Effect of using humic acid and amino acids enriched with different nutrients as partial replacement of mineral nitrogen fertilizers in zebda mango orchards

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Abstract: This study was carried out during 2016 and 2017 seasons to examine the effect of using humicacidand amino acids enriched with NPKMgZnFeMnB as partial replacement of inorganic Nitrogen on growth, tree nutritionals status, flowering and fruit setting, yield and fruit quality of Zebdamangotrees grownunder Aswan region condition. Using nitrogen through 60 to 80 % mineral nitrogen + 0.025 to 0.05 % humic acid and amino acids enriched with NPKMgZnFeMnB applied via leaves had considerable promotion on growth aspects, flowering, fruit setting parameters and yield relative to the use of Nitrogen via 100 % mineral nitrogen or when nitrogen was added via 10 to 40 % mineral nitrogen+ spraying humic acid and amino acids enriched with NPKMgZnFeMnB at 0.1 to 0.4 %. There was a gradual promotion on chlorophylls A, B, total chlorophylls, total carotenoids, N,P, K. Mg, Zn, Fe, and Mn as well as physical and chemical characteristics of the fruits with reducing the percentages of inorganic nitrogen from 100 to 10 % and at the same time enhancing the concentrations of humic acid and amino acids enriched with NPKMgZnFeMnB from 0.0 to 0.4 %. For promoting the yield of Zebda mango tress grown under Aswan region conditions, it is recommended to fertilize the tress with nitrogen at 1000 g /tree/year via 60 % inorganic nitrogen + spraying humic acid and amino acids enriched with NPKMgZnFeMnBat 0.05%. Supplying the tress with nitrogen via 10 % inorganic nitrogen + humic acid and amino acids enriched with NPKMgZnFeMnB at 0.4 % gave the best results with regard to fruit quality.

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1. Introduction

Zebda mango cv is considered a prime and outstanding mango cv, strong spicy flavour, producing appealing aroma, sweet, low in fiber, regular bearing, medium season maturity, popular in the domestic market for fresh consumption and has a wide acceptance in international markets (**Bacha, 1987**).

Clean cultivation is suggested to be one possibility to restore the natural conditions and it has become in the last few decades a positive alternative to chemical fertilizers. It was achieved by using organic and biostimulants such as humic and amino acids.

Humic acid is a commercial product contains many elements as well as reported as the most considerable component of organic substances. It is black or dark brown materials which is partially or fully decomposed plant or animal wastes. The most important property of humic acid is its ability to combine insoluble metal iron oxides and hydroxides and afterwards to release them to crop slowly and continuously when needed (**Abu- Nukta and Parkinson 2007 and Mohd- Yunus *et al,* 2013**).

Amino acids with their antioxidative properties play an important role in plant defense against oxidative stress induced by unfavourable conditions. Application of amino acids was accompanied with enhancing proteins biosynthesis as well as protecting plant cells from senescence and death, preventing the free radicals from oxidation of lipids the components of plasma membrane which is accompanied with the loss of permeability and controlling the incidence of disorders (**Orth *et al,* 1993**). They are responsible for stimulating the biosynthesis of natural hormones like, IAA, ethylene, cytokinins and GA_3 cell division, organic foods, enzymes as well as DNA and RNA. These positive effects surely reflected on producing healthy trees (**Vianello and Marci, 1991 and Elade, 1992**).

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, which are formed by as process in which ribosomes catalyze the polymerization of amino acids (**Davies, 1982 and Raskin, 1992**). Several hypothesis have been proposed the explain for the role of amino acids in plant. Available evidence suggests several alternative routes of IAA and ethylene synthesis in plants, starting from amino acids (**Hashimoto and Yamada, 1994**). In this respect, **(Waller and Nowaki, 1978**) suggested that the regulatory effect of certain amino acids like phenylalanine and ornithine in plant development appeared through their influence on the biosynthesis of gibberellins.

All nutrients have important regulatory roles in building of proteins, amino acids, plant cells, enzymes, RNA, ATP, ADP, cytokinins, IAA, vitamins, antioxidants and plant pigments. It also encourages photosynthetic and cell division **(Mengel, 1984)**

Application of humic substances have beneficial effects on growth and fruiting of different fruit crops **(El-Shenawi 2008; Sayed2008; El-Khawaga 2013; and Ahmed et al 2014a).**

Amino acids have an outstanding effect on fruiting of fruit crops (**El- Badawy and Abd El-aal, 2013; Fathalla2013; Rabeh et al., 2014; Ahmed et al., 2014b; and Gamal, 2006).**

Growth and fruiting of different crops were improved due to treating the trees with different nutrients (**Ahmad et al., 2009; Mohamed and El-Sehrawy 2013; Ibrahiem and Al Wasfy (2014; Mahmoud (2015 and Nopy 2016**).

This study was initiated to examine the effect of supplying Zebda mango trees with humic acid and amino acids enriched with different nutrients as partial replacement of mineral nitrogen on growth characteristics, tree nutritional status, flowering, fruit setting, yield and fruit quality.

2. Material and Methods

This investigation was conducted during two successive experimental seasons 2016 and 2017 on 18 uniform in vigour 20-years old Zebda mango trees onto Succary mango rootstock. The trees are grown in a private orchard situated at Dar El-Salam Village, Naser El-Noba district, Aswan Governorate. The selected trees are planted at 5 x 5 meters apart (5 between rows and 5 between trees). The selected trees were irrigated through surface irrigation system using Nile water. The soil texture of the tested orchard is sandy clay with a water table depth not less than two meters.

Soil samples were taken (four samples) from a depth of 0.0 to 90 cm from soil surface and were physically and chemically analyzed before study start according to the procedure outlined by **Black *et al.,* (1965)** and the obtained data are shown in Table (1).

The selected trees received a basal recommended fertilizer including the application of 20 m^3 farmyard manure (0.35 % N, 0.45 % P_2O_5, and 1.2 % K_2O) added in early December, 200 kg/ fed/ mono calcium superphosphate (15.5% P_2O_5) added in mid January, 450 kg/ fed ammonium sulphate (20.6% N) added in three equal dressings in February, April and July and 200 kg/ fed potassium sulphate (48 % K_2O) added in two equal dressings applied in mid-February and April, in addition to the regular agricultural and horticultural practices which were followed in the orchard including micronutrient application, pruning, hoeing, irrigation with Nile water as well as pathogens, insects and weed control.

Table (1): Analysis of the tested soil

Characteristics	**Values**
Particle size distribution	
Sand %	77.00
Silt %	10.8
Clay %	12.2
Texture grade	Sandy clay
pH (1: 2.5 extract)	7.4
E.C. (1: 2.5 extract mmhos/ 1 cm/ 25°C)	245
Organic matter %	0.12
$CaCO_3$ %	3.15
Macronutrients values	
Total N %	0.3
P (ppm, Olsen method)	2.5
K (ppm, ammonium acetate)	76.2
Mg (ppm)	2.2
EDTA extractable (ppm)	
Zn	1.2
Fe	1.12
Mn	0.9

This study included the following six treatments from mineral nitrogen, humic acid and amino acids enriched with nutrients.

1- Using N (100g/tree) completely via inorganic N (2.985 g ammonium nitrate/tree/year).
2- Using N via 80 % mineral nitrogen (2.388 g ammonium nitrate/tree/year)+ 0.025 % humic acid and amino acids enriched with NPKMgZnFeMnB.
3- Using N via 60 % mineral nitrogen (1.791 g ammonium nitrate/tree/year) + 0.05 % humic acid and amino acids enriched with NPKMgZnFeMnB.
4- Using N via 40 % mineral nitrogen (1.194 g ammonium nitrate/tree/year) + 0.1 % humic acid and amino acids enriched with NPKMgZnFeMnB.
5- Using N via 20 % mineral nitrogen (0.896 g ammonium nitrate/tree/year) + 0.2 % humic

acid and amino acids enriched with NPKMgZnFeMnB.

6- Using N via 10 % mineral nitrogen (0.299 g ammonium nitrate/tree/year) + 0.4 % humic acid and amino acids enriched with NPKMgZnFeMnB.

Therefore, the experiment evolved six treatments. Each treatment was replicated three times, one tree per each. Mineral nitrogen fertilizer namely ammonium nitrate (33.5 %N) was split into four equal batches started on the middle of May and at three week intervals (2nd and 4th week of June and Mid. of July). Humic acid, amino acids (tryptophan, methionine and cysteine) and humic acid were sprayed four times at (1st week of May and at three weeks interval; 3rd week of May, 2nd week of June and 1st week of July). Triton B as a wetting agent at 0.05% was added to all spraying solutions (each tree needs about 25 L solutions). Spraying was done till runoff. The untreated trees sprayed with water containing triton B.

Randomized complete block design (RCBD) was followed where this experiment included six treatments and each treatment was replicated three times, one tree per each.

In spring growth cycle, ten shoots per tree were selected (1st week of June) for measuring average shoot length (cm.), shoot thickness (cm.) and number of leaves per shoot as well as length and width of the leaf (cm).

Twenty leaves below panicles in the spring growth cycle / tree (according to **Summer, 1985**) were taken in the first week of June for measuring the leaf area (cm^2) using the following equation as reported by **Ahmed and Morsy (1999)**.

LA= 0.70 (L x W) – 1.06 where LA = Leaf area (cm^2)

L = Maximum length of leaf (cm.) and W = Maximum width of leaf (cm.)

Samples of five mature fresh leaves from Spring growth cycle (1st week of June) per each replicate were taken. The leaves were cut at small pieces, homogenated and extracted by 25 % acetone in the presence of a little amount of Na_2C0_3 and silica quartz then filtered through central glass funnel G_4.

The optical density of the filtrate was determined using CarlZeis spectrophotometer at the wave length of 662, 644 and 440 nm to determine chlorophylls (a & b) and total carotenoids, respectively, Content of each pigments was calculated by using the following equations (according to **Von-Wettstein, 1957 and Hiscox and Israstam, 1979).**

Chl. A = (9.784 x E 662) - (0.99 x E 644) = mg/ L

Chl. B = (21.426 x E 644) - (4.65 x E 662) = mg/ L

Total Carotenoids = (4.965 x E 440 - 0.268 (chlorophyll a + chlorophyll b)

where E = Optical density at a given wave length.

The chlorophylls a and b as well as total carotenoids were calculated as mg/ 1 g fresh weight of leaves.

In both seasons and in early September, twenty leaves (3rd leaf from the base of non – fruiting spring growth cycle) (according to **Summer, 1985)** were collected carefully at random at the end of September in both (2013 and 2014) seasons. As soon as the leaf samples were picked, they were cleaned with cloth damp to remove any residues that might affect the results. The leaves were oven dried at 70 °C for 48 hours, ground and stored in small pockets prior analysis. Plant material (0.2 g) was digested using hydrogen peroxide plus sulfuric acid as recommended by (**Wilde *et al.*, 1985**).

The digested materials were transferred quantitatively to 50 ml volumetric flask and raised up to the uniformity volume for determination of the following nutrients:

1. Nitrogen % was determined by the modified micro kjeldahl methods as described by **Peach and Tracey (1968).**
2. Phosphorus % was determined by using spekol spectrophotometer **(Cottenie *et al*, 1982).**
3. Potassium % was determined by using Flame photometer according to the procedure reported by **Chapman and Pratt (1965) and Evenhuis and Dewaard (1980).**
4. Percentages of magnesium % and calcium was determined by using versene method **(Chapman and Pratt, 1965)**.
5. Micronutrients namely Zn, Fe, and Mn were determined using atomic absorption spectrophotometer (**Wilde *et al.*, 1985**).

Panicles length and number of flowers / panicle were estimated in the four labeled branches in the four directions. Number of flowers on the twelve labeled shoots (three shoots for each directions) was counted periodically at five days intervals starting at the second week of March in both seasons till completed of fruit setting stage (1st week of April). Then, the number of fruitlets was counted and the percentage of initial fruit setting was calculated by dividing the number of fruitlets by total number of flowers and multiplying the product x 100. Percentage of fruits retention was calculated by counting the number of fruits just before harvesting and dividing the number of fruits by number of setted fruits and multiplying the product x 100.

Harvesting was achieved during the regular commercial harvesting time under Aswan Governorate conditions (first week of July) in both seasons when the flesh becomes yellowish **(Hulme, 1971)**. The yield expressed in weight and number of fruits per tree was recorded.

Twenty fruits were taken randomly from the yield of each tree then transferred to the laboratory for determining the following physical and chemical properties of the fruits.

The following physical and chemical properties of the fruits were determined:

A- Physical properties:

1- Average fruit weight (g.).

2-Averages fruit dimensions (in cm) (height, diameter and thickness by vernier caliper).

3- Percentages of fruit flesh.

4-Edible and non-edible portion of the fruits.

B- Chemical properties of the fruits:

The studied chemical characteristics of fruits included the following parameters.

1- Total soluble solids (TSS %):

The flesh of fruit was well minced with an electric blender and the paste was squeezed and the total soluble solids were determined by using hand refractometer.

2- Sugars content:

The percentages of the total and reducing sugars were determined according to **Lane and Eynon (1965)** volumetric method that outlined in (**A.O.A.C., 2000**).

3- Total acidity (%):

Twenty five grams of flesh were blended with 100 ml distilled water by an electric blender, the extract was filtrated and twenty ml. of it were titrated against 0.1 N sodium hydroxide using phenolphthalein as an indicator according to the (**A.O.A.C., 2000**). Acidity was determined as g citric acid/ 100 g pulp.

4- Total fibre %:

Determination of crude content was achieved using acetic acid glacial and nitric acid mixture at ratio 10: 1 on 1 g sample according to the official methods described in (**A.O.A.C., 2000**).

5- Vitamin C content:

It was determined by titration against 2,6-dichlorophenol indophenol dye (AOAC, 2000).

All the obtained data during the course of this study in the two successive seasons, 2016 and 2017 were tabulated and subjected to the proper statistical analysis. The differences between various treatment means were compared using new L.S.D. test at 5% according to **Snedecor and Cochran, (1980), Steel and Torrie (1984) and Mead *et al*., (1993).**

3. Results

1-Effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on the vegetative growth aspects in the Spring growth cycle.

Data in Table (2) show the effect of using humic acid and amino acids enriched with NPKMGZNFE Mn B as partial replacement of inorganic N on main shoot length, number of leaves/ shoot, length and thickness of shoot, length, width and area of leaf of Zebda mango trees during 2016 and 2017 seasons.

It is clear from the obtained data that significant differences on the six growth aspects were observed among the six inorganic N enriched with NPKMgZn Fe MN B treatments. Using N through 60 to 80% mineral N plus 0.025 to 0.05% humic acid and amino acids enriched with different nutrients applied via leaves had significant promotion on these growth aspects relative to the use of N completely via 100% mineral N or when N was added via 10 to 40 % mineral N plus spraying humic acid and amino acids enriched with NPKMg Zn Fe Mn B at 0.1 to 0.4%. There was a significant reduction on these growth attributes with reducing mineral N from 60 to 10% and at the same time increasing concentrations of humic acid and amino acids enriched with several nutrients from 0.05 to 0.4%. Using N via mineral N alone was significantly superior than using N via 10 to 40% mineral N plus spraying humic acid and amino acids enriched with different nutrients at 0.1 to 0.4%. There was a gradual and significant reduction on these growth aspects with reducing percentages of mineral N from 60 to 10% and at the same times increasing the concentrations of humic acid and amino acids enriched with nutrients from 0.05 to 0.2%. The maximum values of these growth aspects were recorded on the trees that received N as 60% mineral N plus spraying humic acid and amino acids enriched with NPKMgZn Fe MnB each at 0.05 four times. Trees fertilized with N as 10% mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.4% had the lowest values. These results were true during both seasons.

2-Effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on the leaf chemical components.

Data in Tables (3 & 4) show the effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on the photosynthetic pigments namely chlorophylls a & b, total chlorophylls, total carotenoids, N, P, K, Mg, Ca, Zn, Fe and Mn in the leaves of Zebda mango trees during 2016 and 2017 seasons.

It is evident from the obtained data that using the suitable N through 10 to 80% inorganic N plus spraying humic acid and amino acids enriched with NPKMg Zn MnFe B at 0.025 to 0.4% significantly enhanced photosynthetic pigments namely chlorophylls a & b, total chlorophylls, total carotenoids, N, P, K, Mg, Zn, Fe, Mn and B over the control treatment (using N as 100 % inorganic N). There was a gradual and significant projotion on these pigments and nutrienstwith reducing the percentages of inorganic N from 100 to 10% and at the same times enhancing the percentages of humic acid and enriched amino acids from 0.0 to 0.4%. significant differences on these pigments and nutrients were observed among the six investigated treatments. The maximum values were recorded on the trees received N as 10% inorganic N plus spraying humic acid and amino acids enriched with different nutrients at 0.4% four times. The lowest values were recorded on the trees that fertilized with N as 100% mineral N alone. These results ere true during both seasons.

3-Effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on flowering and fruit setting aspects

Table (5) show the effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on panicle length, number of flower panicle and percentages of initial fruit setting and fruit retention in the Spring growth cycle.

It is evident from the obtained data that fertilizing the trees with N via 60 to80 inorganic N plus spraying the trees with humic acid and amino acids enriched with nutrients at 0.025 to 0.05% significantly enhanced panicle length, number of flowers/ panicle and percentages of initial fruit setting and fruit retention relative to using N as 100% inorganic N alone or when N was added as 10 to 40 % mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.1 to 0.4%. There was a gradual and significant reduction on these flowering and fruit setting aspects with reducing inorganic N percentages from 60 to 10% and at the same time increasing concentrations of humic acid and amino acids enriched with nutrients from 0.05 to 0.4%. using N completely via inorganic N significantly enhanced these parameters rather than using N as 10 to 40% mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.1 to 0.4%. The highest values of fruit setting (30.0 & 30.4 %) and fruit retention (0.39 & 0.41 %) were recorded on the trees fertilized with N via 60 % mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.05% four times. The lowest values were recorded on the trees treated with N via 10% mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.4%. These results were true during both seasons.

4-Effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on the yield

Data in Table (5) show the effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on the yield expressed in number of fruits / tree and yield (kg.) of.

It is revealed from the obtained data that supplying the trees with n via 60 to 80 mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.025 to 0.05% had significant promotion on the yield expressed in number of fruits / tree and yield (kg.) relative to the use of N completely via inorganic N or when N was added as 10 to 40% mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.1 to 0.2% A significant reduction on the yield was observed when the trees fertilized with N as 10 to 40% mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.1 to 0.4%. Using N as 100% inorganic N alone significantly was responsible for promoting the yield relative to the application of N as 10 to 40 % mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.1 to 0.4 %. The maximum yield / tree expressed in weight (114.6 & 108.5 kg) was recorded on the trees received N as 60% mineral N plus spraying humic acid and amino acids enriched with nutrients at 0.05% during both seasons, respectively. The trees treated with N as 10% inorganic N plus spraying humic acid and amino acids enriched with nutrients at 0.4. These results were true during both seasons.

5-Effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on some physical and chemical characteristics of the fruits

Data in Tables (6 & 7) show the Effect of using humic acid and amino acids enriched with different nutrients as partial replacement of inorganic on weight, height, diameter and thickness of fruit, fruit flesh %, edible to non-edible portions of fruits, T.S.S. %, total acidity %, total and reducing sugars, vitamin C and total crude fibre % in the fruits of Zebda mango trees during 2016 and 2017 seasons.

It is noticed from the obtained data that all parameters of both physical and chemical fruit quality were significantly varied among the six inorganic N and foliar application of humic acid and amino acids enriched with different nutrient treatments. Results showed that amending Zebda mango trees with N as 10 to 80% inorganic N plus spraying the trees four times with humic acid and amino acids enriched with NPKMGZnFeMn B at 0.025 to 0.4% had significant promotion on fruit quality in terms of increasing weight, height, diameter and thickness of fruit, fruit flesh%, edible to non-e dibble portions of fruits, T.S.S.%, total and reducing sugars and vitamin C content and decreasing total acidity % and total crude fibre % relative to the use of was 100% inorganic N. The promotion on these quality parameters was significantly correlated with reducing the percentages of inorganic N from 100 to 10 % and at the same time increasing concentrations of humic acid and amino acids enriched with NPKMGZnFeMn and B from 0.025 to 0.4%. The best results with regard to fruit quality were obtained when the trees fertilized with N via 10% inorganic N plus spraying humic acid and amino acids enriched with NPKMG ZnFEMN B at 0.4. Unfavourable effects on both physical and chemical characteristics of the fruits were recorded on the trees supplied with N through 100% inorganic N from. These results were true during both seasons.

Table (2): Effect of supplying Zebda mango trees with humic acid and amino acids enriched with different nutrients as partial replacement of mineral N on some vegetative growth characteristic during 2016 and 2017 seasons.

Treatments	Main shoot length (cm.)		Number of leaves/shoot		Leaf length (cm)		Leaf width (cm)		Leaf area (cm2)		Shoot thickness (cm)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% MN alone	16.0	17.7	10.0	12.0	22.9	24.0	4.9	5.1	77.5	84.6	0.59	0.62
80% MN alone + 0.025% humic and amino acids *	17.1	18.8	12.0	13.0	24.0	25.1	5.2	5.5	86.3	95.6	0.64	0.68
60% MN alone + 0.05% humic and amino acids *	19.0	20.0	14.0	14.0	25.2	26.4	5.6	5.8	97.7	106.1	0.67	0.71
40% MN alone + 0.1% humic and amino acids *	14.8	16.4	9.0	10.0	21.7	22.8	4.3	4.6	64.3	72.4	0.56	0.58
20% MN alone + 0.2% humic and amino acids *	13.9	15.3	8.0	9.0	20.9	22.0	4.0	4.2	57.5	63.6	0.53	0.56
10% MN alone + 0.4% humic and amino acids *	13.0	14.1	7.0	8.0	19.8	20.9	3.8	3.9	51.6	56.0	0.49	0.53
New L.S.D. at 5%	0.9	1.1	1.0	1.0	0.8	1.0	0.2	0.3	3.2	2.8	0.03	0.02

MN= Mineral N source (ammonium nitrate 33.5% N
Amino acids = Amino acids enriched with (NPKMgZnFeMnB)

Table (3): Effect of supplying Zebda mango trees with humic acid and amino acids enriched with different nutrients as partial replacement of mineral N on Photosynthetic pigments and percentages of N and P during 2016 and 2017 seasons.

Treatments	Chlorophyll a (mg /g $^{-1}$f.w)		Chlorophyll b (mg /g f.w)		Total Chlorophyll (mg /g f.w)		Total carotenoids (mg /g f.w)		Leaf N%		Leaf P%	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% MN alone	4.1	4.3	1.1	1.0	5.2	5.3	1.0	1.1	1.49	1.64	0.204	0.205
80% MN alone + 0.025% humic and amino acids *	4.6	4.9	1.4	1.4	6.0	6.3	1.4	1.4	1.59	1.68	0.224	0.226
60% MN alone + 0.05% humic and amino acids *	5.1	5.5	1.6	1.7	6.7	7.2	1.7	1.8	1.70	1.72	0.244	0. 247
40% MN alone + 0.1% humic and amino acids *	5.9	6.5	1.9	2.0	7.8	8.4	2.0	2.2	1.77	1.77	0.264	0.265
20% MN alone + 0.2% humic and amino acids *	6.3	7.1	2.2	2.4	8.5	9.5	2.3	2.5	1.85	1.82	0.285	0.291
10% MN alone + 0.4% humic and amino acids *	7.0	7.4	2.4	2.6	9.4	10.0	2.5	2.8	1.93	1.90	0.301	0.310
New L.S.D. at 5%	0.3	0.3	0.2	0.3	0.5	0.5	0.2	0.3	0.06	0.04	0.011	0.015

MN= Mineral N source (ammonium nitrate 33.5% N
Amino acids = Amino acids enriched with (NPKMgZnFeMnB)

Table (4): Effect of supplying Zebda mango trees with humic acid and amino acids enriched with different nutrients as partial replacement of mineral N on Photosynthetic pigments and percentages of N and P during 2016 and 2017 seasons.

Treatments	Leaf K %		Leaf Mg %		Leaf Ca %		Leaf Zn (ppm)		Leaf Fe (ppm)		Leaf Mn (ppm)	
	2016	2017	2016	2017	2016	2017	2016a	2017	2016	2017	2016	2017
100% MN alone	1.11	1.09	0.49	0.45	2.89	2.91	59.9	60.6	56.1	55.7	50.1	49.9
80% MN alone + 0.025% humic and amino acids *	1.2	1.19	0.54	0.55	2.94	3.06	62.3	63.0	59.0	58.9	53.3	53.5
60% MN alone + 0.05% humic and amino acids *	1.29	1.26	0.59	0.61	3.05	3.20	66.0	66.0	62.5	63.0	56.4	56.5
40% MN alone + 0.1% humic and amino acids *	1.40	1.33	0.64	0.66	3.20	3.33	69.0	70.0	65.5	65.3	60.0	59.9
20% MN alone + 0.2% humic and amino acids *	1.46	1.41	0.70	0.69	3.33	3.46	72.9	75.0	68.0	69.0	62.6	62.8
10% MN alone + 0.4% humic and amino acids *	1.53	1.50	0.73	0.75	3.50	3.60	77.0	75.0	71.0	71.9	65.7	66.0
New L.S.D. at 5%	0.05	0.06	0.02	0.03	0.10	0.12	1.9	2.3	2.3	2.1	2.5	2.9

MN= Mineral N source (ammonium nitrate 33.5% N)
Amino acids = Amino acids enriched with (NPKMgZnFeMnB)

Table (5): Effect of supplying Zebda mango trees with humic acid and amino acids enriched with different nutrients as partial replacement of mineral N on panicle length, number of flowers /panicle, percentages of initial fruit setting, fruit retention and yield /tree during 2016 and 2017 seasons.

Treatments	panicle length		Number of flowers /panicle		Initial fruit setting %		fruit retention %		No of fruit / tree		yield /tree (Kg)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% MN alone	19.9	20.0	22.0	27.0	26.9	27.0	0.26	0.24	300.0	280.0	94.7	89.6
80% MN alone + 0.025% humic and amino acids *	20.9	21.0	25.0	30.0	28.3	28.7	0.33	0.34	331.0	311.0	107.9	102.9
60% MN alone + 0.05% humic and amino acids *	21.9	22.0	28.0	34.0	30.0	30.4	0.39	0.41	344.0	321.0	114.6	108.5
40% MN alone + 0.1% humic and amino acids *	18.0	18.3	21.0	24.0	25.8	26.2	0.19	0.17	286.0	252.0	97.0	87.2
20% MN alone + 0.2% humic and amino acids *	16.9	17.0	19.0	21.0	24.9	25.3	0.14	010	272.0	243.0	96.6	87.5
10% MN alone + 0.4% humic and amino acids *	16.2	16.4	17.0	18.0	24.0	24.4	0.09	0.03	261.0	233.0	95.3	86.4
New L.S.D. at 5%	0.4	0.5	2.0	3.0	0.9	1.1	0.05	0.07	10.0	9.0	1.5	1.4

MN= Mineral N source (ammonium nitrate 33.5% N) Amino acids = Amino acids enriched with (NPKMgZnFeMnB)

Table (6): Effect of supplying Zebda mango trees with humic acid and amino acids enriched with different nutrients as partial replacement of mineral N on some Physical characteristics of the fruits during 2016 and 2017 seasons.

Treatments	AV. fruit weight (g)		AV. fruit height (cm)		AV. fruit diameter (cm)		AV. fruit thickness (cm)		Flesh %		Edible to non edible portion of fruit	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% MN alone	315.5	320	11.8	11.9	7.9	8.0	5.9	6.0	71.9	72.0	2.55	2.57
80% MN alone + 0.025% humic and amino acids *	326.0	331.0	12.1	12.2	8.2	8.3	6.2	6.3	72.5	73	2.63	2.70
60% MN alone + 0.05% humic and amino acids *	333.0	338	12.4	12.6	8.5	8.5	6.5	6.6	73.1	74.0	2.71	2.84
40% MN alone + 0.1% humic and amino acids *	340.0	346.0	12.7	12.9	8.8	8.8	6.9	6.8	74.0	74.9	2.84	2.98
20% MN alone + 0.2% humic and amino acids *	355.0	360.0	13.0	13.1	9.1	9.0	7.1	7.0	74.6	76.0	2.93	3.16
10% MN alone + 0.4% humic and amino acids *	365.0	371.0	13.2	13.3	9.4	9.2	7.4	7.2	75.9	76.5	3.14	3.25
New L.S.D. at 5%	4.1	5.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4		

MN= Mineral N source (ammonium nitrate 33.5% N) Amino acids = Amino acids enriched with (NPKMgZnFeMnB)

Table (7):Effect of supplying Zebda mango trees with humic acid and amino acids enriched with different nutrients as partial replacement of mineral N on some chemical characteristics of the fruits during 2016 and 2017 seasons.

Treatments	T.S.S%		Total Acidity %		Total Sugar%		Reducing Sugars %		Vitamin C (mg/100 ml pulp)		Total Crude Fiber %	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% MN alone	14.9	15.0	0.369	0.366	13.5	14.0	4.1	4.3	48.1	49.0	0.39	0.41
80% MN alone + 0.025% humic and amino acids *	15.3	15.5	0.346	0.350	14.0	14.3	4.4	4.6	50.0	50.9	0.35	0.36
60% MN alone + 0.05% humic and amino acids *	15.6	16.0	0.319	0.315	14.5	15.0	4.7	5.0	51.6	54.0	0.31	0.32
40% MN alone + 0.1% humic and amino acids *	16.0	16.4	.0301	0.309	15.1	15.6	5.0	5.3	53.0	55.3	0.26	0.29
20% MN alone + 0.2% humic and amino acids *	16.4	16.8	0.270	0.261	15.6	16.1	5.3	5.6	55.0	56.9	0.20	0.25
10% MN alone + 0.4% humic and amino acids *	16.8	17.2	0.250	0.241	16.1	16.6	5.5	5.9	56.3	58.5	0.14	0.16
New L.S.D. at 5%	0.3	0.4	0.014	0.013	0.4	0.4	0.2	0.3	1.1	1.2	0.4	0.03

MN= Mineral N source (ammonium nitrate 33.5% N) Amino acids = Amino acids enriched with (NPKMgZnFeMnB)

4. Discussion

1- Effect of humic acid:

The outstanding effect of humic substances ongrowth might be attributed to their positive action onreducing soil pH and enhancing organic matter, availability of nutrient and root development (**Abu-Nukta and Parkinson 2007 and Mohd- Yunus *et al*,2013**).

These results are in harmony with those obtained by **El-Shenawi (2008), Sayed (2008), El-Khawaga (2013) and Ahmed et al (2014a).**

2- Effect of amino acids:

Amino acids with their antioxidative properties playan important role in plant defense against oxidative stress induced by unfavourable conditions. Application of amino acids was accompanied with enhancing proteins biosynthesis as well as protecting plant cells from senescence and death, preventing the free radicals from oxidation of lipids the components of plasma membrane which is accompanied with the loss of permeability and controlling the incidence of disorders **(Orth*et al*, 1993).**

They are responsible for stimulating the biosynthesis of natural hormones like, IAA, ethylene, cytokinins and GA3cell division, organic foods, enzymes as well as DNA and RNA. These positive effects surely reflected on producing healthy trees **(Vianello and Marci, 1991).**

Amino acids as organic nitrogenous compoundsare the building blocks in the synthesis of proteins, which are formed by as process in which ribosomes catalyze the polymerization of amino acids **(Davies, 1982 and Raskin,1992).** Several hypothesis have been proposed the explain for the role of amino acids in plant. Available evidence suggests several alternative routes of IAA. and ethylene synthesis in plants, starting from amino acids **(Hashimotoand Yamada, 1994).** In this respect, **(Waller and Nowaki, 1978)** suggested that the regulatory effect of certain amino acids like phenylalanine and ornithine in plant development appeared through their influence on the biosynthesis of gibberellins.

The promoting effect of amino acids in growth, yield and fruit quality of Zebda amino trees was supported by the results **El- Badawy and Abd El-aal (2013), Fathalla (2013), Rabeh *et al.,* (2014), Ahmed et al., (2014b), and Gamal (2006).**

3- Effect of different nutrients

The important regulatory effect of N on building of proteins, amino acids, enzymes, natural hormones, vitamins, antioxidants and plant pigments and encouraging photosynthesis and cell division, P in enhancing the biosynthesis of sugars, plant pigments, enzymes, natural hormones, celldivision, vitamins, root development and photosynthesis, K in stimulating the biosynthesis and translocation of sugars, plant pigments, cell division, tolerance of fruit crops to biotic and abiotic stresses, water tolerance, root development, Mg in building chlorophylls and plant pigments and regulating reduction and oxidants reactions, Fein building chlorophylls and plant pigments and regulating reduction and oxidants reactions, Mn in enhancing co-enzymes that are responsible for enhancing the activity of respiration and oxidation enzymes and the biosynthesis of organic acids, N metabolism, nitrate reduction and the biosynthesis of IAA, Zn in activating metabolism enzymes, biosynthesis of organic foods, IAA, cell division and enlargement, water absorption and nutrient transport and B in enhancing the biosynthesis of N, proteins, IAA, carbohydrates, water uptake and pallor germinationsurely reflected on stimulating growth, palm nutritional status, yield and fruit quality of Zaghloul date palms (**Mengel,1984**).

These results are in agreement with those obtained by **Ahmad et al. (2009), Mohamed and El- Sehrawy (2013),Ibrahiem and Al Wasfy (2014), Mahmoud (2015) and Nopy (2016)**.

Conclusion:

For promoting the yield of Zebda mango tress grown under Aswan region conditions, it is recommended to fertilize the tress with nitrogen at 1000 g /tree/year via 60 % inorganic nitrogen + spraying humic acid and amino acids enriched with NPKMgZnFeMnB at 0.05%. Supplying the tress with nitrogen via 10 % inorganic nitrogen + humic acid and amino acids enriched with NPKMgZnFeMnB at 0.4 % gave the best results with regard to fruit quality.

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