Productive Performance of Golek Mango Trees as Influenced by Spraying Amino Acids and Vitamin B_{12}

Abde El-Hameed, M. Wassel[1], Ahmed Y. Mohamed[2] and Mohamed T. A. Aly [2]

[1]Hort Dept. Fac. of Agric. Minai Univ. Egypt
[2]Tropical. Res. Dept. Hort. Res. Instit. ARC. Giza. Egypt

Abstract: During 2016 and 2017 seasons mango cv. Golek grown under Aswan conditions was subjected to spraying amino acids (tryptophan, methionine and cysteine) at 0.05 to 0.2% and/or vitamin B_{12} at 25 to 100 ppm three times. The goal was examining the effect of amino acids and vitamin B_{12} on growth, tree nutritional status, flowering and fruit setting aspects, yield and fruit quality. Single and combined applications of amino acids at 0.05 to 0.2% and/or vitamin B_{12} at 25 to 100 ppm was very effective in enhancing all growth aspects, pigments, N, P, K, Mg and Ca in the leaves, panicle length, number of panicle/tree and perfect flowers %, fruit setting %, yield as well as fruit quality relative to the control treatment. Percentage of male flowers tended to reduce with the present treatments. Amino acids application was superior to using vitamin B_{12} in enhancing the most investigated characteristics. Combined applications were preferable than using each material alone in this respect. Supplying Golek mango trees grown under Aswan climatic conditions three times with amino acids at 0.1% plus vitamin B_{12} at 50 ppm succeeded in maximizing the yield and improving fruit quality.
[Abde El-Hameed, M. Wassel, Ahmed Y. Mohamed and Mohamed T. A. Aly. **Productive Performance of Golek Mango Trees as Influenced by Spraying Amino Acids and Vitamin B_{12}.** *N Y Sci J* 2018;11(2):8-16]. ISSN 1554-0200 (print); ISSN 2375-723X (online). http://www.sciencepub.net/newyork. 2. doi:10.7537/marsnys110218.02.

Keywords: Golek mango cv, amino acids, vitamin B_{12}, growth, yield, fruit quality.

Introduction

Recently, many attempts were accompanied for improving yield and fruit quality of Mango trees by using non- traditional methods. Out of these methods were the application of amino acids and vitamins.

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**).

Vitamins are considered antioxidants they play a definite role in protecting the plant cells from senescence and death through preventing the producing free radicals during plant metabolism from oxidation of lipids, the components of plasma membrane which is accompanied with the loss of permeability of cells (**Raskin, 1992; Bertschinger and Stadler, 1997 and Buchala and Schmid, 1997**).

Vitamins B have definite roles in decaerboxylation formation of meristem via supplying metabolites to the apex, coenzymes, flavin mononucleotide coenzymes, flavin adenine, dinucleotide and photosynthesis **(Mer, 1957; Robinson, 1973 and Karabanov, 1977**).

Previous studies showed that using amino acids (**El- Badawy and Abd El- aal, 2013; Fathalla, 2013; Ibrahiem *et al.,* 2013, Hassan-Huda 2014, Sayed-Ola, 2014 and Ahmed, 2016**) and vitamins (**Hamad 2008, Badran and Ahmed 2009, Zagzog, 2009, Ahmed *et al,* 2013, Farag, 2013, Ibrahim *et al.*, 2013, Rizk, 2013 and Omar, 2015**) were found to improve growth, tree nutritional status, yield and quality of the fruits.

The main target of this study was elucidating the effect of spraying some amino acids and vitamin B_{12} on growth characteristics, tree nutritional status, yield and fruit quality of Golek Mango trees.

2. Materials and Methods

This investigation was conducted during two successive experimental seasons 2016 and 2017 on thirty uniform in vigour 15-years old Golek mango trees onto polyembyonic seedling rootstock. The trees are grown in a private orchard situated at El- Besalia Village, Edfu district, Aswan Governorate. The selected trees are planted at 5 x 5 meter a part (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 clay with a water table depth not less than two meters.

The target of this study was elucidating the effect of spraying some amino acids and vitamin B_{12} on

growth characteristics, tree nutritional status, yield and fruit quality of Golek Mango trees.

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).

Table (1): Analysis of the tested soil

Characters	Values
Particle size distribution	
Sand %	10.8
Silt %	12.2
Clay %	77.00
Texture grade	clay
pH (1: 2.5 extract)	7.4
E.C. (1: 2.5 extract ((mmhos/ 1 cm/ 25^{o}C)	245
Organic matter %	1.95
$CaCO_3$ %	2.05
Macronutrients values	
Total N %	0.10
P (ppm, Olsen method)	5.00
K (ppm, ammonium acetate)	510.0
Mg (ppm)	6.2
EDTA extractable (ppm)	
Zn	3.5
Fe	4.0
Mn	5.5

The selected trees (30 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 % P2O5) 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.

This study included the following ten treatments from amino acids and vitamin B_{12}.

1- Control treatment
2- Spraying amino acids at 0.05%
3- Spraying amino acids at 0.1%
4- Spraying amino acids at 0.2%
5- Spraying vitamin B_{12} at 25 ppm
6- Spraying vitamin B_{12} at 50 ppm
7- Spraying vitamin B_{12} at 100 ppm
8- Spraying both at low concentration.
9- Spraying both at medium concentration
10- Spraying both at high concentration

Therefore, the experiment evolved ten treatments. Each treatment was replicated three times, one tree per each. The three amino acids used were tryptophan, methionine and cysteine. Vitamin B_{12} (Cyanocobalamin) was dissolved in water. All amino acids and vitamin B_{12} were sprayed three times at growth start (1st week of Mar.), after fruit setting (Middle of April) and at three weeks later (1st week of May). 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 ten treatments and each treatment was replicated three times, one tree per each.

1- Measurements of vegetative growth characters:

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.

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.)

2- Measurements of plant pigments:

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).**

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.

3- Measurements of leaf content of N, P, K, Mg and Ca (as %)

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 taken for determination of total carbohydrates by using phenol-sulfuric method (**Smith *et al.,* 1956**). 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).**

4. Percentages of magnesium % and calcium were determined by using versene method **(Chapman and Pratt, 1965)**.

4 -Measurements of behaviour of flowering and fruit setting:

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.

5 -Measurements of yield as well as physical and chemical properties of the fruits:

5.1 Yield:

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.

5.2 Physical and chemical properties of the fruits:

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.

5.2.1 Physical properties of the fruits:

1- Average fruit weight (g.).

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

3- Percentages of fruit pulp and stone.

5.2.2 Chemical properties of the fruits:

The studied chemical characteristics of fruits included the following parameters.

5.2.2.1 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.

5.2.2.2 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**).

5.2.2.3 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.

5.2.2.4 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**).

5.2.2.5 Total soluble tannins %:

Total soluble tannins % was determined according to **A.O.A.C. (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 **Mead *et al*., (1993).**

3. Results

1-Vegetative growth characteristics:

It is noticed from the obtained data in Table (2) that treating Golek mango trees three times with amino acids at 0.05 to 0.2% and vitamin B_{12} at 25 to 100 ppm either alone or in combinations significantly stimulated the four growth traits namely main length and thickness of shoot, number of leaves/shoot and leaf area over to the control treatment. The stimulation on these growth aspects was significantly correlated to the increase in concentrations of amino acids from

0.05 to 0.2% and vitamin B_{12} from 25 to 100 ppm. Increasing concentrations of amino acids from 0.1 to 0.2% and vitamin B_{12} from 50 to 100 ppm failed to significant promotion on these growth traits. Using amino acids was significantly superior than application of vitamin B_{12} in stimulating these growth aspects. Combined applications significantly were preferable than using each material alone in enhancing these parameters. Using amino acids at 0.2% plus vitamin B_{12} at 100 ppm gave the highest values of main shoot length **(22.3 & 23.1 cm)**, number of leaves/shoot **(15.0 & 15.0 leaf)**, leaf area **(131.5 & 132.0 cm^2)** and shoot thickness **(0.89 & 0.88 cm)** during both seasons, respectively. The untreated trees produced the lowest values. These results were true during 2016 & 2017 seasons.

2- Leaf chemical composition:

Chlorophylls a & b, total carotenoids, N, P, K, Mg and Ca in the leaves of Golek mango trees were significantly improved in response to subjecting the trees three times with amino acids at 0.05 to 0.2% and vitamin B_{12} at 25 to 100 ppm compared to the control treatment as shown in Tables (3 & 4). There was a progressive stimulation on these pigments and nutrients with increasing concentrations of amino acids and vitamin B_{12}. Negligible stimulation on these chemical traits was observed among the higher two concentrations of amino acids (0.1 & 0.2%) and vitamin B_{12} (50 & 100 ppm). A significant promotion on these leaf chemical components was recorded due to using amino acids relative to the application of vitamin B_{12}. Using amino acids at 0.05 to 0.2% plus vitamin B_{12} at 25 to 100 ppm together significantly were preferable than using each material alone in enhancing these parameters. The maximum values of chlorophyll a **(4.83 & 4.86 mg/1.0 g FW)**, chlorophyll b **(1.68 & 1.71 mg/1.0 g FW)**, total carotenoids **(1.80 & 1.81 mg/1.0 g FW)**, N **(1.96 & 1.99%)**, P **(0.171 & 0.178%)**, K **(1.57 & 1.60 %),** Mg **(0.85 & 0.95 %)** and Ca **(2.61 & 2.71%)** were observed due to treating the trees three times with a mixture of amino acids at 0.2% and vitamin B_{12} at 100 ppm during both seasons, respectively. The minimum values of these plant pigments and nutrients were recorded on the untreated trees. Similar results were announced during both seasons.

3- Behaviour of flowering:

It is reveal from the obtained data in Table (5) that exposing Golek mango to amino acids at 0.05 to 0.2% and/or vitamin B_{12} at 25 to 100 ppm significantly enhanced panicle length, number of panicles/ tree and percentage of perfect flowers relative to the untreated trees. Percentage of male flowers was significantly reduced with using amino acids and/or vitamin B_{12} over the control. The promotion and the reduction was in proportional to the increase in concentrations of amino acids and vitamin B_{12} without significant promotion among the higher two concentrations of amino acids (0.1 & 0.2%) and vitamin B_{12} (50 & 100 ppm). Using both materials together significantly was preferable than using each material alone in enhancing these flowering aspects namely panicle length, number of panicles/ tree and percentage of perfect flowers. The maximum values of panicle length **(31.3 & 32.2 cm)**, number of panicles/ tree **(262.0 & 275.0 panicle)**, percentage of perfect flowers **(19.1 & 17.0%)** and the lowest values of mal flowers percentage **(80.9 & 83.0%)** were observed on the trees that received both materials at the higher concentration during both seasons, respectively. The untreated trees produced the lowest values of panicle length **(27.0 & 28.0 cm)**, number of panicles/ tree **(194.9 & 200.0 panicle)**, percentage of perfect flowers **(10.0 & 10.5%)** and the highest percentage of mal flowers percentage **(90.0 & 89.5%)** during both seasons, respectively. The results were true during both seasons.

4- Percentages of initial fruit setting and fruit retention and yield/tree

It is clear from the obtained data in Table (6) that supplying Golek mango trees with amino acids at 0.05 to 0.2% and vitamin B_{12} at 25 to 100 ppm were significantly improved the percentages of initial fruit setting and fruit retention and yield expressed in weight (kg) and number of fruits/tree relative to the control treatment. There was a gradual promotion on these parameters with increasing concentrations of amino acids and vitamin B_{12}. Significant differences on these parameters were observed among the ten treatments. Using amino acids at 0.05 to 0.2% significantly was favourable than using vitamin B_{12} in enhancing these measurements. Combined applications were significantly preferable than using each material alone in improving the percentages of initial fruit setting and fruit retention and yield /tree. Increasing concentrations of amino acids at 0.1 to 0.2% and vitamin B_{12} at 50 to 100 ppm had significant promotion on these parameters. From economical point of view, the beat results with regard to fruit setting and yield/tree were obtained due to treating the trees with amino acids at 0.1% plus vitamin B_{12} at 50 ppm three times. Under such promised treatment yield/tree reached **175.5 & 156.1 kg** compared to the yield in the untreated trees that reached **108.0 & 103.0 kg** during both seasons, respectively. The percentage of increment of yield owing to using the previous promised treatment over the control treatment reached **62.5 & 51.6%** during both seasons, respectively. Similar results were announced during both seasons.

5- Physical and chemical characteristics of the fruits

It is evident from the obtained data in Tables (7 to 9) that single and combined applications of amino acids at 0.05 to 0.2% and vitamin B_{12} at 25 to 100 ppm significantly was very effective in improving quality of the fruits in terms of increasing fruit weight and dimensions (height, diameter and thickness) and percentages of fruit pulp, T.S.S, total and reducing sugars and vitamin C and decreasing percentages of fruit stone, total acidity and total crude fibre relative to the control treatment. The promotion on quality of the fruits was clearly associated with increasing concentrations of amino acids and vitamin B_{12}. No Significant promotion was observed on fruit quality among the two higher concentrations of amino acids (0.1 & 0.2%) and vitamin B_{12} (50 & 100 ppm). Treating the trees with amino acids significantly was favourable in enhancing fruit quality than using vitamin B_{12}. Combined applications significantly were preferable in enhancing fruit quality than using each material alone. The best results were recorded on the trees treated with amino acids at 0.1% plus vitamin B_{12} at 50 ppm three times (since the differences between the higher two concentrations of each material were disappeared). The untreated trees produced unacceptable fruits. Similar results were announced during both seasons.

Table (2): Effect of single and combined applications of amino acids and vitamin B_{12} on some vegetative growth characteristics of Golek mango trees during 2016 and 2017 seasons.

Treatment	Shoot length (cm.)		Shoot thickness (cm.)		Number of leaves / shoot		Leaf area $(cm)^2$	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	18.8	19.1	0.55	0.53	8.0	7.4	118.8	119.0
Spraying amino acids at 0.05%.	20.4	21.0	0.72	0.69	11.0	10.0	124.0	124.5
Spraying amino acids at 0.1%	21.0	21.5	0.78	0.75	12.0	11.0	126.5	127.9
Spraying amino acids at 0.2%	21.0	21.6	0.79	0.76	12.0	11.0	127.0	128.0
Spraying vitamin B_{12} at 25 ppm	19.2	19.8	0.61	0.57	9.0	8.0	119.9	120.0
Spraying vitamin B_{12} at 50 ppm	19.7	20.3	0.66	0.61	10.0	9.0	121.3	121.4
Spraying vitamin B_{12} at 100 ppm	19.8	20.4	0.67	0.62	10.0	9.0	121.4	121.5
Spraying both at low concentration.	21.5	22.2	0.84	0.82	13.0	13.0	129.0	129.9
Spraying both at medium concentration	22.2	23.0	0.88	0.87	15.0	15.0	131.3	131.9
Spraying both at high concentration	22.3	23.1	0.89	0.88	15.0	15.0	131.5	132.0
New L.S.D. at 5%	**0.4**	**0.3**	**0.05**	**0.04**	**1.0**	**1.0**	**0.9**	**1.1**

Table (3): Effect of single and combined applications of amino acids and vitamin B_{12} on some leaf pigments and percentage of N in the leaves of Golek mango trees during 2016 and 2017 seasons.

Treatment	Chlorophyll a (mg/ 1 g F.W.)		Chlorophyll b (mg/ 1 g F.W.)		Total carotenoids (mg/ 1 g F.W.)		Leaf N %	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	4.11	4.15	1.29	1.30	1.40	1.41	1.49	1.55
Spraying amino acids at 0.05%.	4.44	4.46	1.50	1.51	1.61	1.62	1.74	1.81
Spraying amino acids at 0.1%	4.55	4.57	1.55	1.57	1.66	1.68	1.80	1.87
Spraying amino acids at 0.2%	4.57	4.58	1.56	1.58	1.67	1.69	1.81	1.88
Spraying vitamin B_{12} at 25 ppm	4.20	4.26	1.35	1.37	1.46	1.48	1.59	1.66
Spraying vitamin B_{12} at 50 ppm	4.31	4.35	1.41	1.44	1.53	1.55	1.66	1.73
Spraying vitamin B_{12} at 100 ppm	4.32	4.36	1.42	1.45	1.55	1.56	1.67	1.74
Spraying both at low concentration.	4.71	4.79	1.62	1.64	1.74	1.75	1.88	1.94
Spraying both at medium concentration	4.81	4.84	1.67	1.70	1.79	1.80	1.95	1.99
Spraying both at high concentration	4.83	4.86	1.68	1.71	1.80	1.81	1.96	1.99
New L.S.D. at 5%	**0.7**	**0.04**	**0.03**	**0.05**	**0.04**	**0.05**	**0.06**	**0.05**

Table (4): Effect of single and combined applications of amino acids and vitamin B_{12} on percentages of P, K, Mg and Ca in the leaves of Golek mango trees during 2016 and 2017 seasons.

Treatment	Leaf P %		Leaf K %		Leaf Mg %		Leaf Ca %	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	0.112	0.109	1.11	1.08	0.51	0.47	1.99	2.01
Spraying amino acids at 0.05%.	0.142	0.145	1.36	1.40	0.69	0.71	2.30	2.36
Spraying amino acids at 0.1%	0.152	0.155	1.42	1.46	0.74	0.76	2.41	2.47
Spraying amino acids at 0.2%	0.153	0.155	1.43	1.47	0.75	0.77	2.42	2.48
Spraying vitamin B_{12} at 25 ppm	0.120	0.124	1.20	1.23	0.57	0.60	2.11	2.17
Spraying vitamin B_{12} at 50 ppm	0.131	0.133	1.27	1.30	0.63	0.66	2.20	2.27
Spraying vitamin B_{12} at 100 ppm	0.132	0.134	1.28	1.31	0.64	0.67	2.21	2.28
Spraying both at low concentration.	0.163	0.170	1.50	1.53	0.80	0.87	2.53	2.61
Spraying both at medium concentration	0.170	0.177	1.56	1.60	0.84	0.94	2.60	2.71
Spraying both at high concentration	0.171	0.178	1.57	1.60	0.85	0.95	2.61	2.72
New L.S.D. at 5%	**0.004**	**0.006**	**0.04**	**0.06**	**0.03**	**0.05**	**0.06**	**0.08**

Table (5): Effect of single and combined applications of amino acids and vitamin B_{12} on some flowering aspects of Golek mango trees during 2016 and 2017 seasons.

Treatment	Panicle length (cm.)		Number of panicles/ tree		Male flowers %		Perfect flowers %	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	27.1	28.0	194.9	200.0	90.0	89.5	10.0	10.5
Spraying amino acids at 0.05%.	29.1	30.0	221.0	231.0	84.0	86.4	16.0	15.6
Spraying amino acids at 0.1%	30.0	30.9	231.0	241.0	83.0	85.4	17.0	14.6
Spraying amino acids at 0.2%	30.1	31.0	232.2	242.0	82.9	85.0	17.1	15.0
Spraying vitamin B_{12} at 25 ppm	27.6	28.5	201.0	210.0	86.0	88.7	14.0	11.3
Spraying vitamin B_{12} at 50 ppm	28.5	29.4	211.0	221.0	85.0	87.9	15.0	12.1
Spraying vitamin B_{12} at 100 ppm	28.6	29.5	213.0	222.0	84.0	87.4	15.1	12.6
Spraying both at low concentration.	30.6	31.5	250.0	261.0	82.0	84.4	18.0	15.6
Spraying both at medium concentration	31.2	32.1	261.0	274.0	81.0	83.3	19.0	16.7
Spraying both at high concentration	31.3	32.2	262.0	275.0	80.9	83.0	19.1	17.0
New L.S.D. at 5%	**0.4**	**0.5**	**5.1**	**4.8**	**0.9**	**0.8**	**0.6**	**0.8**

Table (6): Effect of single and combined applications of amino acids and vitamin B_{12} on the percentage of initial fruit setting and fruit retention, number of fruits/ tree and yield per tree of Golek mango trees during 2016 and 2017 seasons.

Treatment	Initial fruit setting %		Fruit retention %		Number of fruits / tree		Yield/ tree (kg.)	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	1.11	1.08	0.21	0.14	200.0	190.0	108.0	103.0
Spraying amino acids at 0.05%.	1.30	1.29	0.41	0.39	240.0	220.0	139.0	128.2
Spraying amino acids at 0.1%	1.36	1.35	0.49	0.50	252.0	230.0	149.4	136.9
Spraying amino acids at 0.2%	1.37	1.36	0.50	0.51	253.0	231.0	153.0	137.7
Spraying vitamin B_{12} at 25 ppm	1.16	1.15	0.27	0.27	211.0	201.0	116.5	111.6
Spraying vitamin B_{12} at 50 ppm	1.21	1.21	0.35	0.34	223.0	210.0	126.0	119.3
Spraying vitamin B_{12} at 100 ppm	1.22	1.23	0.36	0.35	225.0	211.0	127.4	120.2
Spraying both at low concentration.	1.50	1.55	0.57	0.56	271.0	241.0	164.2	147.0
Spraying both at medium concentration	1.61	1.69	0.64	0.63	284.0	251.0	175.5	156.1
Spraying both at high concentration	1.62	1.70	0.66	0.65	285.0	252.0	176.4	157.0
New L.S.D. at 5%	**0.4**	**0.3**	**0.04**	**0.06**	**10.0**	**9.0**	**4.1**	**5.2**

Table (7): Effect of single and combined applications of amino acids and vitamin B_{12} on some physical characteristics of the fruits of Golek mango trees during 2016 and 2017 seasons.

Treatment	Average fruit weight (g.)		Fruit height (cm.)		Fruit diameter (cm.)		Fruit thickness (cm.)	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	540.0	541.0	16.9	17.1	6.9	7.1	5.6	5.7
Spraying amino acids at 0.05%.	580.0	582.5	18.5	18.6	8.4	8.5	6.6	6.8
Spraying amino acids at 0.1%	592.0	595.0	19.1	19.3	8.8	8.9	6.8	7.0
Spraying amino acids at 0.2%	593.0	596.0	19.2	19.4	8.9	9.0	6.9	7.1
Spraying vitamin B_{12} at 25 ppm	552.0	555.0	17.4	17.6	7.3	7.5	5.9	7.2
Spraying vitamin B_{12} at 50 ppm	565.0	568.0	18.0	18.3	7.7	7.8	6.2	6.4
Spraying vitamin B_{12} at 100 ppm	566.0	569.5	18.1	18.4	8.0	8.1	6.3	6.5
Spraying both at low concentration.	606.0	610.0	20.0	20.2	9.4	9.4	7.3	7.5
Spraying both at medium concentration	618.0	622.0	20.6	20.8	9.8	9.8	7.5	7.8
Spraying both at high concentration	619.0	623.0	20.7	20.9	9.9	9.9	7.6	7.9
New L.S.D. at 5%	**10.9**	**11.3**	**0.4**	**0.5**	**0.4**	**0.3**	**0.2**	**0.3**

Table (8): Effect of single and combined applications of amino acids and vitamin B_{12} on some physical and chemical characteristics of the fruits of Golek mango trees during 2016 and 2017 seasons.

Treatment	Fruit pulp (%)		Fruit stone (%)		T.S.S (%)		Total sugars (%)	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	77.1	78.0	11.1	11.0	18.1	18.4	15.1	15.2
Spraying amino acids at 0.05%.	81.1	82.0	9.8	9.7	19.5	19.8	16.5	16.7
Spraying amino acids at 0.1%	82.4	83.3	9.5	9.4	20.0	20.3	17.0	17.2
Spraying amino acids at 0.2%	82.5	83.4	9.4	9.3	20.1	20.4	17.1	17.3
Spraying vitamin B_{12} at 25 ppm	78.5	79.4	10.8	10.7	18.5	18.8	15.5	15.7
Spraying vitamin B_{12} at 50 ppm	79.9	80.8	10.5	10.4	19.0	19.3	16.0	16.2
Spraying vitamin B_{12} at 100 ppm	80.0	80.9	10.1	10.0	19.1	19.4	16.1	16.3
Spraying both at low concentration.	84.0	85.0	9.0	8.9	20.7	21.0	17.5	17.7
Spraying both at medium concentration	86.3	88.0	8.7	8.6	21.5	21.7	18.0	18.2
Spraying both at high concentration	87.0	88.3	8.6	8.5	21.6	21.8	18.1	18.3
New L.S.D. at 5%	**1.1**	**0.9**	**0.2**	**0.3**	**0.3**	**0.4**	**0.3**	**0.3**

Table (9): Effect of single and combined applications of amino acids and vitamin B_{12} on some chemical characteristics of the fruits of Golek mango trees during 2016 and 2017 seasons.

Treatment	Reducing sugars %		Total acidity %		Crude fibre %		Total soluble tannins (%)	
	2016	2017	2016	2017	2016	2017	2016	2017
Control treatment	6.6	6.8	0.339	0.340	1.00	0.99	31.3	33.3
Spraying amino acids at 0.05%.	7.7	8.0	0.295	0.290	0.87	0.85	38.0	40.9
Spraying amino acids at 0.1%	8.0	8.3	0.280	0.275	0.84	0.82	40.0	44.0
Spraying amino acids at 0.2%	8.1	8.4	0.279	0.274	0.83	0.81	40.3	44.3
Spraying vitamin B_{12} at 25 ppm	6.9	7.2	0.327	0.323	0.97	0.95	33.4	36.0
Spraying vitamin B_{12} at 50 ppm	7.3	7.6	0.315	0.310	0.93	0.91	36.0	38.0
Spraying vitamin B_{12} at 100 ppm	7.4	7.7	0.310	0.307	0.92	0.90	36.3	38.3
Spraying both at low concentration.	8.5	8.8	0.267	0.264	0.80	0.78	42.0	46.3
Spraying both at medium concentration	8.8	9.3	0.255	0.252	0.71	0.64	44.0	48.9
Spraying both at high concentration	8.9	9.4	0.254	0.250	0.70	0.63	44.0	49.0
New L.S.D. at 5%	**0.2**	**0.3**	**0.010**	**0.010**	**0.02**	**0.03**	**0.02**	**0.03**

4. Discussion:

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**).

Vitamins are considered antioxidants they play a definite role in protecting the plant cells from senescence and death through preventing the producing free radicals during plant metabolism from oxidation of lipids, the components of plasma membrane which is accompanied with the loss of permeability of cells (**Raskin, 1992; Bertschinger and Stadler, 1997 and Buchala and Schmid, 1997**).

Vitamins B have definite roles in decaerboxylation formation of meristem via supplying metabolites to the apex, coenzymes, flavin mononucleotide coenzymes, flavin adenine, dinucleotide and photosynthesis **(Mer, 1957; Robinson, 1973 and Karabanov, 1977**).

This results regarding the effect of amino acids in improving growth, yield and fruit quality of Golek mango trees are in agreement with those obtained by showed that using amino acids **El- Badawy and Abd El- aal, (2013); Fathalla, (2013); Ibrahiem *et al.,* (2013), Hassan-Huda (2014), Sayed- Ola, (2014) and Ahmed, (2016**).

The results of **Hamad (2008), Badran and Ahmed (2009), Zagzog, (2009), Ahmed *et al,* (2013), Farag, (2013), Ibrahim *et al*., (2013), Rizk**, **(2013) and Omar, (2015**) supported the presents results concerning the effect of vitamin B on improving growth, tree nutritional status, yield and quality of the fruits of Golek mangoes.

5. Conclusion:

Supplying Golek mango trees grown under Aswan climatic conditions three times with amino acids at 0.1% plus vitamin B_{12} at 50 ppm succeeded in maximizing the yield and improving fruit quality.

References

1. Ahmed, F. F. and Morsy, M. H. (1999): A new method for measuring leaf area in different fruit species. Minia J. of Agric. Res. & Develop. (19) pp 97-105.
2. Ahmed, F.F.; Akl, A.M.M.A. and Oraby, A.A.F. (2013): Partial replacement of inorganic nitrogen fertilizer of spraying some vitamins, yeast and seaweed extract on Ewaise mango orchard under upper Egypt conditions. Stem Cell. 4 (3): 1-13.
3. Ahmed, M.A.M. (2016): Physiological studies on the effect of some silicon, boron and amino acid treatments on some olive cvs.. Ph. D. Thesis Fac. of Agric. of Al -Azhar Univ. (Assiut branch).
4. Association of Official Agricultural Chemists (A.O.A.C.) (2000): Official Methods of Analysis (A.O.A.C), 12th Ed., Benjamin Franklin Station, Washington D.C., U.S.A. pp. 490-510.
5. Badran, M. A. F. and Ahmed, F.F. (2009): The promotive effect of some antioxidants on the productivity of Taimour mango trees Minia J. of Agric Res. & Develop. (29): 2 pp. 333-348.
6. Bertschinger, L. and Stadler, W (1997): Vitamins First results from field trial in Switzerland. Obst and Weindau 133(6): 150-151.
7. Black, C.A. (1965): Methods of Soil Analysis. Amer. Soc. of Madison, Wisconsin, U.S.A. pp 1-20.
8. Buchala, A. J. and Schmid, C. (1997): Vitamin D and its analogues as new class of plant growth substances affecting Rhizogenesis. Nature 5 pp. 280 – 290.
9. Chapman, H.D. and Pratt, P.E. (1965): Methods of Analysis for Soil, Plant and Water. Univ. of Calif. Division of Agric. Sci. 172- 173.
10. Cottenie, A.; Verloo, M.; Velghe, M. and Camerlynck, R. (1982): Chemical Analysis of Plant and Soil. Ghent, Belgium, Laboratory of Analytical and Agro- chemistry. State Univ. pp. 200-210.
11. El- Badawy, H.E.M. and Abd El- aal, M.M. (2013): Physiological response of Keitte mango *(Mangifera indica* L.) to Kinetin and tryptophan J. of Applied Science Res. Co. 11(2): 14-22.
12. Elade, Y. (1992): The use of antioxidants to control gray mould (*Botrytic cinerg*) and white mold (*Scletotinia sclerotiorum*) in various crops. Plant Pathol. 141: 417 – 426.
13. Farag. A.A.O. (2013): Partial replacement of inorganic nitrogen fertilizer by spraying some vitamins, yeast and seaweed extract in Ewaise mango orchard under Upper Egypt conditions. M. sc. Thesis Fac. of Agric. Minia Univ. Egypt.
14. Fathalla, A.M. (2013): Physiological studies on some mango cultivars. Ph. D. Thesis Fac. of Agric. Menufiya Univ. Egypt.

15. Hamad, A. S. A. (2008): Response of the two mango cvs Taimour and Zebda to fertilization and some antioxidant treatments. Ph. D. Thesis, Fac. of Agric. Minia Univ., Egypt.
16. Hassan- Huda, M. (2014): Impact of effective microorganisms and amino acids enriched with some nutrients on growth and fruiting of Valencia orange trees. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
17. Hulme, A. C. (1971): The Mango. Biochemistry of Fruits and their Products. Vol. 1, London pp 95 – 103.
18. Ibrahiem, H.I.M.; Ahmed, FF.; Akl, A.M.M.A. and Eizk, M.N.S. (2013): Improving yield quantitively and qualititaively of Zaghloul date palms by using some antioxidants. Stem Cell. Vol. (4): No.1, 35-40.
19. Karabanov, L. (1977): Effect of growth regulators and vitamins on growth and certain physiological processes in potato. Plant Growth Regul. Proc. Int. Symp., pp. 761.
20. Lane, J. H. and Eynon, L. (1965): Determination of reducing sugars by means of Fehlings solutions with methylene blue as indicator. A. O. A. C. Washington D. C., U.S.A.
21. Mead, R.; Cunjow, R.N. and Harted, A.M. (1993): Statistical Methods in Agricultural and Experimental Biology. Second Ed. Chapman & Hall. London, pp. 10- 44.
22. Mer, C.L.A. (1957): Reexamination of the supposed effect of riboflavin on growth, Plant physiology 32, 175.
23. Omar, M.G.G. (2015): Response of Saidy date palms growing under New Valley conditions to some organic, inorganic and biofertilization as well as some antioxidant treatments. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
24. Orth, A. B., Sfarra, A.; Pell, R. J. and Tlen, M. (1993): Assessing the involvement of free radicals in fungicide toxicity using x- tocopherol analogs pesticide. Biochemistry and Physiology, 47: 134 – 141.
25. Peach, K and Tracey, I. M. V. (1968): Modern Methods of Plant Analysis. Vol. 1 pp.36 - 38. Inter Sci. New York.
26. Raskin, I. (1992): Role of salicylic acid in plant. Ann. Rev. Plant Physiol. Plant Mol. Biol. 43:439-463.
27. Rizk, M.N.S. (2013): Physiological studies on the effect of some antioxidants on fruiting of Zaghloul date palms M. sc. Thesis Fac. of Agric. Minia Univ. Egypt.
28. Robinson, F.A. (1973): Vitamins Phytochemistry Vol. III: 195-198 Lawrence P. Miller (Ed.) Van Nostrand Rinhold. Comp. New York.
29. Sayed- Ola, M.O. (2014): Effect Of certain amino acids enriched with some nutrients on growth and fruiting of El- Saidy date palms growing under new valley governorate climatic conditions. M.Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
30. Smith, F.; Gilles, M.A.; Hamilton, J.K. and Geders, P.K. (1956): Colorimetric methods for determination of sugars and related substances. Anal. Chem. 28, 350.
31. Summer, M.E. (1985): Diagnosis and Recommendation Integrated system (DRIS) as a guide to orchard fertilization. Hort. Abst. 55(8): 7502.
32. Vianello, A. and Marci, F. (1991): Generation of superoxide anion and hydrogen peroxide at the surface of plant cells. J. Bioenergetics and Biomembranse, 23(2): 409-423.
33. Von- Wettstein, D. V. (1957): Chlroophyll-Lethale under submikroshopische formilkechrel der plastiden celi, prp. Trop. Res. Amer. Soc. Hort. Sci. 20 pp. 427 – 433.
34. Wilde, S. A.; Corey, R. B.; Lyer, I. G. and Voigt, G. K. (1985): Soil and Plant Analysis for Tree Culture. 3rd Oxford & IBH publishing Co., New Delhi, pp. 1 – 218.
35. Zagzog, O.A.I. (2009): Effect of foliar spraying with vitamin C and dry yeast on growth and fruit quality of mango cv. Hendy Meloky. J. Product & Dev. 14 (2): 391-410.

2/3/2018