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Influence of Spraying Vermicompost Tea and Amino Acids Enriched by different Nutrients on Growth and Fruiting of Ewaise Mango Trees

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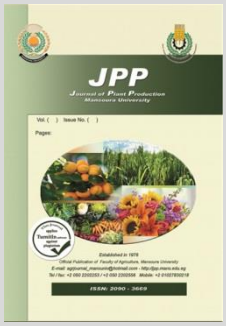

ABSTRACT

One of the main factors responsible for the success of sustainable food production is the availability of using cheap fertilizers from natural sources and reducing the use of mineral fertilizers. This work was undertaken during the 2022 and 2023 seasons to indicate the impact of spraying both amino acids enriched with different nutrients and vermicompost tea (VCT) at 100, 200, 400, and 600 ml/L on the growth, yield, and fruit quality of Ewaise mango trees grown under Aswan climatic conditions. This experiment was set up in a randomized complete block design with five treatments and three replications. Spraying the trees with amino acids enriched with different nutrients and VCT at 100 to 600 ml/L had an announced promotion on all aspects of growth, yield, and fruit quality compared to the control treatment (water spraying). The highest values of the studied growth and fruiting traits were obtained due to the higher concentrations of VCT. Using VCT at concentrations higher (600 ml/L) failed to show measurable effects compared to 400 ml/L. So, the greatest impact on the growth, yield, and fruit quality of Ewaise mango trees was gained by spraying the trees three times with VCT at a 400 ml/L rate.

Keywords: vermicompost tea ; amino acids ; mango

INTRODUCTION

Mango (*Mangifera indica* L.) is considered the queen fruit among all other fruit crops. It is one of the most significant fruits in tropical and subtropical countries around the world. It grows under a wide range of climatic and soil conditions. Mangos are Egypt's second most popular fruit after citrus, with 321040 fed hectares of fruit orchards, yielding an estimated 766128 tonnes a year. The fruiting area reached 18375 fed in the Aswan Governorate, the study's location , and produced about 43738 tons (Egypt's Economic Affairs Sector: Statistical Institute Annual Reports and Agricultural Economic Research, 2021).

Ewaise mango cv. quality due to its pungent taste, attractive aroma, high sweetness, low fiber content, regular storage, medium ripeness, popular fresh consumption in the domestic market, wide acceptance in the international market, and excellent mango cv. (Bacha, 1987).

Lately, several efforts have been made to enhance the output and fruit quality of the premium mango cultivar Ewaise by utilizing unconventional techniques. Out of these strategies were the practices of using both amino acids and enriched with different nutrients and vermicompost tea (VCT).

The aggressive climatic conditions that are common in Aswan regions adversely impair fruit setting and promote fruit dropping, which accounts for the low yield of Ewaise mango cv. planted there. Thus, the proposal of combining vermicompost tea (VCT) with amino acids, enriched by different minerals, was developed.

Amino acids are essential for plants' protection versus oxidative stress brought on by adverse environments because of their antioxidative qualities. In addition to preserving plant cells via senescence and death, the using amino acids also improved the synthesis of proteins and prevented free radicals from oxidizing lipids, which are a part of the plasma membrane's structure and cause permeability to be lost. Additionally, the occurrence of disorders was controlled (Orth *et al.*, 1993). They are responsible for stimulating the synthesis of enzymes, foods that are organic, ethylene, cytokinins, IAA, GA_3 division of cells, and naturally generated hormones such as RNA and DNA, among others. The development of healthy trees is undoubtedly a result of these beneficial impacts. (Elade, 1992).

Numerous metabolic activities in plants depend on nutrients.They have several, significant regulatory functions in the growth of plants.Nutrients perform several roles in plant growth, such as stimulating the production of proteins, lipids, carbohydrates, and natural hormones and promoting the transport of carbohydrates.In addition, they promote cell growth and division, the movement of water and nutrients, and the synthesis of amino acids. (Devlin, and Withdam, 1983 and Nijjar, 1985).

Vermicompost is produced from organic waste using earthworms (Edwards, and Arancon, 2004; Blouin *et al.* 2019), which contain a high concentration of nutrients, microbial activity, and water-retaining capacity (Edwards 2004; Pandya *et al.* 2014; Soobhany *et al.* 2017). The process of turning biodegradable organic waste into compost with the help of earthworms is known as vermicomposting.

Vermicompost contains nutrients, beneficial microbiota, and bioactive metabolites, especially gibberellins, cytokines, auxins, and B vitamins, and can be

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applied alone or in combination with organic or inorganic fertilizers to improve a variety of crop yield and quality.

Application of extracts made from water of vermicompost (vermicompost teas) as a spray on the foliage or soil drench has been shown to promote plant health, yield, and nutritive quality through the following mechanisms: (i) increasing beneficial microbial populations and their impact on agricultural soils and crops; (ii) boosting the plant's mineral nutrient status; and (iii) achieving the production of plant protective substances that have positive bioactivities for humans.(Diver, 2001; Scheuerell and Mahaffee, 2002; Carpenter-Boggs, 2005).

Soluble mineral nutrients recovered from vermicomposts are thought to positively affect plant development in vermicompost extract foliar or soil treatments, despite the complicated chemistry and microbiology of the extracts.VCT may be extracted in both aerated and passive environments. Throughout an aerated extraction process, air circulates into water containing vermicompost to maintain an oxygen level of more than 5 mg/L. (Ingham, 2005)

The present research aimed to clarify the effects of vermicompost tea (VCT) and amino acids loaded with various nutrients applied topically on the growth, yield, and physical and chemical features of Ewaise mango trees cultivated under Aswan governorate conditions.

MATERIALS AND METHODS

This study was carried out on fifteen consistently healthy Ewaise mango trees that were grafted into polyembryonic mango seedling rootstock throughout the 2022 and 2023 seasons. The chosen trees are cultivated in a private orchard located within the Wady El-Nokra sector, Kom Ombo county, Aswan Governorate, Egypt, upon silty clay soil having a minimum water table deep of two meters. The eight-year-old, healthy trees that were chosen were planted seven by seven meters apart (86 trees per fed.). The exact same horticultural and agricultural techniques used in the orchard were also applied to the trees. Through Nile water, surface irrigation technology was used. (Wilde *et al.* 1985).

Randomized Complete Block Design (RCBD) was adopted for carrying out this study. This study included the following five treatments for using vermicompost tea (VCT) and both amino acids enriched with various nutrients:

1- Control (water spraying).
2-Spraying amino acid at 0.1% (g/L) + 100 ml/L VCT
3- Spraying amino acid at 0.1% (g/L) + 200 ml/L VCT
4- Spraying amino acid at 0.1% (g/L) + 400 ml/L VCT
5-Spraying amino acid at 0.1% (g/L) + 600 ml/L VCT

Every treatment was performed three times, and one Ewaise mango tree was selected per block (a total of 15 trees). plant source amino acid chelated trace elements. It includes Ca, Mg, Fe, Cu, Mn, Mo, Zn, and B in chelated form. Triton B as a wetting agent (0.5 mL/L) was placed to amino acids enriched with various nutrients solutions, and spraying was occurred until runoff. Triple sprays were applied to the chosen trees: in the middle of February, following the fruit set (in the beginning week of April), as well as one month thereafter (in the beginning week of May).

Vermicompost tea extraction method:

Vermicompost for the investigation was sourced from the Agriculture Research Center, Egypt's Central Laboratory for Agriculture Climate (CLAC), during two consecutive seasons in 2022 and 2023. Since vermicompost reached a stage of maturity where its organic matter levels recorded 29.70%, it was appropriate for tea extract. As seen in Table 1, vermicompost was also devoid of worms, parasites, harmful bacteria, and weed seeds.

We used aerated vermicompost tea (AVCT) to make vermicompost liquids. Because the presence of chlorine and chloramines may inhibit the development and propagation of microorganisms, de-chlorinating water is essential for promoting their growth and multiplication. Simple methods to achieve this include aerating the tap water for 20 to 120 minutes (Allen, 1994) or putting it in a brewing tank overnight (Martin *et al.*, 2012). In a clear plastic container, vermicompost and tap water were combined in a ratio of 1:10 (w/v). A commercial VCT system made of coiled polyvinyl chloride (PVC) tubing connected to an air pump was used to aerate the mixture. To make aerated tea, well-matured compost must be given oxygen and suspended in water for a minimum of 12 to 24 hours. Just before spraying the final AVCT on trees, it was passed through a nylon membrane filter.

Table 1. Chemical and biological determinations of vermicompost tea

Type of analysis	Vermicompost tea
Chemical analysis	
pH	5.3
EC dS/m	1.901
Organic matter (%)	12.6
$N\text{-}NH^{+4}$ (%)	<1.0
$N\text{-}NO^{3}$ (%)	<1.0
Total-N(%)	6.9
Available-P (%)	0.71
Available-K (%)	<1.5
Biological determination (cfu/ml)	
Total coliform	Nd
Fecal coliform	Nd
Salmonella and shigella	Nd

Nd: not detected

These measurements were taken throughout a two-season seasons:

1- **Vegetative growth:** Leaf area, expressed in centimeters squared (Ahmed and Morsy, 1999). Chlorophylls a and b, total chlorophylls, and total carotenoids (mg/1.0 g F.W.) are the pigments found in leaves (Von Wettstein, 1957 ; Hiscox and Isralstam, 1979).
2- **Yield**: expressed in weight (kg.) per tree, was recorded.
3- **Physical and chemical aspects of the fruits**

a) **Fruit weight (g.) and dimensions of fruits (cm.)** (length, width, and thickness by vernier caliper)
b) **Percentages of flesh (pulp)**.
c) **Total soluble solids (TSS%):** determined using a convenient refractometer
d) **Total acidity (%):** determined by titrating the juice against 0.1 N sodium hydroxide while adding phenolphthalein, just like an indicator (as grams of citric acid per 100 ml of juice). (A.O.A.C., 2000).
e) **Sugar content:** Using the volumetric approach described by Lane, and Eynon, (1965) in (A.O.A.C. 2000).
f) **Vitamin C:** Using 2,6-dichlorophenol indophenol titration, the pulp's vitamin C concentration (milligrams

ascorbic acid/100 grams pulp) was ascertained by (A.O.A.C., 2000).

g) Crude content : was obtained following the approved procedures outlined, utilizing a combination of nitric acid as well as glacial acetic acid at a proportion of 10:1 on a 1 g sample. (A.O.A.C., 2000).

Statistical Analysis

The data collected was tallied and statistically examined throughout the investigation's two consecutive seasons (2022 and 2023). The new LSD at 5% was used to look at the variances among the five treatment means according to. (Mead *et al.* 1993 and Rangaswamy, 1995). Statistix 10.0 was used to conduct the statistical analysis.

RESULTS AND DISCUSSION

Results

Vegetative growth

The data displayed in Tables 2 and 3 illustrates the influence of the 2022 and 2023 seasons' applications of vermicompost tea (VCT), amino acid spraying, enrichment of nutrients on some vegetative growth traits of Ewaise mango trees. Given the data available, it is clear that the two seasons under study both had similar trends in outcomes. In general, the findings indicated that spraying VCT and amino acids enriched with different nutrients, dramatically improved the overall chlorophyll content and leaf development properties when compared to an unsprayed (control). Increases in vermicompost tea concentrations from 100 to 600 mL/L were shown to be strongly correlated with benefits. Given the higher concentrations (400–600 ml/L), no noticeable variations in the analyzed leaf traits were seen.The application of 600 ml/L of spray vermicompost tea produced the greatest results in terms of leaf characteristics from an economical standpoint. In comparison to not applying any nutrients, the main shoot length (25.57 & 25.62 cm), number of leaves/shoot (19.37 & 19.40), leaf area (95.10 & 95.20 cm^2), and the total amount of carotenoids, chlorophylls a and b, and other pigments in the leaves were all greatly increased by applying foliar applications of VCT and amino acids enriched by various nutrients. After that, the main shoot length increment percentages above control were reached. (35.90 & 34.89%), leaf area (14.67 & 14.57%), and total chlorophyll (22.13 & 22.42%) due to spray VCT at 400 ml/L during the two studied seasons. So it could be concluded that spraying vermicompost tea (VCT) applied 100 to 600 ml/L and amino acids enriched with different nutrients at 0.1% was beneficial to the growth and vigor of Ewaise mango trees.

Table 2. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on some vegetative growth attributes in 2022 and 2023 seasons.

Treatments	Main shoot length (cm.)		Mean	Number of leaves/shoot		Mean	Leaf area (cm2)		Mean
	2022	2023		2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	18.85D	19.18D	19.02	14.63D	14.70D	14.67	86.02D	86.17D	86.10
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	23.38C	23.27C	23.33	17.24C	17.30C	17.27	90.00C	90.22C	90.11
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	25.57B	25.62B	25.60	19.37B	19.40B	19.39	95.10B	95.20B	95.15
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	26.82A	26.90A	26.86	19.99A	20.08A	20.04	96.57A	96.60A	96.59
T5:Control (spraying with water).	16.38E	16.68E	16.53	12.24E	12.36E	12.30	81.15E	81.33E	81.24
New L.S.D. at 5%	0.22	0.30		0.21	0.16		0.24	0.20	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Table 3. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on some photosynthetic pigments in 2022 and 2023 seasons.

Treatments	Chlorophyll a (mg /g f.w)		Mean	Chlorophyll b (mg /g f.w)		Mean	Total Chlorophylls (mg /g f.w)		Mean	Total carotenoids (mg/100 g F.W.)		Mean
	2022	2023		2022	2023		2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	22.55D	22.60D	22.58	8.43D	8.55D	8.49	30.98D	31.15D	31.07	8.25 C	8.42 C	8.33
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	24.78C	24.85C	24.82	9.40C	9.48C	9.44	34.18C	34.33C	34.26	9.47 B	9.58 B	9.53
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	26.68B	26.77B	26.73	10.13B	10.20B	10.17	36.82B	36.97B	36.90	11.73 A	11.97 A	11.85
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	27.48A	27.58A	27.53	10.47A	10.52A	10.50	37.95A	38.10A	38.03	11.97 A	12.03 A	12.00
T5:Control (spraying with water).	20.88E	20.83E	20.86	7.78E	7.85E	7.82	28.67E	28.68E	28.68	7.17 D	7.32 D	7.24
New L.S.D. at 5%	0.05	0.09		0.09	0.04		0.05	0.07		0.15	0.06	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Yield components

The results obtained is displayed in Table 4, which shows that supplying, Ewaise mango trees together with vermicompost tea (VCT) and amino acids enriched by various minerals applied through spray has a significant effect on the number of fruits per tree and yield expressed through weights of Ewaise mango trees in comparison to apply vermicompost tea (VCT) from 100 to 600 ml/L and amino acids added to with various minerals (0.1%).

Nevertheless, no discernible increase in the number of fruits/trees studied or yield was noticed among the highest two concentrations, namely, 400 and 600 ml/L. From an economical point of view, the best results with regard to the number of fruits per tree and yield were obtained by spraying vermicompost tea at 400 ml/L. Under such promised treatment, the number of fruit and trees was 291.7 and 301.3, and the yield per tree was 58.7 and 60.0 kg during the two studied seasons, respectively. The

Ewaise mango trees sprayed with water gave yield that reached 35.0 and 37.7 kg in each of the two seasons, correspondingly. Then, the increment percentages of fruit per tree overcontrol were attained (21.74 and 21.91%), and yield was at 40.37 and 37.16%) due to spray amino acids enriched with different minerals and vermicompost tea at 400 ml/L Throughout the two studied seasons.

Table 4. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on number of fruit/tree and yield/tree in 2022 and 2023.

Treatments	No. of fruit / tree		Mean	yield /tree (Kg)		Mean
	2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	245.0 C	249.7 C	247.3	41.7 C	40.0 C	40.8
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	262.7B	270.0 B	266.3	46.7 B	47.0 B	46.8
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	291.7A	301.3 A	296.5	58.7 A	60.0 A	59.3
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	293.0A	305.0 A	299.0	59.0 A	62.0 A	60.5
T5:Control (spraying with water).	228.3D	235.3 D	231.8	35.0 D	37.7 C	36.3
New L.S.D. at 5%	3.0	3.1		1.2	1.3	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Fruit Quality

Physical properties

It is clear from the obtained data in Tables 5 and 6 that the effects of using VCT and amino acids enriched with different nutrients on weight, height, width, and thickness of fruit (pulp, and seed), in addition to T.S.S.% of Ewaise mango fruits throughout the growing seasons of 2022 and 2023. The statistics clearly show that the findings followed a similar pattern over the two research seasons. Data in the prementioned tables showed that spraying with VCT and amino acids enriched with different nutrients significantly increased the fruit weight and fruit dimensions, in addition to the proportion of fruit pulp, and compared with the sample not treated (control). Spraying VCT at 400 or 600 ml/L gave the highest values of fruit weight (208.5 & 210.6) and (212.1 & 213.8 g) respectively, for the two investigated seasons. The recorded fruit weights were (180.3, 186.0, 208.5, 212.1, and 173.5) and (182.0, 187.2, 210.6, 213.8, and 175.5 g) due to spray by VCT at 100, 200, 400, and 600 ml/L and amino acids enriched with different minerals at 0.1% and spraying water (control) for the two seasons that were analyzed, respectively.

However, the treatment greatly raised the pulp percentage compared to the untreated group (control), whereas spraying VCT at 400 or 600 ml/L and amino acids enriched with different nutrients 0.1% had no discernible effect on the flesh percentage. Also, the increase in the fruit length is proportional to the increase in its diameter.

The recorded pulp percentage was (73.1, 74.7, 76.4, 77.2 & 72.0) and (73.1, 74.8, 76.6, 77.4 & 72.1) and avarge fruit thickness (cm) (5.3, 5.7, 6.1, 6.5 & 4.9) and (5.4, 5.8, 6.2, 6.5 & 4.9 cm) due to spray by VCT at t 100, 200, 400, 600 ml./L and amino acids enriched with different nutrients 0.1% and water sprayed (control) for the two seasons that were examined.

Therefore, results showed considerably higher values of fruit height (8.9 and 9.1 cm), fruit width (6.5 and 6.6 cm), fruit thickness (5.3 and 5.4 cm), and fruit pulp percentage (73.1 and 73.1%) throughout the two seasons under study. Additionally, the matching peak values showed a considerable rise (10.3 & 10.5 cm), (7.5 & 7.5 cm), (6.5 & 6.5 cm), and (77.2 & 77.4% during the two studied seasons) for fruit height, fruit width, fruit thickness, and fruit pulp percentage, respectively. Such readings were attained (8.5 & 8.6 cm), (5.9 & 5.8 cm), (4.9 & 4.9 cm), and (72.0 & 72.0%) during the two studied seasons on fruits of trees that were unsprayed (control). Additionally, the results indicated no discernible changes between the two VCT concentrations utilized (400 or 600 ml/L); thus, from an economic standpoint, it is advisable to spray using a concentration of 400 ml/L.

Consequently, it was feasible to draw the conclusion that spraying the Ewaise mango trees with vermicompost tea (VCT) from 100 – 600 ml./L and amino acids enriched with different nutrients 0.1% considerably enhanced every aspect of the fruit's physical qualities. Since the enhanced physical fruit features result in a rise in packable yield, such fruit enhancement is an aim that is far more essential than overall yield.`

Table 5. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on some Physical attributes of the fruits in 2022 and 2023.

Treatments	AV. fruit weight(g)		Mean	AV. fruit height(cm)		Mean	AV. fruit width (cm)		Mean	AV. fruit thickness (cm)		Mean
	2022	2023		2022	2023		2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	180.3 D	182.0 D	181.2	8.9 D	9.1 D	9.0	6.5 C	6.6 C	6.5	5.3 D	5.4 D	5.4
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	186.0 C	187.2 C	186.6	9.4 C	9.5 C	9.5	6.9 B	7.0B	7.0	5.7 C	5.8 C	5.7
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	208.5 B	210.6 B	209.6	10.0 B	10.1 B	10.1	7.4 A	7.4 A	7.4	6.1 B	6.2 B	6.2
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	212.1 A	213.8 A	213.0	10.3 A	10.5 A	10.4	7.5 A	7.5 A	7.5	6.5 A	6.5 A	6.5
T5:Control (spraying with water).	173.5 E	175.5 E	174.5	8.5 E	8.6 E	8.5	5.9 D	5.8 D	5.9	4.9 E	4.9 E	4.9
New L.S.D. at 5%	0.9	0.8		0.11	0.09		0.09	0.07		0.07	0.07	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Table 6. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on some Physical attributes of the fruits in 2022 and 2023.

Treatments	Fruit Pulp %		Mean	Fruit Seeds %		Mean
	2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	73.1 C	73.1 D	73.1	14.50 B	14.6 B	14.6
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	74.7 B	74.8 C	74.8	13.50 C	13.6 C	13.5
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	76.4 A	76.6 B	76.5	12.60 D	12.5 D	12.6
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	77.2 A	77.4 A	77.3	11.97 E	11.8 E	11.9
T5:Control (spraying with water).	72.0 D	72.1 E	72.1	15.10 A	15.0 A	15.1
New L.S.D. at 5%	0.34	0.17		0.23	0.11	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Chemical properties

The results obtained and displayed in Tables 7 , 8 and 9 show that there were significant differences in all chemical fruit quality indicators across the five foliar treatments of vermicompost tea (VCT) from 100 to 600 ml/L and amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo, Zn, and B) 0.1%. Results showed that amending Ewaise mango trees with VCT spraying the trees three times 100 – 600 ml/L and amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo, Zn, and B) had significant promotion on fruit chemical quality in terms of increasing total and reducing sugars and vitamin C content and decreasing total acidity%,total crude fiber%.

The outstanding results with In terms higher-quality fruits were obtained when the trees received treatment with vermicompost tea 100–600 ml/L and amino acids enriched with different nutrients 0.1%. Positive impacts on the fruit's chemical characteristics were noted on the trees receiving 100–600 ml/L of vermicompost tea. For both seasons, the same results remained true. As a result, spraying the Ewaise mango trees with VCT at 400–600 ml/L and spraying them three times using amino acids enriched with various minerals 0.1% produced the greatest results in terms of quality criteria. From an economic standpoint, As there was no discernible improvement in production or fruit quality when the spraying concentration was increased from 400 to 600 ml/L, the greatest results for both fruit quality and yield were obtained by spraying VCT at 400 ml/L.

Table 7. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on some chemical attributes of the fruits in 2022 and 2023.

Treatments	T.S.S%		Mean	Total Acidity %		Mean
	2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	16.50 D	16.5 C	16.52	0.315 B	0.312 B	0.313
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	17.33 C	17.5 B	17.42	0.263 C	0.257 C	0.260
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	18.27 B	18.4 A	18.32	0.195 D	0.192 D	0.193
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	18.60 A	18.7 A	18.63	0.187 D	0.188 D	0.188
T5:Control (spraying with water).	15.77 E	15.9 D	15.82	0.345 A	0.337 A	0.341
New L.S.D. at 5%	0.12	0.25		6.5	8.4	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Table 8. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on some chemical attributes of the fruits in 2022 and 2023.

Treatments	Total Sugar%		Mean	Reducing Sugars %		Mean
	2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	15.47 C	15.55 C	15.51	4.22 C	4.28 C	4.25
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	16.03 B	16.12 B	16.08	4.53 B	4.60 B	4.57
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	16.85 A	16.95 A	16.90	4.78 A	4.85 A	4.82
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	16.98 A	17.02 A	17.00	4.82 A	4.87 A	4.84
T5:Control (spraying with water).	14.75 D	14.83 D	14.79	3.90 D	3.92 D	3.91
New L.S.D. at 5%	0.08	0.08		0.05	0.08	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Table 9. Influence of spraying Ewaise mango trees with vermicompost tea and amino acids enriched by various minerals on some chemical attributes of the fruits in 2022 and 2023.

Treatments	Vitamin C (mg/100 ml pulp)		Mean	Total fibre %		Mean
	2022	2023		2022	2023	
T1 : Amino acid at 0.1% (g/L) + (100 ml./L) VCT	37.80 D	38.02 D	37.91	0.93 B	0.94 B	0.93
T2 :Amino acid at 0.1%(g/L) + (200 ml./L) VCT	40.92 C	41.90 C	41.41	0.82 C	0.84 C	0.83
T3:Amino acid at 0.1% (g/L) + (400 ml./L) VCT	43.02 B	43.63 B	43.33	0.68 D	0.66 D	0.67
T4:Amino acid at 0.1% (g/L) + (600 ml./L) VCT	43.78 A	44.15 A	43.97	0.66 D	0.64 D	0.65
T5:Control (spraying with water).	35.47 E	35.70 E	35.58	1.06 A	1.05 A	1.06
New L.S.D. at 5%	0.23	0.20		0.04	0.04	

Amino acids = Amino acids enriched with (Ca, Mg, Fe, Cu, Mn, Mo , Zn and B)
VCT = Vermicompost tea

Discussion

Effect of amino acids

Amino acids are crucial for plants' protection against oxidative stress brought on by adverse environments because of their antioxidative qualities. Adding amino acids to plant cells improved their ability to synthesize proteins, prevented lipids which are essential components of the plasma membrane from being oxidized by free radicals, preventing

senescence and death of the cells, and reduced the frequency of diseases. (Orth *et al*, 1993).

Natural hormones such as IAA, ethylene, cytokinins, GA_3 development of cells, organic foods, enzymes, DNA, and RNA are all stimulated by them. Growing healthy trees is undoubtedly a result of these beneficial consequences. (Vianello and Marci, 1991 and Elade, 1992).As organic nitrogenous chemicals, amino acids are the fundamental building blocks used in the production of proteins. This polymerization of amino acids is catalyzed by ribosomes. (Davies, 1982 and Raskin, 1992).

Function of amino acids in plants has been explained by several types of theories. Based on existing data, there are several possible pathways for the production of ethylene and IAA in plants, beginning with amino (Hashimoto and Yamada, 1994). In this regard, (Waller and Nowaki 1978) postulated that the influence of some amino acids, such as phenylalanine and ornithine, on the manufacture of gibberellins demonstrated their regulatory role in plant growth.

The results confirmed that amino acids had a positive impact on the quantity and quality of fruit produced by Ewaise mango trees. (El- Badawy, and Abd El-aal, 2013 ; Fathalla ,2013 ; Rabeh *et al.,* 2014, and Wassel *et al.*, 2018).

Effects of different nutrients Ca, Mg, Fe, Cu, Mn, Mo, Zn, and B .

Calcium is required for enzymatic processes, maintains the balance between anions and cations in plants, is essential for dividing cells and elongation of cells, and plays a key role in stabilizing cell membranes. (Rizzi and Abruzzese, 1990 and Biggs, 1999).

The current results are almost identical to those found by Attalla *et al*., 2007; El Salhy *et al*., 2007; El Salhy, 2008 ; Ahmed *et al*., 2014, Khayyat *et al*., 2007, Abd-Allah, 2006; Abdalla, 2016; and Khodair *et al*., 2021.

Magnesium is essential for building chlorophylls and enhancing sugar phosphorylation, DNA, RNA, protein and fat biosynthesis, seed formation, P uptake, sugar translocation, trying microsomes, and enzymes that are responsible for building proteins, amides, and glutamic and aspartic acid formation (Miller *et al*., 1990).

Iron is a component of several enzymes involved in energy transmission, nitrogen reduction and fixation, and lignin synthesis. In plants, iron and sulfur combine to generate molecules that function as catalysts for other processes. (Mengel *et al*., 2001).

Copper is a fundamental component of numerous enzyme proteins, including polyphenol oxidase, diamine oxidase, cytochrome, and ascorbic acid. It can likewise act as a catalyst or as a component of various enzyme systems (Ram and Bose, 2000).

Manganese is very effective for improving co-enzymes that function to raise for boosting the activity of respiration and oxidation enzymes, the formation of oxidase enzymes, and the biosynthesis of organic acids such as citric acid. It also helps N metabolism, the Krebs cycle, nitrate reduction, and the biosynthesis of IAA (Mengel *et al*., 2001).

Molybdenum (Mo), an essential micronutrient, plays an important role in nitrogen (N) metabolism and protein synthesis in plants. During symbiotic N fixation, Mo acts as a cofactor for nitrogenase enzymes to catalyze the redox reaction to convert elemental N into ammonium ($NH4^+$) ions (Mendel and Hänsch 2002).

Zinc regulates a wide range of crucial plant metabolic activities. In addition to improving the production of some organic foods and IAA and activating a number of enzymes that control plant metabolism, it also promotes division of cells, expansion, absorption of water, and transport of nutrients. It is also crucial for decreasing the development of the abscission zone and fortifying the cell wall. (Yagodin, 1990; Mengel *et al.*, 2001,and Omar *et al.,* 2014).

Boron has a substantial significantly impacted on a numerous plant functions, which includes as hormone transmission, sodium absorption, blossoming and fruiting, pollen germination, and most notably the direction of pollen tube development. (El-Salhy *et al.*, 2007,and El-Salhy, 2008). The importance of boron in plant metabolism is additionally known to involve a wide range of physiological processes, including the metabolism of nucleic acids, the biosynthesis of proteins and natural hormones, the construction and transfer of carbohydrates, photosynthesis, division of cells, the synthesis of cell walls, membrane function, water uptake, and pollen germination. (Pilbeam and Kirkby, 1983; Blevins and Lukaszweski, 1998 and Ahmad *et al*., 2009). undoubtedly had an impact on the nutritional status, yield, and fruit quality of Ewaise mango trees.

Obtaining a suitable fruit set and fruit quality appears to be largely dependent on the effects of particular microelements, including boron, on tree mango production and fruit quality (Abd-Allah, 2006, Khayyat *et al.*, 2007 and Attalla, *et al.*, 2007).

These findings concur with those obtained by Desouky *et al.,* (2007) on Barhee date palms; Shahin (2007) on Khalas date palms, Abdalla (2008) on Zaghloul date palms and Mohamed and Mohamed (2013) on Sakkoti date palms.

The results of Mohamed and El-Sehrawy (2013) on Hindy Bisinnara mangoes; Hamed-Mona (2011) on Balady mandarins; Ibrahiem and Al-Wasfy (2014) on Valencia oranges; Mohamed *et al.,* (2015) on Succary mangoes and Madany (2016) on Succary mangoes emphasized the present results.

Effect of vermicompost tea

Vermicompost tea has a great deal of promise for disease prevention in plants. It may be applied to plants for use on leaf surfaces, decrease the number of places where pathogens might infect them, or boost the variety of microorganisms that can destroy dangerous pathogens. Vermicompost tea is regarded as a long-term supply of nutrients, whether macro and micro, that crops may readily absorb. (Atiyeh *et al.* 2000)

Water-extractable growth regulators or phytohormones extracted from vermicompost may also have a positive effect on initial root development and plant growth. (Edwards, 2006 and Keeling *et al.*, 2003).

Several studies have shown a positive effect of vermicompost tea on the suppression of certain plant diseases, such as botrytis on green beans, strawberries, grapes, and geraniums; leaf spot on tomatoes; bacterial speck in Arabidopsis; and powdery mildew on apples. (Hoitink,1997, Zhang *et al.*,1998 , and Al-Dahmani *et al*.,2003)

Microorganisms facilitate the conversion of insoluble nutrients through soluble forms, which in turn support a wide range of organisms in the brewing procedure of vermicompost tea. There is uncertainty regarding the way in which compost tea inhibits illness. (Scheuerell 2002). One idea, though, suggests that the humic components and physico-chemical characteristics of the nutrients in compost tea may enhance the nutritional value of plants, cause a systemic resistance to the disease, or even be directly harmful to the pathogen. (Kone' *et al.* 2010). There is also a notion that suggests the compost teas on the leaf surfaces encourage the growth of good microorganisms, which in turn acts as a biocontrol agent against infections. (Dianez *et al*. 2007). The cultivation and protection of crops are two major uses for vermicompost tea.Despite the complexity of the extract's chemistry and microbiology, it is anticipated that the soluble mineral nutrients drawn out of vermicompost would promote plant development when applied topically and in the soil. (Ingham,2005).

CONCLUSION

In light of prior findings, it can be inferred that a high yield and the highest quality fruit would come from spraying the Ewaise mango trees cultivated in the Aswan region at least three times using vermicompost tea (VCT) at 400 ml/L and amino acids enhanced with various nutrients at 0.1%.

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تاثير رش شاى السماد الدودى والاحماض الامينية المدعمة بالعناصر الغذائية المختلفة على نمو و إثمار اشجار المانجو العويس

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الملخص

أجريت هذه الدراسة خلال موسمى 2022، 2023 على اشجار المانجو العويس المتجانسة والمطعومة والنامية فى مزرعة خاصة بقرية المنار بوادى النقرة بمحافظة أسوان و مزروعة على مسافة 7 × 7 متر والتربة طينية سلتية والرى سطحى وتم إجراء جميع العمليات البتسانية المعتاد اجراءها فى البستان. والهدف من الدراسة اختبار تأثير رش شاى كمبوست الديدان والاحماض الامينية المزودة بالعناصر الغذائية المختلفة على بعض خصائص النمو و كمية محصول وجودة ثمار اشجار المانجو العويس تحت ظروف منطقة اسوان . اشتملت هذه التجربة على الخمسة معاملات الاتية :1- معاملة المقارنة 2- رش الاحماض الامينية بتركيز 1 % + 100 مل من شاى كمبوست الديدان / لتر 3- رش الاحماض الامينية بتركيز 1 % + 200 مل من شاى كمبوست الديدان / لتر 4- رش الاحماض الامينية بتركيز 1 % + 400 مل من شاى كمبوست الديدان / لتر 5- رش الاحماض الامينية بتركيز 1 % + 600 مل من شاى كمبوست الديدان / لتر ، تصميم التجربة نظام القطاعات الكاملة العشوائية وتم قياس بعض الصفات الخضرية وبعض الخصائص الطبيعية والكيميائية للثمار . أدى الرش باى من تركيزات شاى كمبوست الديدان الى زيادة معنوية فى وزن وكمية المحصول للشجرة ، وكذلك تحسين معنوى فى خصائص الثمار الكيمائية مقارنة بمعاملة الكنترول وكانت أفضل المعاملات نتيجة الرش بـ شاى كمبوست الديدان بتركيز 400 مل/لتر مع الاحماض الامينية المزودة بالعناصر الغذائية المختلفة . وعلية ينصح بالرش بشاى كمبوست الديدان بتركيز 400 مل/لتر مع الاحماض الامينية المزودة بالعناصر الغذائية المختلفة بتركيز 1 % وذلك لتحسين النمو الخضرى و انتاج محصول عال ذو خصائص ثمرية جيدة لاشجار المانجوالعويس تحت ظروف اسوان.

الكلمات الدالة : شاى كمبوست الديدان ، الاحماض الامينية ، المانجو العويس