 C	45.00 C	12.66 C	101.33 C
Spray vitamin-x 2% twice	77.33 B	53.66 B	13.66 B	109.33 B
Spray vitamin-x 2% three times	80.33 A	56.66 A	14.66 A	117.33 A
LSD at 0.05 level	2.02	2.72	0.99	7.99
	2017 season			
Control	70.00 C	40.00 C	11.66 D	93.33 D
Spray vitamin-x 2% once	75.66 B	42.33 C	13.66 C	109.33 C
Spray vitamin-x 2% twice	79.33 A	47.66 B	14.66 B	117.33 B
Spray vitamin-x 2% three times	79.66 A	51.66 A	15.33 A	122.67 A
LSD at 0.05 level	1.59	3.24	0.57	4.61

Fruit physical properties

In case of fruit weight (gm) results in table (2) indicate that all foliar spray treatments with vitamin–x at 2% increased fruit weight as compared with the untreated palms in both seasons of the study.

The heaviest fruit weight was recorded due to spraying vitamin-x at 2% three times which recorded 9.16 gm in the first season and 9.96 gm in the second one, followed by spraying 2% vitamin–x twice which gave 8.33 and 8.73 gm in the first and second seasons, respectively. The lowest fruit weight was obtained from untreated palms (6.5 and 6.83 gm) in the first and second seasons, respectively.

As for fruit dimensions (length and diameter), results in Table (2) clear that spraying Amhat date palm with vitamin-x at 2% either once or twice or three times improved fruit dimensions as compared with the untreated palms in both seasons of the study.

The highest fruit length was recorded from the palms sprayed with vitamin-x at 2% three times, since they gave 4.43 cm and 4.30 cm in the first an second seasons, respectively, followed by spraying vitamin-x at 2% twice which recorded 3.70 and 3.80 cm in both seasons of the study. The lowest value of fruit length was recorded from the untreated palms, since it gave 2.93 and 3.10 cm in the first and second seasons, respectively.

The highest fruit diameter value was recorded due to foliar spray with vitamin-x at 2% three times, since the diameter recorded 2.43 and 2.33 cm in the first and second seasons, respectively. The lowest fruit diameter value was obtained with the untreated palms (control) which gave 1.73 and 1.86 cm in the two seasons of the study.

Concerning pulp and seed weight (gm), it is clear from the results in Table (2) that foliar spray treatments with vitamin–x at 2% were significantly affected and improved pulp weight compared with the untreated palms in both seasons, while seed weight was not affected significantly by foliar spray with different treatments in the two seasons of the study.

In this respect, the highest value of pulp weight (8.33 and 9.1 gm) was obtained from palms sprayed with vitamin–x at 2 % three times compared with the other treatments including the untreated palms which gave the lowest value of pulp weight (5.63 and 5.90 gm) in the first and second seasons, respectively. In case of seed weight the value ranged from 0.83 to 0.93 gm in the two seasons.

Table (2): Effect of foliar spray with some vitamins on physical properties of Amhat date palm

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (gm)	Pulp weight (gm)	Seed weight (gm)
	2016 season				
Control	2.93 C	1.73 D	6.50 D	5.63 D	0.86 A
Spray vitamin-x 2% once	3.36 B	1.93 C	7.50 C	6.60 C	0.90 A
Spray vitamin-x 2% twice	3.70 B	2.23 B	8.33 B	7.63 B	0.86 A
Spray vitamin-x 2% three times	4.43 A	2.43 A	9.16 A	8.33 A	0.83 A
LSD at 0.05 level	**0.34**	**0.09**	**0.40**	**0.42**	**NS**
	2017 season				
Control	3.10 D	1.86 C	6.83 C	5.90 C	0.93 A
Spray vitamin-x 2% once	3.50 C	2.06 B	8.30 B	7.43 B	0.86 A
Spray vitamin-x 2% twice	3.80 B	2.23 A	8.73 B	7.90 B	0.83 A
Spray vitamin-x 2% three times	4.30 A	2.33 A	9.96 A	9.10 A	0.86 A
LSD at 0.05 level	**0.27**	**0.14**	**0.59**	**0.50**	**NS**

Fruit chemical properties

Results in Table (3) clear that all foliar spray treatments with vitamin–x at 2% (once, twice or three times) on Amhat date palm, significantly improved fruit quality in terms of increasing total soluble soils %, reducing sugars %, non reducing sugars % and total sugars compared with the untreated palms (control). On the other hand, the same treatments decreased total acidity % and soluble tannins % compared with the untreated Amhat date palms.

The beneficial effect of the antioxidant vitamins on activating cell division and the biosynthesis of sugars could explain the present results.

Table (3) Effect of foliar spray with some vitamins on chemical characteristics of Amhat date palm

Treatments	TSS (%)	Acidity (%)	Reducing sugars (%)	Non reducing sugars	Total sugars (%)	Tannins (%)
	2016 season					
Control	29.33 B	0.483 A	24.50 C	5.50 B	30.33 C	0.62 A
Spray vitamin-x 2% once	33.00 A	0.420 B	27.16 B	6.50 A	33.66 B	0.52 B
Spray vitamin-x 2% twice	31.66 A	0.403 BC	29.50 A	6.16 AB	35.66 A	0.45 C
Spray vitamin-x 2% three times	33.00 A	0.390 C	29.50 A	6.50 A	36.00 A	0.43 C
LSD at 0.05 level	**1.37**	**0.029**	**0.49**	**0.86**	**1.59**	**0.06**
	2017 season					
Control	29.33 C	0.483 A	25.00 D	6.16 BC	31.16 D	0.67 A
Spray vitamin-x 2% once	33.33 B	0.416 B	27.23 C	6.10 C	33.33 C	0.57 B
Spray vitamin-x 2% twice	34.66 A	0.400 BC	28.33 B	6.63 AB	34.96 B	0.51 C
Spray vitamin-x 2% three times	35.33 A	0.396 C	29.66 A	6.93 A	36.60 A	0.50 C
LSD at 0.05 level	**0.99**	**0.018**	**0.94**	**0.48**	**1.19**	**0.03**

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

IV. CONCLUSION

The best results with regard to yield as well as physical and chemical fruit properties of Amhat date palms were obtained owing to foliar spray with vitamin-x at 2 % three times annually.

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