PLANT SCIENCE TODAY
ISSN 2348-1900 (online)
Vol 12(1): 1-5
https://doi.org/10.14719/pst.4992

HORIZON
e-Publishing Group
HePG

RESEARCH ARTICLE

Efficiency of the application of foliar spray of vermicompost and amino acids in growth and yield of eggplant

Aqeel KH Al-Tufaili[1*], Aseel A Abd[1*] & Haidar AK Al-Khazraji[2,3*]

[1]Department of Horticulture and Landscape, College of Agriculture, University of Kufa, Najaf, Iraq

[2]Department of Plant Protection, College of Agriculture, University of Misan, Misan, Iraq

[3]Al-Manara College for Medical Sciences, Maysan, Iraq

*Email: assela.almamoori@uokufa.edu.iq ; aqeel.altufaili@uokufa.edu.iq ; hayder-ali@uomisan.edu.iq

OPEN ACCESS

ARTICLE HISTORY
Received: 08 August 2024
Accepted: 18 September 2024
Available online
Version 1.0 : 11 January 2025
Version 2.0 : 12 January 2025

Check for updates

Additional information
Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information is available at https://horizonepublishing.com/journals/index.php/PST/open_access_policy

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc
See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

CITE THIS ARTICLE
Al-Tufaili AKH, Abd AA, Al-Khazraji HAK. Efficiency of the application of foliar spray of vermicompost and amino acids in growth and yield of eggplant. Plant Science Today. 2025; 12(1): 1-5. https://doi.org/10.14719/pst.4992

Abstract

The experiment was conducted at the research station of the College of Agriculture/University of Kufa for the 2022 growing season. The aim of this experiment was to evaluate the eggplant plant response in terms of growth and yield to foliar spray with vermicompost at three concentrations (0. 25 and 50mL $L^{-1)}$ and/or amino acids (Tecamin Max) at three levels (0, 1.5 and 2 mL L^{-1}). The experiment was a factorial, completely randomized block design with three replications. The results showed that the 50 mL L^{-1} of vermicompost or 2 ml L^{-1} of amino acids were the best treatments and led to the highest values of plant height (61.00 and 56.44 cm), number of leaves (129.8 and 123.1 leaf $plant^{-1}$), number of branches (7.33 and 6.89 branch $plant^{-1}$), fruit length (11.60 and 11.78 cm), fruit weight (228.00 and 238.33 g) and leaf content of carbohydrates (5.93 and 7.10 mg 100 gm^{-1}). Except for plant height, all indicators under study increased significantly in the combination treatments between the two experimental factors compared to the individual treatments and the control treatment.

Keywords

fertilizers; leaf carbohydrates; plant nutrients; Solanum

Introduction

Eggplant (*Solanum melongena* L.) belongs to the Solanaceae family of vegetable crops that are consumed at a high rate in Iraq. Eggplant is grown for consumption and medicinal purposes and phytochemical analysis of eggplant showed that it is a rich source of various essential compounds, such as aspartic acid, tropane, flavonoids, lanosterol, gramisterol, steroid alkaloids and glycoalkaloids. Moreover, histidine, nasunin, oxalic acid, solasodine, ascorbic acid and tryptophan are found in the fruits and leaves of eggplant. It contains low calories and high moisture contents and these compounds have been found useful in treating various diseases and conditions as anticancer, anti-inflammatory, anti-asthmatic, anti-platelet, hypo-lipidemic and hypotensive (1).

Increasing eggplant production requires attention to the plant's service processes, especially plant nutrition by providing the plant with growth promoters, including amino acids. Studies have shown that 85% of the plant's nutrient requirements can be provided by foliar spray on the plant's vegetative parts (2).

Amino acids are important for plants to synthesize many compounds, i.e., proteins, amines, nitrogenous bases (purines and pyrimidines), alkaloids, vitamins and terpenes, as well as important enzymes and hormones necessary

for metabolic activities (3, 4).

Recently, amino acids have been used via foliar sprays or soil treatments as a means of enhancing plant growth and productivity (5). It has been found that treating plants with amino acids has always led to a significant improvement in the growth parameters of the plant (6). El-Zohiri and Asfour found that spraying amino acids on potato plants at a rate of 0.25 mL/L resulted in a significant increase in vegetative growth expressed as plant height and plant dry weight (7). It was also indicated that spraying with Tecamin max (commercial organic fertilizer) on okra plants at concentrations of 0, 2.5 or 5 mL L^{-1} showed that the 2.5 mL L^{-1} was significantly higher in fruit weight, plant yield and total yield, while the concentration of 5 mL L^{-1} resulted in the highest chlorophyll content in leaves.

Al-Hamdani et al. found that spraying 2 L.H-1 of Tecamin Max solution on potato plants led to a significant increase in plant height, number of plant stems, leaf content of total chlorophyll and leaf area, compared to the untreated plants (8). It was also reported by Al-Sultani and Al-Tufaili that spraying with tryptophan and arginine at a concentration of 50 mg L^{-1} resulted in significant plant growth increase over the control (9). Where arginine was significantly better than tryptophan and the control treatments, recording the highest rates in plant height, number of main branches, average leaf area, total chlorophyll content in leaves, fruit content of total amino acids and total yield.

In general, organic fertilizers are very important in the production of vegetable crops, as studies indicate that adding organic matter increases the readiness of nutrients for the plant, which has a positive impact on plant growth and production (10).

When studying the effect of mineral and organic fertilizers on the quality and yield of eggplant plants, it was found that organic fertilizers achieved a noticeable increase in plant height, number of leaves, number of branches and fresh and dry weight of branches and leaves, in addition to increasing the leaves nutrient content (11).

The study aimed to demonstrate the effect of spraying with three different concentrations of vermicompost and the commercial amino acids (Tecamin Max), individually or in combination on growth indicators (plant height, number of leaves, leaf area, number of branches and leaf content of carbohydrate) and fruit quality (fruit length, fruit weight) in eggplants.

Materials and Methods

The field experiment was carried out to grow eggplant during the 2023 agricultural season brought from local nursery in Baghdad governorate in one of the greenhouses at the research station affiliated with the Faculty of Agriculture - University of Kufa. Agricultural operations were carried out by preparing the soil by plowing and smoothing. The field land was divided into three sectors, each sector containing 9 treatments (experimental unit) and each treatment containing 3 plants, the distance between one plant and another was 50 cm, with a total number of plants of 81 plants. Planting was done on a row, as the distance between the rows 100 cm and therefore the area of the experimental unit was 0.5 m^2.

Seedlings were planted in the field on 6/24/2023, in a factorial RCBD experiment of two factors and three replicates. The first factor was spraying with amino acids (Tecamin Max, Spanish company) at three concentrations (0, 1.5 and 2 mL L^{-1} according the company recommendations, while the second factor was spraying with three concentrations (0, 25 and 50 mL L^{-1}) of vermicompost which was obtained from the Uruk Organic Fertilizer Company, Iraq (Table1). Both experimental factors were sprayed four times with a 20 days interval for each corresponding concentration. The first spraying of vermicompost was applied on 7/30/2023, while the first spray of Tecamin Max was given 15 days later on 8/1/2023 and experimental data were recorded for growth indicators, including plant height (cm), number of leaves (leaf plant $^{-1}$), leaf area (dm^2 plant^{-1}), number of branches (plant branch^{-1}) and yield data for fruit length (cm) and fruit weight (cm). The carbohydrate content in plant leaves (mg 100 g^{-1}) was also estimated (7). The accumulative total yield (Kg m^2) was also estimated for 5 harvests.

Table 1. Some physical and chemical characteristics of the vermicompost used in the study

Property/content	Value	Property/	Value
EC	1.1	*K2O %	0.394
pH	7.66	Ilt/Clmeg	15.5
O.M%	32.77	Moisture %	25
O.C %	20	Fe	36-50 ppm
N %	1.69	Zn	27-40 ppm
C/N	15-25	Mn	15-25 ppm
*P2O5 %	0.0103	Cu	5-90 ppm

• K2O = Potassium oxide, P2O5 = Phosphorus pentoxide

Statistical analysis

All experimental data were subjected to analysis of variance (ANOVA) using the GenStat package 2009 (12th edition) version 12.1.0.3278 (www.vsni.co.uk) (12). Means were compared for the least significant difference (LSD) with multiple comparisons using Duncan's multiple range test at 95% confidence ($P \leq 0.05$).

Results and Discussion

The results of Table 2 have shown that the experimental factors showed a significant effect ($p \leq 0.05$) on plant height, number of leaves and number of branches. It was noted that vermicompost spray at a concentration of 50 ml L^{-1} had a significantly superior effect compared with the lower concentration of vermicompost spray of 25 mL $L^{-1}$and the control; and recorded a higher rate of plant height, number of leaves and number of branches of vermicompost spray at a concentration of 50mL, with a significant difference when compared with the lower concentration of vermicompost of 25 mL L^{-1}, which also recorded significantly higher rates than the untreated control. On the other hand, for spraying with amino acids, it was noted that the two concentrations (1.5 and 2 mL L^{-1}) showed no significant difference on growth indicators, but at the same time recorded significantly higher values for the indicators under study compared to the untreated control. As for the combination between the two factors, the treatment of 50 mL L^{-}

Table 2. Effect of Tecamin Max and vermicompost on plant height (cm), leaves number (leaf plant^{-1}) and branches number (fruit plant^{-1}) of eggplant plant

Vermicompost	**Tecamin Max (mL L^{-1})**			
(mL L^{-1})	0	1.5	2	Vermi. Average
0	44.33	52.67	50.33	49.11
25	52.33	54.00	55.00	53.77
50	58.00	61.00	64.00	61.00
Teca. Max average	51.55	55.89	56.44	
xLSD (P≤0.05)	Tec. Max=2.38	Vermi. =2.38		interaction= N.S.
	Leaves number (leaf plant^{-1})			
Vermicompost	**Tecamin Max (mL L^{-1})**			
(mL L^{-1})	0	1.5	2	Vermi. Average
0	110.7	107.3	99.3	105.7
25	120.3	123.0	134.0	125.7
50	124.7	128.7	136.0	129.8
Teca. Max average	118.5	119.6	123.1	
LSD (P≤0.05)	Tec. Max=3.02	Vermi. = 3.02		interaction= 8.42
	branches number (branch plant^{-1})			
Vermicompost	**Tecamin Max (mL L^{-1})**			
(mL L^{-1})	0	1.5	2	Vermi. Average
0	4.33	4.67	6.00	5.00
25	5.67	6.33	6.67	6.22
50	7.00	7.00	8.00	7.33
Teca. Max average	5.66	6.00	6.89	
LSD (P≤0.05)	Tec. Max= 0.73	Vermi. = 0.73		Interaction= 1.12

^{11} of vermicompost and 2 mL L^{-1} of amino acids resulted in the highest average number of leaves (136 leaf plant^{-1}) and number of branches (8.00 branch plant^{-1}), while there is no significant difference between the two factors in plant height.

The effect of experimental factors on fruit length, fruit weight and carbohydrate content of leaves was also observed (Table 3) and it was noted that 25 and 50 mL L^{-1} of foliar spray of vermicompost led to a significant increase in these indicators compared to the untreated control. Higher rates of fruit length, fruit weight and carbohydrate content of leaves were recorded in the Tecamin Max amino acid treatment, showing significant differences compared with the control treatment, regardless of the concentration used (Table 3). The results of the same table also indicated that the highest values of the studied indicators were recorded at the 50 mL L^{-1} vermicompost spray in combination with 2 mL. L^{-1} of Tecamin Max, which recorded 13.55 cm fruit length, 260 g fruit weight and 7.10 mg 100g^{-1} total chlorophyll content, showed a significant difference from all the other treatments.

The highest percentage increase in yield (kg/m^2) was recorded in the combination treatment of 50 mL L^{-1} vermicompost spray with 2 mL L^{-1} of Tecamin Max, which recorded fruit yield increase of more than 160% compared to the the control, with a significant difference from all the other treatments (Fig. 1). The other treatments recorded yield increase that ranged from 120%, in the two combination treatments of 25 or 50 mL L^{-1} vermicompost sprays with 1.5 mL L^{-1} Tecamin Max, which had no significant difference between them, to 20%, in the 25 mL L^{-1} vermicompost treatment.

The positive effect resulting from the treatment with amino acids is mostly due to the important physiological role in being vital growth stimulants with positive effects on plant growth and yield and reduces the effects and damages resulting from environmental stresses (13). Amino acids are also a nitrogen source for building proteins and enzymes and providing energy that enhances vegetative and root growth (14).

Table 3. Effect of Tecamin Max and vermicompost on fruit length (cm), fruit weight (g) and the carbohydrate content of the leaves (mg 100gm^{-1}) of eggplant plant

		Fruit length (cm)		
Vermicompost		**Tecamin Max (mL L^{-1})**		
(mL L^{-1})	0	1.5	2	Vermi. Average
0	7.02	9.04	8.97	8.34
25	10.12	9.92	12.83	10.95
50	10.12	11.14	13.55	11.60
Teca. Max average	9.08	10.03	11.78	
LSD (P≤0.05)	Tec. Max=0.90	Vermi. = 0.90		Interaction= 1.56
		Fruit weight (g)		
Vermicompost	**Tecamin Max (mL L^{-1})**			
(mL L^{-1})	0	1.5	2	Vermi. Average
0	166	204	199	189.66
25	186	215	256	219.00
50	206	218	260	228.00
Teca. Max average	186.00	212.33	238.33	
LSD (P≤0.05)	Tec. Max= 19	Vermi. = 19		Interaction= 26.1
	The Carbohydrate content of the leaves (mg 100gm^{-1})			
Vermicompost	**Tecamin Max (mL L^{-1})**			
(mL L^{-1})	0	1.5	2	Vermi. Average
0	3.77de	4.07de	4.70cd	4.18
25	3.98de	4.56cd	5.00cd	4.51
50	5.05bc	5.64b	7.10a	5.93
Teca. Max average	4.26	4.75	5.60	
LSD (P≤0.05)	Tec. Max= 0.34	Vermi. = 0.34		Interaction= 0.62

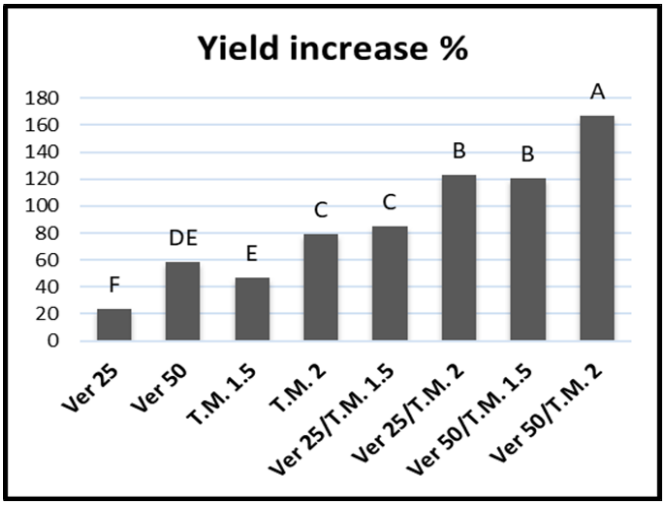

Fig. 1. Total yield increase over the control for the accumulative total yield (Kg m^2) estimated for 5 harvests.

Thus, plant growth indicators increase, especially plant height, number of leaves and number of branches. Amino acids also play an important role in the plant metabolism to improve the increased yield and crop quality, as well as increase the plant's tolerance to abiotic stress and recovery from it. They also acilitate nutrient absorption and transport mechanism (15). This was generally reflected in an increase in the length and weight of the fruits and the carbohydrate content of the leaves. This is consistent with the results of spraying a mixture of amino acids on sweet pepper plants, which has a role in increasing the efficiency of photosynthesis and thus giving the best vegetative growth (16). It is also consistent with Manusheva et al., who noted that spraying the nutrient solution Tecamin Max on pepper plants at a concentration of 2 L h^{-1} led to a significant increase in the dry matter characteristics of the fruit, fruit weight, total yield per unit area, yield and decreased the period for first fruit formation on the plant (17). In the same manner, the results of another study showed the efficiency of seaweed extract foliar spray led to a significant improvement in the growth and yield of treated tomatoes, *Solanum lycopersicum* (18).

Similar positive effects were recorded in this study with the spraying of organic fertilizer (vermicompost). Such effects are often attributed to the various components present in the organic fertilizer that are important in promoting plant growth, including vegetative growth indicators. Foliar organic fertilizers contain nutrients such as nitrogen, phosphorus, potassium and some microelements necessary for the synthesis of aminoacids, nuclear acids and enzymes. These components are important in increasing the vegetative growth and the formation of the chlorophyll molecule, which is necessary for photosynthesis, which in turn increases the number of other synthetic processes and increases plant growth rates (19). This is also reflected in increased yield indicators and carbohydrate content of the leaves. Similar results were obtained by Yildirim when he studied the effect of adding different concentrations of humic acid of 0, 10 and 20 mL L^{-1} sprayed on the leaves and added to the soil on the growth and resulted in the increase fresh and dry weight of the shoots, plant height, number of fruits, fruit diameter and fruit weight and obtained the maximum percentage of total yield (20). The results of the study are also consistent with the results of Hashem and Al-Hadrawi on the snake cucumber, that spraying of liquid organic fertilizers with humic acids had a significant effect in improving all vegetative indicators and chemical characteristics (21).

Conclusion

The findings revealed that foliar spray of vermicompost and/or amino acids applications were effective in increasing eggplant growth and yield parameters under study. This study revealed that the best results obtained by using a higher concentration of application of foliar spray of vermicompost and/or Tecamin Max compared to lower concentration. The combination treatments of vermicompost and commercial Tecamin Max amino acids had always positive effects and resulted in higher values than any other individual treatment. In addition, the use of organic matter is one of the factors of sustainable development, as it is environmentally friendly and does not harm the person spraying. Also, the use of amino acids enables the plant to resist various stress conditions.

This study provides enough evidence of the importance of sustainable agriculture by using organic fertilizers and preventing pollution from chemical fertilizers.

Authors' contributions

AK carried out the writing work of the research results and performing the statistical analysis: AA is responsible of conducting the field experiment, collecting data and following up on corrections for publication. HAK assists in reviewing the references and providing research requirements and expenses. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

References

1. Naeem MY, Ugur S. Nutritional content and health benefits of eggplant. Turkish Journal of Agriculture - Food Science and Technology. 2019;7:31-6. https://doi.org/10.24925/turjaf.v7isp3.31-36.3146
2. Abdul KS, Physiology of Nutrients Elements. Foundation of Dar AL-Kotob University of Mosul, Ministry of Higher Education and Science Research, Iraq. 1988.
3. Abood MA, Abd Al-Shammari AM, Hamdi GJ. Foliar application of Tecamin max® to alleviate water deficit effects on yield and water-use efficiency (WUE) of okra. Acta Scientiarum Polonorum Hortorum Cultus. 2019;18(2):15-20. https://doi.org/10.24326/asphc.2019.2.2
4. Rashad ES, El-Abagg HM, Amin AA. Physiological effects of some bioregulators on growth and productivity of two broad bean cultivars. Egypt J Appl Sci. 2003;18:132-49.
5. Spann TM, Little HA. Effect of Stimplex® crop biostimulant on drought tolerance of 'Hamlin' sweet orange. In: Proceedings of the Florida State Horticultural Society; 2010;123:100-04.
6. El-Shabasi MS, Mohamed SM, Mahfouz SA. Effect of foliar spray with

amino acids on growth, yield and chemical composition of garlic plants. In: The 6th Arabian Conf. for Hort. Ismailia, Egypt; 2005.

7. El-Zohiri SSM and YM Asfour. Effect of some organic compounds on growth and productivity of some potato cultivars. Annals of Agric.Sci., Moshtohor. 2009;47(3):403 -15.
8. Al-Hamdani SA. Wahab, Mohammad A. Al-Janabi, Ghazzwan S. Al-Azzawi. The effect of fermentation of foul tries fertilizer and spray with Tecamin Max in the growth and yield of potato. (*Solanum tuberosum* L.). Journal of Agricultural, Environmental and Veterinary Sciences. 2017;4(1):19-27 https://doi.org/10.26389/AJSRP.G141017
9. Al-Sultani AM, Al-Tufaili AK. The effect of spraying nano potassium, arginine and tryptophan on some vegetative and qualitative traits of eggplant plant solanum melongena. Plant Archives. 2020;20 (2):1887-90.
10. Bohn H, McNeal B, O'Connor GA. Soil organic matter. In: Soil Chemistry 2nd. John Wiley and Sons. NY, USA. 1985.
11. Mona AM, Mahmoud AR, El-Desuki M, Rizk FA. Yield and fruit quality of eggplant as affected by organic and mineral fertilizers application. Res. J. Agric. Biol. Sci. 2011;7(2):196-202.
12. VSN International .2009. GenStat for Windows 12th Edition. VSN International, Hemel Hempstead, UK.
13. Kowalczyk K, Zielony T, Gajewski M. Effect of Aminoplant and Asahi on yield and quality of lettuce grown on rockwool. In: Conf. of biostimulators in modern agriculture; 2008;7-8.
14. Nahed GAE, Balbaa LK. Influence of tyrosine and zinc on growth, flowering and chemical constituents of Salvia farinacea plants. Journal of Applied Science Research. 2007;3(11):1479-89.
15. Calvo P, Nelson L, Kloepper JW. Agricultural uses of plant biostimulants. Plant and Soil. 2014;383:3-41. https://doi.org/10.1007/s11104-014-2131-8
16. Serna M, Hernández F, Coll F, Coll Y, Amorós A. Brassinosteroid analogues effects on the yield and quality parameters of greenhouse-grown pepper (*Capsicum annuum* L.). Plant Growth Regulation. 2012;68:333-42. https://doi.org/10.1007/s10725-012-9718-y.
17. Manusheva BH, Ivanova DT, Dimov AB. Application of organic products to reducing mineral fertilization in pepper. European Union of Scientists. 2016;3(24):94-6. https://doi.org/10.1021/cen-09406-scicon005.
18. Yusuf R, Syakur A, Kalaba Y, Tole S. Effect of seaweed liquid organic fertilizer in different concentrations on tomato (Solanum lycopersicum) growth and yield. Aquaculture, Aquarium, Conservation & Legislation. 2023;16(5):2689-97.
19. Mangel S. Potassium. In (Ed. A. V. Berker and j. Pilbean), Handbook of Plant Nutrition, N.Y. 2007:395-402
20. Yildirim E. Foliar and soil fertilization of humic acid affect productivity and quality of tomato. Acta Agriculturae Scandinavica Section B-Soil and Plant Science. 2007;57(2):182-86. https://doi.org/10.1080/09064710600813107
21. Hashem AA, DAK Al-hadrawi. Effect of Foliar application of humic acid and boron on vegetative and yield parameters of *Cucumis melo* var flexuosus. Euphrates Journal of Agriculture Science. 2022;13 (4):337-42.