

**THE RELATION BETWEEN USING SOME ANTIOXIDANTS
AND PRODUCTIVITY OF SEWY DATE PALMS**

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ABSTRACT

The effects of spraying four antioxidants namely, citric acid and ascorbic acid each at 500 ppm, tryptophan at 50 ppm and vitamins B complex at 25 ppm either singly or in all possible combinations on yield as well as physical and chemical characteristics of Sewy date fruits were investigated during 2005 and 2006 seasons. The palms received four sprays from these antioxidants.

Results showed that application of all antioxidants either alone or in all possible combinations were very effective in improving initial and ultimate fruit setting number of bunches / palm, yield, bunch weight, pulp percentage, fruit weight and dimensions, total soluble solids, total and reducing sugars, fruit content of N, P, K, Ca, Mg and Fe and reducing soluble tannins, crude fibers and total acidity compared to control treatment. The promotion was associated with the use of citric acid, ascorbic acid, tryptophan and vitamins B complex, in the descending order. Combined applications of these antioxidants were favorable than using each alone in this respect.

The best results with regard to yield, fruit quality and nutritional values of fruits were obtained with spraying the four antioxidants together four times at 0.1 %.

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INTRODUCTION

Poor cropping of Sewy date palms grown under sandy soil conditions is considered to be a serious and a major problem that faces date palm growers. This problem could be attributed mainly to poor setting and / or extensive dropping of flowers and fruits. Malnutrition and environmental conditions are considered to be the main factors responsible for low yielding. Antioxidants such as organic acids, amino acids and vitamins may play a definite role in solving the problem of poor yielding through enhancing growth, nutritional status, yield and fruit quality in different evergreen fruit crops namely date palms, citrus, mangoes, bananas and olives, (Barakat *et al.*, 1984; Ahmed *et al.*, 1998; Abd El- Wahab, 1999; Hegab, 2000; Hammam *et al.*, 2001; Ahmed, *et al.*, 2001; Ahmed 2001; Ahmed and Ragab, 2003; Abo-El-Komsan *et al.*, 2003, Gobara, 2004; Hamad, 2004, Shaarawy, 2005 and Gamal, 2006).

Antioxidants have an important and crucial roles in protecting the plant cells from free radicals or active oxygen species (Singlet O₂, superoxide anion, H₂O₂, hydroxyl and ozone) produced during plant metabolism which are responsible for oxidation of lipids (the component of plasma membrane) and the loss of plasma membrane permeability, consequently the death of plant cells. The positive action of antioxidants in chelating the free radicals could result in extending the shelf life of plant cells and stimulating growth aspects (Rao *et al.*, 2000). The same researchers also emphasized the beneficial of antioxidants in delaying the loss of membrane integrity and ethylene production, which are responsible for the enhancing of peroxidase and catalase activity that catalyze the oxidation of H₂O₂ (which is toxic to cells) and impairs resistance of plants against various disorders.

This study was designed to highlight the important effect of spraying of four antioxidants (citric and ascorbic acids, tryptophan and vitamins B complex) on yield and fruit quality of Sewy date palms grown under sandy soil conditions. The effect of these antioxidants on mineral content of fruits was also studied.

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MATERIALS AND METHODS

The present study was carried out during 2005 and 2006 seasons on 30 years old Sewy date palms grown in an orchard located at El-Dakhlah Oasis, New Valley Governorate. Forty-eight data plants uniform in vigour growth; were selected for treatments applications. The orchard soil was sandy and with water table depth not less than two meters. Palms were planted at 8x8 meters apart. Soil analysis (Table 1) was carried out according to Chapmann and Pratt (1961).

Table : 1 Analysis of the tested soil

Sand %	: 82.0
Silt %	: 5.6
Clay %	: 12.4
Texture	: Sandy
pH (1: 2.5 extract)	: 8.31
E.C. (1 : 2.5 extract)	: 0.63
CaCO₃ %	: 4.7
Organic matter %	: 0.62
Total N %	: 0.03
Available P (Olsen, ppm)	: 5.2
Available K (ammonium acetate, ppm)	: 210.0

The selected palms received a basal fertilization program included 10 m³ F.Y.M. (0.25 % N), 82 kg calcium superphosphate (37.5 % P₂O₅) , 246 kg ammonium nitrate (33.5 % N) and 41 kg potassium sulphate (48 % K₂O) per feddan. Other horticultural practices such as artificial pollination with vigour male of the same date palms, hoeing, pruning and irrigation were carried out as usual. Before the start of the experiment, number of bunches was adjusted to 10 bunches/palm for all investigated palms (48 palms).

The experiment included the following sixteen treatments from single and combined applications of the four antioxidants (citric acid, ascorbic acid, tryptophan and vitamins B complex).

Control (untreated palms)

Spraying citric acid at 500 ppm (0.5 g /L)

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- Spraying ascorbic acid at 500 ppm (0.5 g /L)
- Spraying tryptophan at 50 ppm (50 mg /L)
- Spraying vitamins B complex (B1, B3 and B6) at 25 ppm (25 mg/ 1 L water)
- Spraying citric acid at 500 ppm + ascorbic acid each at 500 ppm
- Spraying citric acid at 500 ppm + tryptophan at 50 ppm
- Spraying citric acid at 500 ppm + vitamins B at 25 ppm
- Spraying ascorbic acid at 500 ppm + tryptophan at 50 ppm
- Spraying ascorbic acid at 500 ppm + Vitamins B at 25 ppm
- Spraying Tryptophan at 50 ppm + Vitamins B at 25 ppm
- Spraying citric acid + ascorbic acid each at 500 ppm + tryptophan at 50 ppm
- Spraying citric acid + ascorbic acid each at 500 ppm + Vitamins B at 25 ppm
- Spraying ascorbic acid at 500 ppm + Tryptophan at 50 ppm + Vit. B at 25 ppm
- Spraying citric acid at 500 ppm + Tryptophan at 50 ppm + Vit. B at 25 ppm
- Spraying the four antioxidants together at the pre-mentioned concentrations

The antioxidants were applied at the recommended concentrations according to Abd El- Wahab, (1999); Abo El- Komsan *et al.*, (2003) and Gamal, (2006). Palms were sprayed with these antioxidants at four times during each growing season on the first week of March, April, May and June.

Each treatment was replicated three times, one palm per each. Triton B as a wetting agent was applied at 0.1 % to all spraying solutions of antioxidants and sprayed till run off with a motor sprayer. The design of this experiment was completely randomized block with three replicates.

The number of setted fruits per strand was counted using ten attached strands / spathe on each three bunches / palm after one month from artificial pollination; then initial and ultimate fruit setting percentages were calculated as follows:

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$$\text{Initial fruit setting \%} = \frac{\text{No of setted fruits / strand}}{\text{No of total flowers / strand}} \times 100$$

$$\text{Ultimate fruit setting \%} = \frac{\text{No of retained fruits / strand}}{\text{No of setted fruits / strand}} \times 100$$

The bunches (ten bunches) of all the chosen palms were picked at the optimum commercial harvesting date (2nd week of September) in both seasons for measuring the yield and number of bunches per palm (kg.) and bunch weight (kg) . Hundred fruits were taken randomly from the yield of each palm for the determination of the following physical and chemical characters of the fruits:-

Weight (g), length (cm) and width (cm) of fruit as well as pulp weight %.

Percentages of total soluble solids, total and reducing sugars and total acidity (expressed as g citric acid/ 100 g pulp) in the pulp were determined according to the standard methods which are outlined in A.O.A.C. (1996)

Percentage of soluble tannins in the pulp was determined according to Balbaa (1981) method.

Percentage of crude fibers was determined according to the standard procedures that outlined in A.O.A.C. (1996)

Nitrogen was determined in the digested samples of fruits by Kjeldahl method and the other nutrients (P, K, Ca, Mg, and Fe) were determined by atomic absorption and the standard methods outlined according to Chapmann and Pratt, (1961).

All obtained data were tabulated and subjected to the proper statistical analysis according to Gomez and Gomez (1984) using New L.S.D. parameter.

RESULTS

Effect of the antioxidants on initial and ultimate fruit setting percentages:

It is clear from the data in Table 2 that foliar application of citric acid and ascorbic acid each at 500 ppm, tryptophan at 50 ppm or vitamins B at 25 ppm either singly or in all possible combinations was significantly favorable for enhancing percentages of initial and ultimate fruit setting of Sewy date palms compared to the control treatment. Spraying vitamins B complex, Tryptophan, ascorbic acid and citric acid, in ascending order was very effective in stimulating such two characters. Double, triple or four applications of the used antioxidants were preferable in enhancing percentages of initial and ultimate fruit setting than using each antioxidant alone. The promotion was associated with the increase in the number of applied antioxidants. The best double and triple application treatments were citric and ascorbic acids as well as application of citric and ascorbic acid with tryptophan, respectively. Significant differences on the such two traits were observed among all studied treatments. The maximum values of initial (78.2 and 79.5 %) and ultimate fruit setting (62.2 and 65.0 %) were recorded on palms received four sprays of a mixture containing the four antioxidants. The untreated palms produced the minimum values. Similar results were observed in both seasons.

Effect of the antioxidants on yield / palm and bunch weight:

Data in Tables 2 and 3 clearly show that yield of Sewy date palms expressed in weight (kg) and bunch weight improved significantly with foliar application of citric acid and ascorbic acid each at 500 ppm, tryptophan at 50 ppm or vitamins B complex at 25 ppm either singly or in various combinations compared with control treatment. In the ascending order, application of vitamins B complex, tryptophan, ascorbic acid and citric acid was favorable in enhancing yield and bunch weight. Combined application of the four antioxidants was beneficial in enhancing yield and bunch weight compared to single application. From statistical point of view,

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significant differences on these parameters were observed among all antioxidant treatments. Four sprays of the four antioxidants at the pre-mentioned concentrations are suggested to induce the highest yield. Yield in such striking treatment reached 154 and 152.9 kg in both seasons, respectively. Untreated palms produced the minimum values (64.0 and 62.4 kg in both seasons). These results were true in both 2005 and 2006 seasons.

Table 2: Effect of the antioxidants on initial and ultimate fruit setting % of Sewy date palms during 2005 and 2006 seasons.

Antioxidant Treatment	Initial setting %		Ultimate setting %	
	2005	2006	2005	2006
Control treatment	50.1	50.0	31.5	33.0
Citric acid at 500 ppm	62.2	60.0	40.0	42.2
Ascorbic acid at 500 ppm	59.6	55.0	38.0	40.0
Tryptophan at 50 ppm	37.5	53.0	36.0	37.2
Vitamins B complex at 25 ppm	55.0	51.5	3.6	35.1
Citric + Ascorbic	70.4	69.0	52.2	55.0
Citric + tryptophan	69.0	67.4	50.2	52.4
Citric + vitamins B	66.9	66.0	48.2	50.3
Ascorbic + tryptophan	65.4	64.5	46.1	48.2
Ascorbic + Vitamins B	64.0	63.0	44.0	46.0
Tryptophan + Vitamins B	63.2	61.5	41.9	44.0
Citric + Ascorbic + Tryptophan	76.6	77.0	60.0	62.0
Citric + Ascorbic + Vitamins B	75.4	75.0	58.0	60.0
Ascorbic + Tryptophan + vitamins B	71.9	71.5	54.0	57.0
Citric + Tryptophan + vitamins B	73.3	73.0	56.0	58.0
The four antioxidants together	78.2	79.5	62.2	65.0
New L.S.D at 5%	1.3	1.0	1.9	2.0

Effect of the antioxidants on physical and chemical characters of the fruits.

Data obtained (Tables 3, 4, 5 and 6) show a remarkable and significant improvement in fruit quality in terms of increasing fruit weight and dimensions, pulp percentage as well as total soluble solids, total and reducing sugars and a decrease in total acidity, soluble tannins / and crude fibers in response to single or combined applications of the four antioxidants rather than non- application. The improvement was associated with using citric acid, ascorbic acid, tryptophan and vitamins B complex, in the descending orders. Increasing frequency of antioxidants was followed by promotion in fruit quality gradually. Fruit quality varied significantly according to antioxidant treatments. The best results with regard to fruit quality were obtained with the spraying of the four antioxidants four times annually. Unfavorable effects of fruit quality were recorded on the untreated palms. Similar results were recorded in both seasons.

Effect of the antioxidants on mineral content of fruits

It is evident from the data in Tables 7 and 8 that various treatments affected significantly fruit content of various nutrients. Single or combined application of the four antioxidants was followed by a significant improvement in N, P, K, Ca, Mg and Fe in the fruits compared with the control. Using citric acid, ascorbic acid, tryptophan, and vitamins B complex, in the descending order was favorable for enhancing these nutrients in the fruits. The major nutrients in Sewy date fruits were, K, N, P, Ca, Mg and Fe, in the descending order. The maximum values were recorded on fruits harvested from palms treated four times with the four antioxidants together. The lowest values were recorded on fruits picked from the untreated palms. These results were true in both seasons.

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Table 3 : Effect of the antioxidants on yield / palm (kg.), bunch weight (kg) and fruit weight (g) of Sewy date palms during 2005 and 2006 seasons.

Antioxidant Treatment	Yield/ palm (kg.)		Bunch weight (kg)		Fruit weight (g.)	
	2005	2006	2005	2006	2005	2006
Control treatment	64.0	62.4	8.0	7.5	14.0	13.8
Citric acid at 500 ppm	98.0	100.0	9.8	10.0	15.0	14.8
Ascorbic acid at 500 ppm	95.0	94.0	9.5	9.4	14.7	14.5
Tryptophan at 50 ppm	90.0	86.0	9.0	8.6	14.5	14.3
Vitamins B complex at 25 ppm	86.0	82.0	8.6	8.2	14.3	14.0
Citric + Ascorbic	132.0	133.1	12.0	12.1	15.8	15.4
Citric + tryptophan	127.6	129.8	11.6	11.8	15.7	15.2
Citric + vitamins B	123.0	124.3	11.2	11.3	15.6	14.9
Ascorbic + tryptophan	118.8	119.9	10.8	10.9	15.6	14.6
Ascorbic + Vitamins B	114.4	115.5	10.4	10.5	15.4	14.4
Tryptophan + Vitamins B	102.0	113.3	10.2	10.3	15.2	14.2
Citric + Ascorbic + Tryptophan	143.0	146.3	13.0	13.3	16.8	16.4
Citric + Ascorbic + Vitamins B	140.8	143.0	12.8	13.0	16.6	16.1
Ascorbic + Tryptophan + vitamins B	122.0	136.4	12.2	12.4	16.1	15.6
Citric + Tryptophan + vitamins B	125.0	138.6	12.5	12.6	16.3	15.8
The four antioxidants together	154.0	152.9	14.0	13.9	17.4	17.0
New L.S.D at 5%	2.5	2.8	0.3	0.3	0.2	0.2

Table 4: Effect of some antioxidants on fruit dimensions (Length and width in cm) and pulp % of Sewy date palms during 2005 and 2006 seasons.

Antioxidant Treatment	Fruit length (cm.)		Fruit width (cm.)		Pulp %	
	2005	2006	2005	2006	2005	2006
Control treatment	3.60	3.44	2.21	2.12	71.0	74.0
Citric acid at 500 ppm	3.90	3.66	2.40	2.29	78.0	78.2
Ascorbic acid at 500 ppm	3.82	3.60	2.34	2.23	76.4	77.2
Tryptophan at 50 ppm	3.71	3.55	2.30	2.20	75.0	76.1
Vitamins B complex at 25 ppm	3.65	3.48	2.25	2.15	72.3	75.0
Citric + Ascorbic	4.12	4.00	2.70	2.55	84.0	83.3
Citric + tryptophan	4.08	3.95	2.66	2.50	83.0	82.9
Citric + vitamins B	4.04	3.90	2.60	2.46	82.5	82.0
Ascorbic + tryptophan	4.00	3.82	2.55	2.42	82.0	81.2
Ascorbic + Vitamins B	3.96	3.76	2.51	2.37	81.2	80.1
Tryptophan + Vitamins B	3.93	3.71	2.46	2.33	80.0	79.1
Citric + Ascorbic + Tryptophan	4.26	4.20	2.78	2.75	88.0	86.3
Citric + Ascorbic + Vitamins B	4.22	4.14	2.75	2.70	87.0	86.0
Ascorbic + Tryptophan + vitamins B	4.16	4.05	2.71	2.62	85.0	84.2
Citric + Tryptophan + vitamins B	4.19	4.09	2.72	2.66	86.5	85.0
The four antioxidants together	4.41	4.44	2.82	2.80	88.8	87.0
New L.S.D at 5%	0.03	0.04	0.2	0.3	1.2	1.0

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Table 5: Effect of some antioxidants on some chemical characters of fruit of Sewy date palms during 2005 and 2006 seasons.

Antioxidant Treatment	T.S.S. %		Total sugars %		Reducing sugars %	
	2005	2006	2005	2006	2005	2006
Control treatment	34.0	35.0	30.0	31.0	25.1	25.1
Citric acid at 500 ppm	35.6	37.0	31.8	32.1	26.6	26.6
Ascorbic acid at 500 ppm	35.1	36.2	31.2	31.9	26.3	26.3
Tryptophan at 50 ppm	34.9	35.7	30.8	31.6	26.0	26.0
Vitamins B complex at 25 ppm	34.4	35.3	30.3	31.3	25.4	23.4
Citric + Ascorbic	38.6	40.1	34.0	34.9	28.5	29.0
Citric + tryptophan	38.1	39.1	33.6	34.6	28.2	28.4
Citric + vitamins B	37.3	38.9	33.3	34.2	27.9	28.0
Ascorbic + tryptophan	37.0	38.5	33.0	33.8	27.6	27.5
Ascorbic + Vitamins B	36.5	38.2	32.5	33.4	27.3	27.3
Tryptophan + Vitamins B	36.1	38.0	32.0	33.0	27.0	27.0
Citric + Ascorbic + Tryptophan	40.9	41.0	36.2	36.2	30.0	30.8
Citric + Ascorbic + Vitamins B	40.8	40.9	35.6	35.6	29.6	30.4
Ascorbic + Tryptophan + vitamins B	40.0	40.4	35.0	35.0	29.0	29.6
Citric + Tryptophan + vitamins B	40.5	40.6	35.2	35.2	29.3	30.0
The four antioxidants together	41.5	41.9	37.0	37.0	31.0	31.3
New L.S.D at 5%	0.4	0.3	0.2	0.2	0.2	0.2

Table 6: Effect of some antioxidants on total acidity %, soluble tannins % and crude fibers % of Sewy date palms during 2005 and 2006 seasons.

Antioxidant Treatment	Total acidity %		Soluble tannins %		Crude fibers %	
	2005	2006	2005	2006	2005	2006
Control treatment	0.355	0.392	1.82	1.80	1.91	1.94
Citric acid at 500 ppm	0.250	0.300	1.60	1.50	1.70	1.69
Ascorbic acid at 500 ppm	0.275	0.320	1.66	1.60	1.75	1.75
Tryptophan at 50 ppm	0.301	0.348	1.71	1.68	1.80	1.80
Vitamins B complex at 25 ppm	0.330	0.370	1.77	1.74	1.85	1.89
Citric + Ascorbic	0.188	0.250	1.73	1.15	1.27	1.25
Citric + tryptophan	0.190	0.260	1.45	1.20	1.41	1.30
Citric + vitamins B	0.192	0.269	1.50	1.25	1.48	1.36
Ascorbic + tryptophan	0.197	0.271	1.53	1.30	1.55	1.41
Ascorbic + Vitamins B	0.200	0.277	1.58	1.38	1.60	1.51
Tryptophan + Vitamins B	0.230	0.280	1.62	1.41	1.65	1.60
Citric + Ascorbic + Tryptophan	0.180	0.230	1.15	0.95	1.05	1.05
Citric + Ascorbic + Vitamins B	0.184	0.233	1.20	1.00	1.10	1.10
Ascorbic + Tryptophan + vitamins B	0.187	0.240	1.31	1.10	1.20	1.20
Citric + Tryptophan + vitamins B	0.186	0.237	1.27	1.05	1.14	1.13
The four antioxidants together	0.170	0.199	1.04	0.91	1.00	0.96
New L.S.D at 5%	0.021	0.21	0.03	0.05	0.05	0.04

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Table 7: Effect of some antioxidants on fruit content of N (%), P (mg/100g pulp) and K (%) of Sewy date palms during 2005 and 2006 seasons.

Antioxidant Treatment	Fruit N %		Fruit P (mg/ 100 g pulp)		Fruit K %	
	2005	2006	2005	2006	2005	2006
Control treatment	0.48	0.50	60.2	61.0	0.80	0.85
Citric acid at 500 ppm	0.58	0.59	65.3	65.3	1.05	1.10
Ascorbic acid at 500 ppm	0.56	0.56	64.2	64.1	0.99	1.02
Tryptophan at 50 ppm	0.53	0.55	62.3	63.0	0.92	0.96
Vitamins B complex at 25 ppm	0.51	0.52	61.2	61.9	0.86	0.90
Citric + Ascorbic	0.78	0.73	73.2	73.0	1.43	1.46
Citric + tryptophan	0.75	0.70	72.1	71.6	1.37	1.40
Citric + vitamins B	0.71	0.68	70.9	70.5	1.30	1.35
Ascorbic + tryptophan	0.68	0.65	69.9	68.9	1.22	1.30
Ascorbic + Vitamins B	0.65	0.63	68.5	67.6	1.16	1.22
Tryptophan + Vitamins B	0.62	0.61	66.5	66.5	1.10	1.16
Citric + Ascorbic + Tryptophan	0.90	0.82	77.9	78.5	1.71	1.79
Citric + Ascorbic + Vitamins B	0.87	0.80	76.6	77.0	1.63	1.66
Ascorbic + Tryptophan + vitamins B	0.81	0.75	74.2	74.1	1.50	1.55
Citric + Tryptophan + vitamins B	0.84	0.78	75.3	75.2	1.55	1.60
The four antioxidants together	0.95	0.87	78.3	80.0	1.80	1.86
New L.S.D at 5%	0.02	0.02	0.8	0.9	0.04	0.03

Table 8: Effect of some antioxidants on fruit content of Ca, Mg and Fe (mg/100g pulp) of Sewy date palms during 2005 and 2006 seasons.

Antioxidant Treatment	Fruit Ca (mg/ 100 g pulp)		Fruit Mg (mg/ 100 g pulp)		Fruit Fe (mg/ 100-g pulp)	
	2005	2006	2005	2006	2005	2006
Control treatment	50.0	48.0	40.0	38.2	2.11	2.01
Citric acid at 500 ppm	53.0	50.7	45.5	43.5	2.35	2.52
Ascorbic acid at 500 ppm	52.6	50.0	44.0	42.2	2.30	2.42
Tryptophan at 50 ppm	51.8	49.3	42.3	40.5	2.22	2.22
Vitamins B complex at 25 ppm	51.0	48.6	41.2	39.3	2.16	2.11
Citric + Ascorbic	63.0	57.6	53.3	51.0	2.71	3.41
Citric + tryptophan	60.9	56.6	52.2	49.6	2.66	3.20
Citric + vitamins B	58.3	55.5	51.2	48.5	2.60	3.11
Ascorbic + tryptophan	56.2	53.8	49.9	47.5	2.52	3.00
Ascorbic + Vitamins B	55.0	52.9	48.5	45.7	2.46	2.84
Tryptophan + Vitamins B	54.0	51.9	47.0	44.6	2.41	2.72
Citric + Ascorbic + Tryptophan	71.0	62.9	58.9	55.2	3.11	3.88
Citric + Ascorbic + Vitamins B	68.0	61.2	57.5	54.0	3.00	3.82
Ascorbic + Tryptophan + vitamins B	65.0	59.0	55.0	52.0	2.77	3.62
Citric + Tryptophan + vitamins B	66.3	60.0	56.2	52.9	2.89	3.74
The four antioxidants together	72.5	64.0	61.0	57.2	3.19	4.00
New L.S.D at 5%	0.7	0.6	1.0	1.1	0.02	0.03

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DISCUSSION

The positive action of the four antioxidants on yield, fruit quality and nutritional status of the fruits could mainly attributed to their catching effect on the free radicals (previously mentioned), prolonging shelf- life of plant cells, delaying ethylene production and protecting plants from different disorders. Our results are supported by the previous work carried out by Rao *et al.* (2000); Hammam *et al.*, (2001), Ahmed *et al.*, (2001) ; Ahmed (2001); Hamad (2004) and Gamal (2006).

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العلاقة بين استخدام بعض المواد المضادة للاكسدة والإنتاجية في نخيل البلح السيوى

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تم دراسة تأثيرات رش اربعة مواد مضادة للاكسدة هي حامض الستريك وحامض الاسكوربيك بتركيز 500 جزء في المليون لكل منهما والحامض الامينى الترتوفان بتركيز 50 جزء في المليون وفيتامين ب المركب بتركيز 25 جزء في المليون أما بصورة فردية او بجميع التوليفات المختلفة على كمية المحصول والخصائص الطبيعية

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والكيميائية للثمار فى نخيل البلح السيوى وذلك خلال موسى 2005 ، 2006 ولقد تم رش النخيل اربعة مرات بهذه المواد المضادة للاكسدة.

لقد اشارت نتائج الدراسة أن الاستخدام الفردى او المشترك للمواد المضادة للاكسدة كان فعالا جدا فى تحسين النسبة المئوية للعقد المبدئى والنهائى للثمار وعدد السويطات فى النخلة الواحدة ، كمية المحصول ، وزن السويطة ، النسيبة المئوية للب ووزن وابعاد الثمرة والنسيبة المئوية للمواد الصلبة الذائبة الكلية والسكريات الكلية والمختزلة وتحتوى الثمار من عناصر النيتروجين والفوسفور والبوتاسيوم والكالسيوم والماغنسيوم والحديد وفى نقص النسبة المئوية للحموضة الكلية والتانينات الذائبة والالياف الخام وذلك بالمقارنة بعدم استخدام هذه المواد وكان التحسن مرتباً باستخدام حامض الستريك ، حامض الاسكوربيك ، التريبتوفان وفيتامين ب المركب مرتبة ترتيباً تنازلياً وكان الاستخدام المشترك لهذه المواد افضل من الاستخدام الفردى فى هذا الصدد.

أمكن الحصول على أفضل النتائج بخصوص كمية المحصول وخصائص الجودة للثمار والقيمة الغذائية لها عند رش النخيل بمضادات الأكسدة الأربعة معاً.