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Amino acids application improves Mango Ewaise (*Mangifera indica l*) trees growth and fruit quality

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Abstract

Ewaise mango is the most delicious mango varieties in Egypt. It is very popular. However, it suffers of low fruit yield. The shortage of yield may be due to the adverse effects of the unfavorable environmental conditions. Amino acids are proved to improve these negative effects. In this study, Ewaise mango trees grown during 2020 and 2021 seasons were treated with four amino acids; aspartic acid 50 ppm, tryptophan 50 ppm, methionine 50 ppm and glycine 50 ppm alone or in combination. Amino acids application improved plant growth and development and fruit quality comparing to control. The combination of the four amino acids yielded the highest values of leaves area, chlorophyll and nutrients content, yield and its components and the physical and chemical traits of the fruit. To enhance yield and fruit quality of Ewaise mango trees, it is suggested to use three sprays of a mixture containing (aspartic acid 50 ppm, tryptophan 50 ppm, methionine 50 ppm and glycine 50 ppm).The objective of this study is to investigate the enhancement of Ewaise mango crop by application of amino acids.

Keywords:
Amino acids, Mango, fruit quality.

INTRODUCTION

Ewaise mango (*Mangifera indica* L.) is one of Egypt's most important tropical fruit crops. Mango quality depends strongly on orchard management, such as amino acids being studied on many fruit crops to increase vegetative growth, number of fruit /per tree, fruit length, width and yield. Several studies have, also, been reported using the foliar application of amino acids for improving leaf photosynthetic rate, fruit quality and yield (Khan et al, 2012 and Amr and Alaa, 2017). Poor cropping is considered to be a serious and major problem that faces Ewaise 'mango growers in Egypt. There are many factors responsible for lowering yield such as unfavorable environmental conditions. Fruiting in mango is affected by various biotic and abiotic stresses. Various studies showed that using amino acids was beneficial in improving the adverse effects of water stress on the plants' vegetative growth, yield and fruit quality. The plant needs amino acids mainly for its growth and development. Amino acids are organic nitrogenous compounds that contain both acid and basic groups and act as buffers, which help maintain favourable pH value within the plant cell (Davies, 1982; Hildebrandt et al., 2015). Its importance comes in its wide use where it is considered an initiator for the biosynthesis of some plant hormones (Singh, 1999). Amino acids are essential for plants because they are considered the building blocks in synthesizing proteins. It also participates in the biosynthesis of numerous non-protein nitrogenous materials like pigments, vitamins, coenzymes as well as purine and pyrimidine bases (Bell, 2003). Amino acids directly or indirectly affect the plant's physiological activities, which contribute to increasing the photosynthesis efficiency, stomata movement (D'Mello, 2015) and mitigating the damage caused by environmental stresses. (Hammad and Ali, 2014; Rodrigues-Correa and Fett-Neto, 2019). The role of amino acids as biostimulants have been investigated by many researchers. Amino acids application improves the growth and development in many fruit crops such as in Aml et al., (2011) when they sparyed amino acids (Pepton85/16) in olive saplings, El-Shazly and Mustafa (2013) when they sprayed a mixture of amino acids (Amino green II) on orange (Citrus sinensis L. Osbeck) trees, Rasmia et al., (2014) when they applied several types of amino acids on offshoots of the date palm (Phoenix dactylifera L.), Ali et al., (2019) when they used amino nutrient on olive trees, Al-Janabi (2020) when they sprayed sweet orange saplings with amino acids solution (Amino Plus TG). Tryptophan, an amino acid, is a precursor of IAA (indole-3-acetic acid) that result in increasing fruit set and size. L-tryptophan might be a safe, cheap alternative treatment compared with other synthetic auxins, that used in commercial fruit trees production (Pillitteri et al., 2010). Similarly, Hanfy et al., (2012) found that L-tryptophan enhanced tree growth, productivity and fruit characteristics regarding its impacts on physicochemical changes in total phenols, total amino acids and total sugars. Woijcik et al., (2016) found that tryptophan foliar sprays improved the concentrations of IAA and calcium concentration in fruits. In addition, Ahmed et al., (2017) found positive influences of foliar application with tryptophan on fruit set percentage and fruit yield (kg/ tree).

The aim of this study is investigate the effect of foliar application of amino acids tryptophan, aspartic acid, methionine and glycine on growth, yield and fruit quality of Ewais mango trees.

MATERIALS AND METHODS

This investigation was conducted during the two consecutive seasons of 2020 and 2021 on thirty 20-years old Ewaise mango trees onto seedling rootstock. The trees are grown in a private mango orchard located at Tema city, Sohag Governorate. A uniform 30 trees of Ewaise mango planted at 5 X 5 meters apart were selected. The soil texture of the tested orchard is silty clay with a water table depth not less than two meters. The results of orchard soil analysis (according to Wilde *et al.*, 1985) are shown in Table (1).

Table (1): Mechanical, physical and chemical analysis of the tested orchard soil.

Particle size distribution	
Sand %	10.1
Silt %	53.7
Clay	36.2
Texture	Silty clay
pH (1:2.5 extract)	7.33
EC (1: 2.5 extract) (mmhos/Icm/25°C)	0.59
O.M. %	2.33
$CaCO_3$ %	1.56
Total N %	0.17
Available P (ppm, Olsen)	4.0
Available K (ppm/ ammonium acetate)	519
Available Mg (ppm)	132.00
Available S (ppm)	6.77
B (ppm) (hot water extractable)	0.29
Available EDTA extractable micronutrients (ppm)	
Zn	1.12
Fe	12.33
Mn	10.22
Cu	1.65

The present experiment incolouded the following twelve treatments from single and combined applications of the four amino acids (Aspartic, tryptophane, methionene and Glycine):

- T1- Control (untreated trees).
- T2= Aspartic acid 50 ppm.
- T3= tryptophan 50 ppm.
- T4= Methionine 50 ppm.
- T5= Glycine 50 ppm.
- T6= Methionine 50 ppm+ Aspartic acid 50 ppm
- T7= Methionine acid 50 ppm+ tryptophan acid 50 ppm.
- T8= Methionine acid 50 ppm+ Glycine acid 50 ppm
- T9= Aspartic acid 50 ppm+ tryptophan acid 50 ppm.
- T10= Aspartic acid 50 ppm+ Glycine acid 50 ppm.
- T11= tryptophan acid 50 ppm+ Glycine acid 50 ppm.
- T12= Methionine acid 50 ppm+ Aspartic acid 50 ppm+ tryptophan acid 50 ppm+ Glycine acid 50 ppm.

Each treatment was replicated three times, one tree per each. All amino acids were sprayed three times during each season as follows; (1) at growth start, (2) just after fruit setting and (3) one month later. Triton B as a wetting agent was added at 0.05% to all amino acids solutions as well as the control. All amino acids were dissolved in water. Spraying was done till the trees were covered completely with solutions (10 liters/ tree). Each treatment was replicated three times, one tree per each.

Regular agricultural and horticultural practices which were followed in the orchard including pruning, hoeing, fertilization with P and K, irrigation with Nile water as well as pathogens, pests and weed control were carried out as usual.

Twenty leaves below the panicles in the spring growth cycle (according to Summer, 1985) were taken in the first week of July to measure the leaf area (cm2) using the following equation as reported by Ahmed and Morsy (1999).

$$LA = 0.70 (L \times W) - 1.06$$

Where: LA = Leaf area (cm2); L = Maximum length of leaf (cm.); W = Maximum width of leaf (cm.)

Measurements of plant pigments

Samples of five mature and fresh leaves from spring growth cycle per replicate were taken. The leaves were cut into small pieces, homogenate and extracted by 25% acetone in the presence of a little amount of Na_2CO_3 and silica quartz, then filtered through central glass funnel G4.

The optical density of the filtrate was determined using Carl- Zeis spectrophotometer at the wave length of 662 and 644 nm to determine chlorophylls (a and b). Each pigment's content was calculated using the following equations (according to A.O.A.C., 1995).

$$\text{Chl. A} = (9.784 \times E\ 662) - (0.99 \times E\ 644) = \text{mg/L}$$

$$\text{Chl. B} = (21.426 \times E\ 644) - (4.65 \times E\ 662) = \text{mg/L}$$

Where: E = Optical density at a given wave length. The chlorophylls a and b were calculated as mg/g fresh weight of leaves. Also, total chlorophylls were estimated (mg/g F.W.)

Measurements of leaf content of N, P and K

The same previous leaves taken for measuring leaf area were well washed with running tap water followed twice by distilled water, dried in oven at 70° C for 24 hours and ground in stainless steel mill. Wet digestion was done by using concentrated sulphoric acid overnight. The digest was boiled and cooked using H2O2 till it became colourless. The leaf content of N, P, K was determined as follows on dry weight basis (Chapman and Pratt, 1965).

1- Nitrogen % was determined by the modified micro kjeldahl method (Chapman and Pratt, 1965).
2- Phosphorus % was determined by using spekol spectrophotometer (Chapman and Pratt, 1965).
3- Potassium % was determined by using Flame photometer according to the procedure reported by Chapman and Pratt (1965).

Harvesting was achieved during the regular commercial harvesting time under Sohag Governorate conditions (mid of July) in both seasons when the flesh of fruits become yellowish. The yield expressed in Kilograms was recorded.

Twenty fruits were taken randomly from each tree's yield to determine the following physical and chemical properties of the fruits.
1- Fruit firmness (Pound/ inch2) by using a pressure tester.
2- Average fruit weight (g.)
3- Percentages of pulp, peel and seed
4- Percentages of total soluble solids as well as percentages of total and reducing sugars and total acidity % (as g citric acid (ppm) /100 ml pulp) (A.O.A.C., 1995).

All the obtained data during this study in the two successive seasons, 2010 and 2011 were tabulated and statistically analyzed. The ezxperiment was arranged in RCBD layout. The differences between various treatment means were compared using new L.S.D. parameter at 5 % (Mead et al., 1993).

RESULTS AND DISCUSSION

Leaf area and its content of total chlorophylls and percentages of N, P and K in the leaves

It is clear from the data in tables 2 that single and combined applications of the four amino acids, namely aspartic acid 50 ppm, tryptophan 50 ppm, methionine 50 ppm and glycine 50 ppm) significantly increased the leaf area and leaf content of N, P, K and total chlorophylls in relative to the check treatment. The increase was associated with using methionine, tryptophan, glycine and aspartic acid in ascending order. Combined applications of amio acids were significantly superior to using each compound alone. The maximum values were recorded on the trees that applied methionine 50 ppm+ Aspartic acid 50 ppm+ tryptophan 50 ppm+ Glycine 50 ppm. Untreated trees gave the lowest values. These results were true during 2020 and 2021 seasons.

The essential roles of amino acids on stimulating cell division, the biosynthesis of organic materials and the resistance of plants to all stresses (Singh et al., 2004) could explain the present results. The application of amino acids significantly increased the leaves area in olive trees and the leaves number and area in fig saplings (Ali et al.,2019; Rzouki et al., 2019). Amino acids application increased N and chlorophyll content in leaves of peach trees Abd El-Razek and Saleh (2012)and sweet orange sapling Al-Janabi (2020).

Yield and yield components

It is worth to mention that fruit yield/ tree (kg), fruits weight (g) pulb peentage were significantly improved in response to foliar application of amino acids either alone or in all possible combinations comparing with the control treatment (Table 3). Using all the amino acids together was superior than using single, double or triple amino acids. The best results were obtained on the trees that applied methionine 50 ppm+ aspartic acid 50 ppm+ tryptophan 50 ppm+ glycine 50 ppm for fruit weight/tree, fruit weight and pulp % in both seasons. However, the lowest values were obtained in control in both seasons.

The positive effects of these bio-stimulants on growth and tree nutritional status in favor of enhancing the C/N ratio and producing a higher number of flowers could improve the yield. It was suggested that, amino acids can serve as a source of carbon and energy when carbohydrates become deficient in the plant. Amino acids can be recylcled releasing the ammonia and organic acid from which the amino acid was originally formed. The organic acids then enter the kreb's cycle, to be broken down to release energy through respiration Goss (1973). Thom et al. (1981) pointed out that, amino acids provide plant cells with an immediately available source of nitrogen, which generally can be taken by the cells more rapidly than inorganic nitrogen. In addition, Yogeratnam and Greenham (1982) attributed the enhancement happened in fruit quantity due to providing trees with tryptophan to its effects on improving construction and mobilization of carbohydrate substances and its related enzymes in plant tissues the application of phenylalanine or methionine significantly increased in yield in the periwinkle plants (Catharanlhus roseus G. Don) Naguib et al., (2003). Woijcik et al., (2016) found a significant increment in apple tree yield sprayed with tryptophan at pre-bloom or post-bloom stages. Such treatments also increased the concentrations of free IAA in fruitlets by about twofold compared with control. Also, Ahmed et al., (2017) reported that tryptophan at 25 and 50 ppm improved fruit set percentage and yield (kg/ tree) as well as improved vegetative growth characteristics on Washington navel orange. The increment in fruit weight in response to tryptophan treatments might be due to the activation of synthesis of the important components for fruit development and maturity (Sahota and Arora, 1981).

On the other hand, Woijcik et al., (2016) mentioned that tryptophan-spraying treatments did not affect average fruit weight of apple fruit cv. Red Jonaprince at the harvest.

Physical and chemical characteristics of the fruits

Tables (4 and 5) reveal that single and combined applications of amino acids significantly improved fruit quality in terms of increasing fruit length, fruit width, fruit thickness, total sugars, reducing sugars, total acidity and vitamin C content comparing to control in both seasons. The best single amino acids in order were methionine, tryptophan, glycine and aspartic acid. Combined amino acids produced better results than single amino acids. The best results with regard to fruit quality were obtained when the four amino acids were applied together. Untreated trees produced the least fruit quality in both seasons.

The beneficial effects of these stimulants on enhancing nutrients and plant pigments surely were accompanied with enhancing and promoting fruit quality. Mohseni et al., (2017) found that arginine at concentrations of 250 or 500 μM enhanced fruit quality and productivity characteristics compared to control treatment.

The present data are in line with Mohseni et al., (2017) who found that arginine at concentrations of 250 or 500 μM enhanced fruit quality and productivity characteristics compared to control treatment. Woijcik et al., (2016) mentioned that tryptophan spray treatments improved fruit skin colour of apple fruits at harvest. Similar effects of amino acids application, including tryptophan and arginine were found on ‘Washington’ navel orange Pillitteri et al. (2010) and on Valencia orange trees Hanfy et al. (2012) Moreover, Darwesh et al. (2014) approved the relation between plant total amino acids content and tryptophan treatment in date palm.

As a conclusion, it is necessary to supply Ewaise mango trees with some amino acids (Aspartic acid 50 ppm, Methionine 50 ppm, tryptophan 50 ppm and Glycine 50 ppm) three times for improving yield quantitively and qualitatively.

Pillitteri et al. (2010) on ‘Washington’ navel orange and Hanfy et al. (2012) on Valencia orange trees stated similar effects of amino acids applications, including tryptophan and arginine. Moreover, Darwesh et al. (2014) approved the relation between total amino acids content and tryptophan treatment in date palm.

Table (2): Effect of foliar application of amino acids (aspartic acid, tryptophane, methionene and glycine) on the leaf area, total chlorophylls and percentages of N and P in the leaves of Ewaise mango trees during 2020 and 2021 seasons.

Treatments	Leaf area (m^2)		Total chlorophylls (mg/ g F.W)		Leaf N %		Leaf P %		Leaf K %	
	2010	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**
Control (untreated trees)	76.2	78.5	1.10	1.14	1.43	1.43	0.12	0.14	0.81	0.89
Aspartic acid 50 ppm	79.4	80.7	1.21	1.26	1.52	1.51	0.14	0.16	0.86	0.92
Tryptophan 50 ppm	83.2	84.1	1.35	1.40	1.72	1.68	0.18	0.18	0.87	0.91
Methionine 50 ppm	81.5	83	1.30	1.38	1.62	1.60	0.17	0.17	0.89	0.97
Glycine 50 ppm	82.5	83.5	1.35	1.40	1.64	1.69	0.17	0.17	0.86	0.90
Methionine 50 ppm+ Aspartic acid 50 ppm	84	87.3	1.41	1.42	1.62	1.85	0.18	0.2	0.93	1.07
Methionine 50 ppm+ tryptophan 50 ppm	84.1	89.5	1.48	1.51	1.71	1.9	0.2	0.21	0.95	1.1
Methionine 50 ppm+ Glycine 50 ppm	6.8	91.7	1.51	1.52	1.73	1.91	0.2	0.23	1	1.15
Aspartic acid 50 ppm+ tryptophan 50 ppm	89.0	94.2	1.61	1.58	1.79	1.96	0.21	0.23	0.86	0.97
Aspartic acid 50 ppm+ Glycine 50 ppm	89.5	94.5	1.63	1.59	1.65	1.97	0.22	022	0.89	0.98
Tryptophan 50 ppm+ Glycine 50 ppm	90.0	84.2	1.38	1.4	1.62	1.74	0.18	0.2	1	1.17
Methionine 50 ppm+ Aspartic acid 50 ppm+ tryptophan 50 ppm+ Glycine 50 ppm	93	96.5	1.65	1.63	1.81	1.98	0.22	0.24	1.01	1.18
New L.S.D at 5 %	**3.1**	**3.2**	**0.09**	**0.10**	**0.06**	**0.07**	**0.01**	**0.03**	**0.04**	**0.05**

Table (3): Effect of foliar application of amino acids (aspartic acid, tryptophane, methionene and glycine) on yield/ vine, fruit weight (g.) and percentage of pulp in the fruits of Ewaise mango trees during 2020 and 2021 seasons.

Treatments	Yield/ tree (kg.)		Fruit weight (g.)		Pulp %	
	2010	**2011**	**2010**	**2011**	**2010**	**2011**
Control (untreated trees)	46	50	192	199	71.7	70.3
Aspartic acid 50 ppm	48	52	197	202	78.7	77.8
Tryptophan 50 ppm	52.9	51.9	198	203	81.6	82
Methionine 50 ppm	55.6	54.6	201	206	83.2	84.4
Glycine 50 ppm	51.9	50.9	196	201	81.6	82
Methionine 50 ppm+ Aspartic acid 50 ppm	57.9	62	204	212.5	85.7	85.8
Methionine 50 ppm+ tryptophan 50 ppm	61	65	205	213	87.6	87.8
Methionine 50 ppm+ Glycine 50 ppm	64.5	68.5	210	217.5	89.7	90.3
Aspartic acid 50 ppm+ tryptophan 50 ppm	50.6	54.6	198	206	80.2	80.4
Aspartic acid 50 ppm+ Glycine 50 ppm	52.9	56.9	198	207	81.6	82
Tryptophan 50 ppm+ Glycine 50 ppm	69	73	210	218	92.6	92.8
Methionine 50 ppm+ Aspartic acid 50 ppm+ tryptophan 50 ppm+ Glycine 50 ppm	72	76	211	221	94.7	95.3
New L.S.D at 5 %	**1.9**	**2.0**	**2.8**	**3.0**	**1.2**	**1.3**

Table (4): Effect of foliar application of amino acids (aspartic acid, tryptophane, methionene and glycine) on some physical and chemical characteristics of the fruits of Ewaise mango trees during 2020 and 2021seasons.

Treatments	**Fruit length (cm.)**		**Fruit width (cm.)**		**Fruit thickness (cm.)**		**T.S.S %**	
	2010	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**
Control (untreated trees)	9.3	9.6	6.1	6.2	4.8	4.6	18.4	18.2
Aspartic acid 50 ppm	9.6	10	6.3	6.5	5.1	4.9	18.8	18.9
Tryptophan 50 ppm	9.7	10	6.3	6.6	5.1	5	18.8	19.4
Methionine 50 ppm	10.2	10.5	6.6	7	5.4	5.2	19.3	19.8
Glycine 50 ppm	9.9	10.2	6.4	6.8	5.2	5	19	19.5
Methionine 50 ppm+ Aspartic acid 50 ppm	10.6	11.4	7.5	7.7	5.8	5.8	20.4	21
Methionine 50 ppm+ tryptophan 50 ppm	10.6	10.8	6.9	7.6	5.7	5.4	19.8	20.4
Methionine 50 ppm+ Glycine 50 ppm	10.5	10.7	6.8	7.2	5.5	5.2	19.4	19.8
Aspartic acid 50 ppm+ tryptophan 50 ppm	10.5	10.8	6.8	7.5	5.5	5.3	19.4	19.9
Aspartic acid 50 ppm+ Glycine 50 ppm	10.3	10.4	6.5	7.2	5.5	5.3	19.4	19.5
Tryptophan 50 ppm+ Glycine 50 ppm	10.2	10.5	6.6	7	5.3	5.2	19.3	19.6
Methionine 50 ppm+ Aspartic acid 50 ppm+ tryptophan 50 ppm+ Glycine 50 ppm	10.7	11.5	7.5	7.7	5.9	6.1	20.5	21
New L.S.D at 5 %	**0.2**	**0.2**	**0.1**	**0.2**	**0.1**	**0.2**	**0.3**	**0.4**

Table (5): Effect of foliar application of amino acids (aspartic acid, tryptophane, methionene and glycine) on some chemical characteristics of the fruits of Ewaise mango trees during 2020 and 2021 seasons.

Treatments	**Total sugars %**		**Reducing sugars %**		**Total acidity %**		**Vitamin C content (mg / 100 g pulp)**	
	2010	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**
Control (untreated trees)	17.3	17.3	7.3	7.2	0.381	0.385	31.8	31.5
Aspartic acid 50 ppm	17.7	17.7	7.7	7.7	0.359	0.361	33.9	33
Tryptophan 50 ppm	17.8	17.8	7.8	7.8	0.339	0.336	34	33.3
Methionine 50 ppm	18.2	18.4	8.2	8.3	0.214	0.215	36	36.2
Glycine 50 ppm	18	18.1	7.9	8.2	0.309	0.307	33.4	34
Methionine 50 ppm+ Aspartic acid 50 ppm	18.3	18.8	8.6	8.8	0.214	0.215	40	40
Methionine 50 ppm+ tryptophan 50 ppm	18.3	18.5	8.3	8.6	0.254	0.255	36	35.9
Methionine 50 ppm+ Glycine 50 ppm	18.4	18.5	8.4	8.7	0.234	0.235	36.3	38.1
Aspartic acid 50 ppm+ tryptophan 50 ppm	18.1	18.3	8.3	8.2	0.274	0.275	35.9	35.6
Aspartic acid 50 ppm+ Glycine 50 ppm	18.2	18.4	8.4	8.3	0.275	0.276	35.9	35.6
Tryptophan 50 ppm+ Glycine 50 ppm	18.5	19.0	8.8	9.05	0.197	0.199	40.2	41.3
Methionine 50 ppm+ Aspartic acid 50 ppm+ tryptophan 50 ppm+ Glycine 50 ppm	18.8	19.2	9.1	9.4	0.174	0.178	42.5	43
New L.S.D at 5 %	**0.2**	**0.2**	**0.15**	**0.2**	**0.016**	**0.018**	**2.1**	**1.7**

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استجابة المانجو العويس للمعاملة ببعض الاحماض الامينية (الأسبارتيك، التربتوفان، الميثونين والجليسين)

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الملخص العربي

تمت معالجة أشجار المانجو العويس خلال موسمي 2020 و2021 ثلاث مرات بأربعة أحماض أمينية وهي (حمض الأسبارتيك 50 جزء في المليون، التربتوفان 50 جزء في المليون، الميثيونين 50 جزء في المليون والجليسين 50 جزء في المليون) إما منفردة أو في جميع التوليفات الممكنة. تم دراسة مساحة الورقة ومحتواها من (النيتروجين والفوسفور والبوتاسيوم والكلوروفيل الكلي) والمحصول بالإضافة إلى الخصائص الفيزيائية والكيميائية للثمار استجابة للمعاملات الحالية. كانت التطبيقات المنفردة والمركبة لهذه المركبات فعالة للغاية في تعزيز الورقة ومحتواها من (النيتروجين والفوسفور والبوتاسيوم والكلوروفيل الكلي)، بالإضافة إلى الخصائص الفيزيائية والكيميائية للثمار بالنسبة إلى معاملة الكنترول. ارتبط التعزيز في هذه الصفات باستخدام حمض الميثيونين وحمض التربتوفان وحمض الجليسين وحمض الأسبارتيك بترتيب تصاعدي. لتعزيز محصول وجودة ثمار أشجار المانجو العويس، يُقترح رش أشجار المانجو العويس، ثلاث مرات بخليط يحتوي على (حمض الأسبارتيك 50 جزء في المليون، التربتوفان 50 جزء في المليون، الميثيونين 50 جزء في المليون والجليسين 50 جزء في المليون). تعتبر المانجو العويس واحد من أطعم أصناف المانجو في مصر، كما أنها من الأصناف المشهورة، إلا أنها تعاني من نقص المحصول، و قد يرجع ذلك النقص الي الظروف البيئية الغير مناسبة، لقد ثبت أن المعاملة بالأحماض الأمينية تحسن الأثار السلبية للظروف البيئية الغير مناسبة. قمنا في هذه التجربة بمعاملة المانجو صنف العويس النامية في موسمي 2020 و 2021 باربعة أحماض أمينية: حمض الأسبارتك 50 جزء في المليون و تربتوفان 50 جزء في المليون و مثيونين 50 جزء في المليون و جليسين 50 جزء في المليون بمفردهم أو مجتمعين. حسن رش الأحماض العضوية نمو تطور الأشجار و صفات الجودة في الثمارمقارنة بالكنترول. أعطي رش اللأشجار بالأربعة أحماض الأمينية مجتمعين أعلي قيم في مساحة الورقة و محتوي الكلوروفيل و محتوي الورقة من العناصر و المحصول و مكوناته والصفات الفيزيائية و الكيميائية للثمار. لتحسين المحصول و صفات الجودة في أشجار المانجو العويس ينصح برش ثلاثة مرات من خليط الأحماض الأربعة (حمض الأسبارتك 50 جزء في المليون و تربتوفان 50 جزء في المليون و مثيونين 50 جزء في المليون و جليسين 50 جزء في المليون). الهدف من هذه الدراسة هو دراسة تأثير تحسين محصول المانجو العويس بالأحماض الأمينية.