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

Faissal F. Ahmed1, Ali H. Ali1, Abbas S. Abdalla2 and Ola M.S. Omar1

1Hort. Dept. Fac. of Agric. Minia Univ. Egypt

2Tropical Fruit Dept. Hort. Res. Instit. ARC Giza, Egypt

FaissalFadel@yahoo.com

**Abstract:** During 2012 and 2013 seasons, El- Saidy 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- Saidy date palms three times with amino acids (tryptophan, methionene and arginine) enriched with NPKMgZnFeMn and B at 0.1% proved to be effective for promot0ing 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 Lukaszweski, 1998; Yagodin, 1990 and Mengel *et al,* 2001**).

Using amino acids (**Rizk, 2013; El- Badawy and Abd El-aal, 2013; Ahmed *et al,* 2013; Ibrahiem *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 Saidy 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- Saidy 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 % K2O), 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 carotenodis (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 date in Tables (3 to 7) show that plant pigments (chlorophylls a & b, total chlorophylls and total carotenods), 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 El- Saidy 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); El- 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- Saidy 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- Saidy 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- Saidy 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- Saidy 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** |
| **1-Control**  | 25.0 | 25.7 | 11.91 | 12.01 | 7.82 | 7.91 | 3.31 | 3.35 |
| **2-Amino acids enriched with nutrients at 0.05 % twice** | 26.9 | 27.6 | 12.51 | 13.01 | 8.55 | 8.66 | 3.51 | 3.60 |
| **3- Amino acids enriched with nutrients at 0.05 % thrice**  | 28.0 | 28.8 | 13.11 | 13.61 | 8.90 | 9.01 | 3.71 | 3.80 |
| **4-Amino acids enriched with nutrients at 0.05 % four times**  | 28.3 | 29.0 | 13.17 | 13.68 | 9.94 | 9.05 | 3.73 | 3.82 |
| **5- Amino acids enriched with nutrients at 0.1 % twice** | 30.0 | 30.8 | 14.16 | 14.67 | 9.74 | 9.87 | 4.11 | 4.20 |
| **6- Amino acids enriched with nutrients at 0.1 % thrice** | 33.0 | 33.8 | 15.17 | 15.67 | 10.55 | 10.71 | 4.51 | 4.60 |
| **7- Amino acids enriched with nutrients at 0.1 % four times**  | 33.7 | 34.5 | 15.20 | 15.71 | 10.66 | 10.74 | 4.55 | 4.64 |
| **8- Amino acids enriched with nutrients at 0.2 % twice** | 30.3 | 31.0 | 14.25 | 14.75 | 9.76 | 9.91 | 4.13 | 4.22 |
| **9- Amino acids enriched with nutrients at 0.2 % thrice**  | 33.6 | 33.9 | 15.29 | 15.79 | 10.60 | 10.75 | 4.53 | 4.62 |
| **10- Amino acids enriched with nutrients at 0.2 % four times**  | 34.0 | 34.8 | 15.41 | 15.91 | 10.76 | 10.79 | 4.57 | 4.67 |
| **New L.S.D. at 5%**  | 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 contenoids, total carbohydrates% and N% in the leaves of El- Saidy 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** |
| **1-Control**  | 11.13 | 11.26 | 2.91 | 2.95 | 11.55 | 11.60 | 1.71 | 1.74 |
| **2-Amino acids enriched with nutrients at 0.05 % twice** | 12.06 | 12.26 | 3.04 | 3.11 | 11.90 | 11.94 | 1.80 | 1.88 |
| **3- Amino acids enriched with nutrients at 0.05 % thrice**  | 12.61 | 12.81 | 3.16 | 3.23 | 12.25 | 12.28 | 1.88 | 1.96 |
| **4-Amino acids enriched with nutrients at 0.05 % four times**  | 12.67 | 12.87 | 3.18 | 3.25 | 12.30 | 12.34 | 1.90 | 1.98 |
| **5- Amino acids enriched with nutrients at 0.1 % twice** | 13.85 | 14.07 | 3.31 | 3.37 | 12.80 | 12.84 | 1.99 | 2.08 |
| **6- Amino acids enriched with nutrients at 0.1 % thrice** | 15.06 | 15.31 | 3.46 | 3.53 | 13.25 | 13.28 | 2.09 | 2.17 |
| **7- Amino acids enriched with nutrients at 0.1 % four times**  | 15.21 | 15.39 | 3.50 | 3.57 | 13.31 | 13.53 | 2.10 | 2.19 |
| **8- Amino acids enriched with nutrients at 0.2 % twice** | 13.89 | 14.33 | 3.33 | 3.40 | 12.82 | 12.86 | 2.00 | 2.09 |
| **9- Amino acids enriched with nutrients at 0.2 % thrice**  | 15.13 | 15.37 | 3.50 | 3.57 | 13.28 | 13.22 | 2.10 | 2.18 |
| **10- Amino acids enriched with nutrients at 0.2 % four times**  | 15.33 | 15.46 | 3.51 | 3.60 | 13.39 | 13.44 | 2.12 | 2.21 |
| **New L.S.D. at 5%**  | 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- Saidy 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- Saidy 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- Saidy 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- Saidy 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- Saidy 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- Saidy 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- Saidy date palms three times at growth start, just after fruit setting and at one month later with amino acids (tryptophan, methionene and arginene) enriched with NPKMgZnFeMn and B at 0.1% gave the best results with regard to yield and fruit quality of El- Saidy date palms.

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