

## Using Some Amino Acids Enriched With Certain Nutrients for Improving Productivity of El- Saily Date Palms

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**Abstract:** During 2012 and 2013 seasons, El- Saily date palms treated twice, thrice or four times with amino acids (tryptophan, methionene and arginine) enriched with NPKMgZnFeMn and B at 0.05 to 0.2%. Growth characters, plant pigments, leaf content of N, P, K, Mg, Ca, Zn, Fe, Mn and Cu, total carbohydrates %, C/N, yield and fruit quality in response to application of these amino acids and various nutrients were investigated. Foliar application of amino acids enriched with nutrients twice, thrice or four times at 0.05 to 0.2% was very effective in enhancing growth, all nutrients, plant pigments, total carbohydrates %, yield and fruit quality in relative to the check treatment. The promotion was in proportional to the increase in concentrations and frequencies of spraying amino acids enriched with nutrients. Supplying El- Saily date palms three times with amino acids (tryptophan, methionene and arginine) enriched with NPKMgZnFeMn and B at 0.1% proved to be effective for promoting productivity.

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### 1. Introduction

Amino acids with their antioxidative properties play an important role in plant defense against oxidative stress induced by unfavourable conditions. They are responsible for enhancing the biosynthesis of proteins, plant pigments, vitamins and natural hormones such as IAA and ethylene and stimulating cell division (Sies, 1997).

Macro and micro nutrients play many important regulatory roles in activating various enzymes, biosynthesis of organic foods, plant pigments, vitamins and hormones and enhancing cell division as well as water and nutrient uptake (Blevins and Lukaszewski, 1998; Yagodin, 1990 and Mengel *et al*, 2001).

Using amino acids (Rizk, 2013; El- Badawy and Abd El-aal, 2013; Ahmed *et al*, 2013; Ibrahim *et al*, 2013 and Hassan, 2014) and various macro and micro nutrients (Diab, 2006; Al- Hamoudi, 2006; Moghimi, 2007; Khayyat *et al*, 2007; Behrooznam and Shirzadi, 2007; Desouky *et al*, 2007; Attalla, *et al*, 2007; Abdalla, 2008, Harhash and Abdel- Nasser, 2010; Attalla *et al*, 2011; Mohamed and Mohamed, 2013 and Ahmed *et al*, 2014) were very effective in improving yield and fruit quality in different date palms cvs.

The objective of this study was elucidating the effect if certain concentrations and frequencies of amino acids enriched with some macro and micro nutrients on growth, palm nutritional status, yield as well as physical and chemical characteristics of El Saily date palms grown new Valley climatic conditions.

### 2. Material and Methods

This study was carried in a private date palm orchard situated at Moot village, El- Dakhla oasis, New valley Governorate during two consecutive seasons of 2012 and 2013 on 12- years old El- Saily date palms (as semi dry date palm cv.). The selected palms were uniform in vigour, healthy, good physical conditions, free from insects, damages and diseases. The texture of the soil is sandy loam. They are planted at 8 x 8 meters apart. The selected palms were irrigated through surface irrigation system. The number of female spathes per palm was adjusted to ten spathes. The leaf bunch ratio was maintained at 8: 1.

Generally hand pollination of all the selected palms was achieved. Pollination was carried out throughout two days after spathe cracking at the day time of afternoon. All the selected palms received the common horticultural practices that are already applied in the orchard. The experiment included ten treatments from three concentrations (0.05, 0.1 and 0.2%) and frequencies (twice, thrice or four times) of spraying amino acids (tryptophan, methionene and arginine) enriched with NPKMgZnFeMn and B besides the control treatment. Macro and micro nutrients mixture used contain urea (46% N), orthophosphoric acid, potassium sulphate (48 % K<sub>2</sub>O), and magnesium sulphate (9.6%Mg), each applied at 0.2% besides chelated Zn, Fe, and Mn each at 0.05% and boric acid (17% B ) at 0.05%. Spraying was done twice (at growth start and just after fruit setting), thrice (at the same previous two dates and at one month later) or four times (at the same previous three dates and at one

month later). Triton B as a wetting agent was applied at 0.05% for all solutions. Each treatment was replicated three times one palm per each. Randomized complete block design was followed.

During both seasons the following measurements were recorded.

- 1- Vegetative growth characters namely number of green leaves / palm, number of pinnae / leaf, length, width and area of leaf and pinnae (**Ahmed and Morsy, 1999**), number of spines / leaf and spine length(cm).
- 2- Leaf chemical composition including plant pigments namely chlorophylls a& b, total chlorophylls and total carotenoids (mg 100 g F.W.) (**Von-Wettstein, 1957**), total carbohydrates % ( **A.O.A.C., 2000**) and leaf content of N, P, K, Mg, Ca, (as %), Zn, Fe, Mn and Cu ( as ppm) (**Cottenie et al, 1982**).
- 3- Yield / palm (kg.) and bunch weight (kg.)
- 4- Physical and chemical characteristics of the fruits namely weight, length and width of fruit, percentages of pulp and seed, pulp / seed, T.S.S.%, total, reducing and non- reducing sugars %, total acidity ( as g malic acid/ 100 g pulp), total crude fibre % and total soluble tannins % (**A.O.A.C., 2000**).

Thereafter, the obtained data were tabulated and subjected to the proper statistical analysis of variance using New L.S.D test for recognizing the significance differences among the various treatment means according to the method outlined by **Mead et al., (1993)**.

### 3. Results

#### 1- Growth characters:

It is clear from the data in Tables ( 1 & 2 & 3) that foliar application of amino acids enriched with nutrients at 0.05 to 0.2% twice, thrice or four times significantly stimulated number of green leaves per palm, number of pinnae / leaf, length, width and area of leaf and pinnae, number of spines/ leaf and spine length in relative to the control. The promotion was in proportional to the increase in concentrations from 0.05 to 0.2% and frequencies from twice to four times. Increasing concentrations from 0.1 to 0.2% and frequencies from thrice to four times caused a slight promotion. The maximum values were recorded on the palms that received four sprays of amino acids enriched with nutrients at 0.2%. The same trend was noticed during 2012 and 2013 seasons.

#### 2- Leaf chemical composition:

The data in Tables (3 to 7) show that plant pigments (chlorophylls a & b, total chlorophylls and total carotenoids), total carbohydrates %, N, P, K, Mg, Ca, (as %) Zn, Fe and Mn were significantly enhanced in response to spraying amino acids enriched with nutrients at 0.05 to 0.2% either twice, thrice or four

times rather than non- application. There was a gradual stimulation on these nutrients with increasing concentrations and frequencies without significant promotion among the higher two concentrations and frequencies. The investigated treatments had no significant effect on the leaf content of Cu and C/N. The maximum values were recorded on the palms that received four sprays of amino acids enriched with nutrients at 0.2 %. Similar results were announced during 2012 and 2013 seasons.

#### 3- Yield per palm and bunch weight:

The data in Table (7) reveal that yield per palm and bunch weight were significantly improved owing to treating the palms twice, thrice or four times with amino acids enriched with nutrients at 0.05 to 0.2% rather than non- application. The promotion was associated with increasing concentrations and frequencies. Insignificant promotion was observed among the higher two concentrations and frequencies. Therefore the recommended concentration and frequency were 0.1 and thrice, respectively. The maximum yield (120.0 & 120.0 kg ) and bunch weight ( 12.0 & 12.0 kg) were recorded on the palms that received three sprays of amino acids enriched with nutrients at 0.1% during both seasons, respectively. The percentage of increase on the yield owing to using the promised treatment over the check treatment reached 29.03 and 26.3 % during both seasons, respectively.

#### 4- Fruit quality:

Data listed in Tables ( 7 to 10) clearly show that supplying the palms twice, thrice or four times with amino acids enriched with nutrients at 0.05 to 0.2 % was significantly very effective in improving fruit quality in terms of increasing fruit weight and dimensions, pulp % and pulp/ seed, T.S.S. % as well as total and reducing sugars % and decreasing seeds %, total acidity %, crude fibre % and total soluble tannins % compared to non application. The promotion was correlated with increasing concentrations and frequencies. Increasing concentrations from 0.1 to 0.2 and frequencies from thrice to four times had no significant promotion. The best results were obtained on the palms that sprayed thrice with amino acids enriched with nutrients at 0.1%. These results were true during 2012 and 2013 seasons.

#### 4. Discussion

The previous beneficial effects of amino acids on growth and fruiting of EI- Sady date palms might be ascorbic to their important roles in enhancing proteins, plant pigments, vitamins, natural hormones and organic foods biosynthesis and the resistance of plants to different stresses as well as stimulating cell division ( **Sies, 1997**).

These results are in harmony with those obtained on different date palm cvs by **Rizk (2013)**; EI-

**Badawy and Abd El-aal (2013); Fathalla (2013); Haggag- Laila et al, (2013); Ahmed et al, (2013); Ibrahiem et al, (2013) and Hassan (2014).**

The promoting effect of nutrients on growth and productivity of El- Saily date palms might be ascribed to their positive action in enhancing plant anabolism and building of all organic foods, vitamins, plant pigments and natural hormones. Their essential role in

enhancing cell division and the uptake of water and nutrients and the efficiency of pollination and fertilization did not neglect in this respect (**Yagodin, 1990 and Mengel et al, 2001**).

These results are in accordance with those obtained by **Attala et al, (2011); Mohamed and Mohamed (2013) and Ahmed et al, (2014)** on different date palm cvs.

**Table (1):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the number of a green leaves per palm, number of pinnae / leaf as well as length and width of leaf (cm) of El- Saily date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Number of green leaves per palm		Number of pinnae per leaf		Leaf length (m)		Leaf width (m)	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	21.3	21.0	195.0	199.6	4.60	4.61	0.59	0.61
2-Amino acids enriched with nutrients at 0.05 % twice	21.6	21.3	197.6	203.0	4.90	4.92	0.66	0.69
3- Amino acids enriched with nutrients at 0.05 % thrice	21.7	21.6	200.3	206.0	5.20	5.25	0.73	0.76
4-Amino acids enriched with nutrients at 0.05 % four times	21.7	21.7	201.0	207.0	5.26	5.27	0.74	0.77
5- Amino acids enriched with nutrients at 0.1 % twice	22.0	22.0	206.0	211.0	5.71	5.77	0.82	0.86
6- Amino acids enriched with nutrients at 0.1 % thrice	22.3	22.6	211.0	216.7	6.11	6.21	0.88	0.94
7- Amino acids enriched with nutrients at 0.1 % four times	22.3	22.7	212.0	217.0	6.17	6.24	0.89	0.95
8- Amino acids enriched with nutrients at 0.2 % twice	22.6	23.0	206.6	212.0	6.77	5.80	0.84	0.87
9- Amino acids enriched with nutrients at 0.2 % thrice	22.7	23.1	211.3	217.0	6.16	6.25	0.90	0.95
10- Amino acids enriched with nutrients at 0.2 % four times	22.7	23.1	212.7	217.7	6.20	6.28	0.92	0.97
New L.S.D. at 5%	NS	NS	1.9	2.1	0.21	0.23	0.05	0.06

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (2):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the length, width and area of pinnae and leaf area of leaf (cm) of El- Saily date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Pinnae length(cm.)		Pinnal width(cm.)		Pinnae area (cm2)		Leaf area (cm2)	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	47.1	48.2	3.11	3.15	64.49	66.47	1.26	1.33
2-Amino acids enriched with nutrients at 0.05 % twice	49.9	51.0	3.31	3.34	71.40	73.32	1.41	1.49
3- Amino acids enriched with nutrients at 0.05 % thrice	52.9	54.0	3.67	3.71	82.12	84.42	1.64	1.74
4-Amino acids enriched with nutrients at 0.05 % four times	53.0	54.1	3.70	3.75	82.85	85.35	1.67	1.77
5- Amino acids enriched with nutrients at 0.1 % twice	57.0	58.1	3.92	3.97	92.96	95.63	1.91	2.02
6- Amino acids enriched with nutrients at 0.1 % thrice	64.0	65.1	4.12	4.17	107.85	110.73	2.28	2.40
7- Amino acids enriched with nutrients at 0.1 % four times	64.8	65.9	4.14	4.19	109.55	112.45	2.32	2.44
8- Amino acids enriched with nutrients at 0.2 % twice	58.0	59.1	3.93	3.99	94.63	97.54	1.96	2.07
9- Amino acids enriched with nutrients at 0.2 % thrice	64.9	66.0	4.14	4.20	109.70	112.85	2.32	2.45
10- Amino acids enriched with nutrients at 0.2 % four times	65.3	66.4	4.15	4.22	110.56	113.97	2.35	2.48
New L.S.D. at 5%	1.8	1.9	0.11	0.09	2.22	2.11	0.08	0.08

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (3):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the number of spines / leaf, spine length as well as chlorophylls a and b in the leaves of El- Saigy date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Number of spines /leaf		Spine length (cm.)		Chlorophyll a (mg/100gFw)		Chlorophyll b (mg/100gFw)	
	2012	2013	2012	2013	2012	2013	2012	2013
<b>1-Control</b>	25.0	25.7	11.91	12.01	7.82	7.91	3.31	3.35
<b>2-Amino acids enriched with nutrients at 0.05 % twice</b>	26.9	27.6	12.51	13.01	8.55	8.66	3.51	3.60
<b>3- Amino acids enriched with nutrients at 0.05 % thrice</b>	28.0	28.8	13.11	13.61	8.90	9.01	3.71	3.80
<b>4-Amino acids enriched with nutrients at 0.05 % four times</b>	28.3	29.0	13.17	13.68	9.94	9.05	3.73	3.82
<b>5- Amino acids enriched with nutrients at 0.1 % twice</b>	30.0	30.8	14.16	14.67	9.74	9.87	4.11	4.20
<b>6- Amino acids enriched with nutrients at 0.1 % thrice</b>	33.0	33.8	15.17	15.67	10.55	10.71	4.51	4.60
<b>7- Amino acids enriched with nutrients at 0.1 % four times</b>	33.7	34.5	15.20	15.71	10.66	10.74	4.55	4.64
<b>8- Amino acids enriched with nutrients at 0.2 % twice</b>	30.3	31.0	14.25	14.75	9.76	9.91	4.13	4.22
<b>9- Amino acids enriched with nutrients at 0.2 % thrice</b>	33.6	33.9	15.29	15.79	10.60	10.75	4.53	4.62
<b>10- Amino acids enriched with nutrients at 0.2 % four times</b>	34.0	34.8	15.41	15.91	10.76	10.79	4.57	4.67
<b>New L.S.D. at 5%</b>	101	1.2	0.49	0.47	0.25	0.21	0.14	0.15

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (4):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the total chlorophylls and total contentoids, total carbohydrates% and N% in the leaves of El- Saigy date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Total chlorophylls (mg/100gFw)		Total corotenoids (mg/100gFw)		Total carbohydrates%		Leaf N%	
	2012	2013	2012	2013	2012	2013	2012	2013
<b>1-Control</b>	11.13	11.26	2.91	2.95	11.55	11.60	1.71	1.74
<b>2-Amino acids enriched with nutrients at 0.05 % twice</b>	12.06	12.26	3.04	3.11	11.90	11.94	1.80	1.88
<b>3- Amino acids enriched with nutrients at 0.05 % thrice</b>	12.61	12.81	3.16	3.23	12.25	12.28	1.88	1.96
<b>4-Amino acids enriched with nutrients at 0.05 % four times</b>	12.67	12.87	3.18	3.25	12.30	12.34	1.90	1.98
<b>5- Amino acids enriched with nutrients at 0.1 % twice</b>	13.85	14.07	3.31	3.37	12.80	12.84	1.99	2.08
<b>6- Amino acids enriched with nutrients at 0.1 % thrice</b>	15.06	15.31	3.46	3.53	13.25	13.28	2.09	2.17
<b>7- Amino acids enriched with nutrients at 0.1 % four times</b>	15.21	15.39	3.50	3.57	13.31	13.53	2.10	2.19
<b>8- Amino acids enriched with nutrients at 0.2 % twice</b>	13.89	14.33	3.33	3.40	12.82	12.86	2.00	2.09
<b>9- Amino acids enriched with nutrients at 0.2 % thrice</b>	15.13	15.37	3.50	3.57	13.28	13.22	2.10	2.18
<b>10- Amino acids enriched with nutrients at 0.2 % four times</b>	15.33	15.46	3.51	3.60	13.39	13.44	2.12	2.21
<b>New L.S.D. at 5%</b>	0.26	0.29	0.11	0.12	0.31	0.29	0.06	0.05

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (5):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the percentages of P, K, Mg and Ca in the leaves of El- Saïdy date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Leaf P%		Leaf K%		Leaf Mg %		Leaf Ca %	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	0.13	0.14	1.29	1.32	0.33	0.35	1.94	1.99
2-Amino acids enriched with nutrients at 0.05 % twice	0.15	0.18	1.35	1.38	0.37	0.40	2.03	2.10
3- Amino acids enriched with nutrients at 0.05 % thrice	0.17	0.21	1.41	1.44	0.42	0.47	2.10	2.17
4-Amino acids enriched with nutrients at 0.05 % four times	0.18	0.22	1.42	1.45	0.43	0.48	2.12	2.19
5- Amino acids enriched with nutrients at 0.1 % twice	0.21	0.25	1.50	1.55	0.51	0.55	2.22	2.29
6- Amino acids enriched with nutrients at 0.1 % thrice	0.24	0.28	1.57	1.62	0.57	0.60	2.31	2.38
7- Amino acids enriched with nutrients at 0.1 % four times	0.25	0.29	1.58	1.63	0.58	0.62	2.32	2.39
8- Amino acids enriched with nutrients at 0.2 % twice	0.22	0.26	1.52	1.57	0.52	0.56	2.23	2.30
9- Amino acids enriched with nutrients at 0.2 % thrice	0.25	0.29	1.59	1.65	0.58	0.61	2.33	2.41
10- Amino acids enriched with nutrients at 0.2 % four times	0.26	0.30	1.60	1.67	0.59	0.63	2.35	2.43
New L.S.D. at 5%	0.02	0.03	0.05	0.04	0.03	0.03	0.06	0.07

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (6):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the leaf content of Zn, Fe, Mn and Cu (as PPM) in the leaves of El- Saïdy date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Leaf Zn (ppm)		Leaf Fe (ppm)		Leaf Mn (ppm)		Leaf Cu (ppm)	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	41.1	42.0	42.9	44.0	51.0	51.3	2.2	2.4
2-Amino acids enriched with nutrients at 0.05 % twice	44.5	45.5	4.71	48.2	54.5	55.2	2.2	2.4
3- Amino acids enriched with nutrients at 0.05 % thrice	48.0	49.0	51.2	52.3	59.0	59.7	2.3	2.5
4-Amino acids enriched with nutrients at 0.05 % four times	48.6	49.7	52.0	53.1	60.0	60.7	2.3	2.5
5- Amino acids enriched with nutrients at 0.1 % twice	52.0	53.1	59.0	60.1	64.9	65.7	2.3	2.5
6- Amino acids enriched with nutrients at 0.1 % thrice	57.0	58.0	65.0	66.1	69.3	70.1	2.3	2.5
7- Amino acids enriched with nutrients at 0.1 % four times	57.8	58.8	66.2	67.3	70.0	70.8	2.3	2.5
8- Amino acids enriched with nutrients at 0.2 % twice	52.5	53.5	60.9	62.0	65.0	65.9	2.4	2.6
9- Amino acids enriched with nutrients at 0.2 % thrice	57.3	58.5	66.3	67.4	70.0	70.8	2.4	2.6
10- Amino acids enriched with nutrients at 0.2 % four times	58.0	59.0	67.0	68.1	71.0	71.9	2.4	2.6
New L.S.D. at 5%	8.1	2.9	2.9	2.8	2.1	2.2	NS	NS

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (7):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on C(N in the leaves, yield/ Palm (Kg.), bunch weight (Kg.) and fruit weight(g.) of El- Saïdy date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	C/N		Yield/Palm (Kg.)		Bunch weight (Kg.)		Fruit weight(g.)	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	6.75	6.67	93.0	95.0	9.3	9.5	6.85	6.90
2-Amino acids enriched with nutrients at 0.05 % twice	6.61	6.35	98.0	100.0	9.8	10.0	6.98	7.03
3- Amino acids enriched with nutrients at 0.05 % thrice	6.52	6.27	103.0	106.0	10.3	10.6	7.14	7.20
4-Amino acids enriched with nutrients at 0.05 % four times	6.47	6.23	105.0	107.0	10.5	10.7	7.16	7.21
5- Amino acids enriched with nutrients at 0.1 % twice	6.43	6.17	112.0	114.0	11.2	11.4	7.31	7.37
6- Amino acids enriched with nutrients at 0.1 % thrice	6.34	6.12	120.0	120.0	12.0	12.0	7.45	7.52
7- Amino acids enriched with nutrients at 0.1 % four times	6.34	6.10	121.0	121.0	12.1	12.1	7.47	7.54
8- Amino acids enriched with nutrients at 0.2 % twice	6.41	6.15	113.0	115.0	11.3	11.5	7.33	7.41
9- Amino acids enriched with nutrients at 0.2 % thrice	6.32	6.11	121.0	120.0	12.1	12.0	7.47	7.55
10- Amino acids enriched with nutrients at 0.2 % four times	6.32	6.08	122.0	123.0	12.2	12.3	7.49	7.57
New L.S.D. at 5%	NS	NS	5.0	4.9	0.4	0.5	0.09	0.10

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (8):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on length and width of fruit as well as percentages of pulp and seed of El- Saïdy date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Fruit length(cm.)		Fruit width (cm.)		Pulp %		Seeds %	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	2.91	2.94	1.81	1.83	76.3	76.5	23.7	23.5
2-Amino acids enriched with nutrients at 0.05 % twice	2.98	3.10	1.86	1.93	76.9	77.0	23.1	23.0
3- Amino acids enriched with nutrients at 0.05 % thrice	3.06	3.18	1.91	1.98	77.9	78.0	22.1	22.0
4-Amino acids enriched with nutrients at 0.05 % four times	3.07	3.19	1.92	1.99	78.0	78.2	22.0	21.8
5- Amino acids enriched with nutrients at 0.1 % twice	3.34	3.46	1.98	2.06	79.2	79.3	20.8	20.7
6- Amino acids enriched with nutrients at 0.1 % thrice	3.51	3.63	2.14	2.21	80.0	80.2	20.0	19.8
7- Amino acids enriched with nutrients at 0.1 % four times	3.53	3.65	2.15	2.23	80.3	80.4	19.7	19.6
8- Amino acids enriched with nutrients at 0.2 % twice	3.35	3.47	1.99	2.07	79.4	79.4	20.6	20.6
9- Amino acids enriched with nutrients at 0.2 % thrice	3.52	3.64	2.15	2.22	80.2	80.3	19.8	19.7
10- Amino acids enriched with nutrients at 0.2 % four times	3.53	3.66	2.16	2.24	80.5	80.5	19.5	19.5
New L.S.D. at 5%	0.06	0.07	0.03	0.04	0.4	0.4	0.4	0.5

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (9):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the ratio between pulp and seed as well as percentages of total soluble solids and total and reducing sugars in the fruits of El- Saïdy date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Pulp/seed		T.S.S %		Total sugars%		Reducing sugars%	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	3.22	3.26	69.3	70.0	61.1	61.5	27.5	27.7
2-Amino acids enriched with nutrients at 0.05 % twice	3.33	3.35	70.7	71.4	62.2	63.1	28.2	28.5
3- Amino acids enriched with nutrients at 0.05 % thrice	3.52	3.55	71.9	72.6	63.2	64.1	28.9	29.2
4-Amino acids enriched with nutrients at 0.05 % four times	3.55	3.59	72.2	72.8	63.6	64.5	29.0	29.3
5- Amino acids enriched with nutrients at 0.1 % twice	3.81	3.83	74.2	74.9	64.8	65.7	30.0	30.3
6- Amino acids enriched with nutrients at 0.1 % thrice	4.00	4.05	75.3	75.9	66.0	66.9	30.8	31.1
7- Amino acids enriched with nutrients at 0.1 % four times	4.08	4.10	75.5	76.1	66.5	67.2	31.0	31.3
8- Amino acids enriched with nutrients at 0.2 % twice	3.85	3.85	74.4	75.0	65.0	65.8	30.2	30.6
9- Amino acids enriched with nutrients at 0.2 % thrice	4.05	4.08	75.6	76.1	66.3	67.0	31.0	31.2
10- Amino acids enriched with nutrients at 0.2 % four times	4.13	4.13	75.8	76.3	66.7	67.4	31.3	31.5
New L.S.D. at 5%	0.09	0.11	0.9	0.8	0.8	0.7	0.6	0.5

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

**Table (10):** Effect of different concentrations and frequencies of amino acids enriched with nutrients on the percentages of non-reducing sugars, total acidity, crude fibre and total soluble tannins in the fruits of El- Saily date palms during 2012 and 2013 seasons.

Amino acids enriched with nutrient treatments	Non-Reducing sugars%		Total acidity%		Crude fibre%		Total soluble tannins%	
	2012	2013	2012	2013	2012	2013	2012	2013
1-Control	33.6	33.8	0.355	0.351	0.92	0.92	0.80	0.79
2-Amino acids enriched with nutrients at 0.05 % twice	34.0	34.6	0.335	0.330	0.71	0.66	0.71	0.61
3- Amino acids enriched with nutrients at 0.05 % thrice	34.3	34.9	0.311	0.306	0.64	0.59	0.60	0.50
4-Amino acids enriched with nutrients at 0.05 % four times	34.6	35.2	0.308	0.302	0.62	0.57	0.57	0.47
5- Amino acids enriched with nutrients at 0.1 % twice	34.8	35.4	0.290	0.285	0.52	0.47	0.50	0.40
6- Amino acids enriched with nutrients at 0.1 % thrice	35.2	35.8	0.271	0.266	0.42	0.37	0.45	0.35
7- Amino acids enriched with nutrients at 0.1 % four times	35.5	35.9	0.269	0.264	0.39	0.34	0.43	0.33
8- Amino acids enriched with nutrients at 0.2 % twice	34.8	35.2	0.288	0.283	0.50	0.45	0.49	0.39
9- Amino acids enriched with nutrients at 0.2 % thrice	35.3	35.8	0.269	0.264	0.40	0.35	0.44	0.34
10- Amino acids enriched with nutrients at 0.2 % four times	35.4	35.9	0.266	0.261	0.37	0.32	0.42	0.32
New L.S.D. at 5%	NS	NS	0.018	0.019	0.04	0.05	0.05	0.04

Amino acids = tryptophan + methionene + aginine

Nutrients = urea, orthophosphoric acid, potassium sulphate and magnesium sulphate each at 0.2% + chelated Zn, Fe and Mn each at 0.05 % + boric acid at 0.05%.

### Conclusion:

Treating El- Saily date palms three times at growth start, just after fruit setting and at one month later with amino acids (tryptophan, methionene and arginine) enriched with NPKMgZnFeMn and B at 0.1% gave the best results with regard to yield and fruit quality of El- Saily date palms.

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