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VERMICOMPOST EXTRACT ROLE IN IMPROVING THE GERMINATION AND SEEDLING GROWTH OF TOMATO (LYCOPERSICON ESCULENTUM MILL.) UNDER SALT STRESS

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Abstract

High soil salinity considered a negatively impacts the growth and productivity of economic crops. Therefore, it is crucial to find solutions that adapt plants to salt stress using eco - friendly practices. the aim of this study to produce vermicompost using Eisenia fetida and palm fronds and a mixture of sheep manure and determine the effect of vermicompost on the germination and growth parameters of tomato plants under salt stress. The vermicompost product revealed a moderate pH of 7.57,EC of 1.66 mS/cm, high levels of organic matter, Carbon, Nitrogen, Phosphorus and Potassium. The study was conducted under a greenhouse in two trials. the first experiment results showed an increase in germination rate, hypocotyl length, and radicle length when tomato seeds it were soaked in a 100% Solution vermicompost extract at a salinity level of (50mmol/L). In the second, irrigating the trays soil with a 100% vermicompost extract at a salinity level of (50 mmol/L) resulted in a significant increase in seedling length, number of branches, fresh weight and total chlorophyll content compared to the treatment with only the saline solution. The results show that vermicompost plays an important role in mitigating the negative effects of salinity levels not exceeding (50 mmol/L).

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Keywords: Eisenia fetida; Vermicompost; Salinity; Tomato; eco-friendly

1. Introduction

Tomato (Lycopersicon esculentum Mill.) one of the most important vegetable crops in the world due to its high nutritional and economic value. They are consumed preserved or fresh and are included in most diets (Espinosa-Antón et al.,2025) the total of area cultivated with tomatoes in Iraq reached 86,942 dunam. with an average production of 534,821 tons (Agricultural Statistics, 2023). Recently, tomato cultivation in Iraq has faced numerous challenges, the most one notably soil salinity. Salinity is a major limiting factor for agricultural production in southern and central Iraq, where it has rendered more than half of the land unusable for agriculture (Alhadidi et al., 2024). Although tomato plants can tolerate salinity

levels up to 2.5–3.0 dS/m¹, high levels cause a significant decrease in growth and yield Although tomato plants can tolerate salinity levels up to 2.5–3.0 dS/m¹, (Cuartero, 1999). While rface scraping or susoil leachingis commonly used to reduce salinity in agricultural soils, These methodscostly and require a long time. Intensive efforts are being made to transform the agricultural sector towards sustainable farming practices, with a focus on plant nutrition that enhances salt tolerance, and to advance bio-fertilizers and organic fertilizers as a globally effective alternative. Vermicompost, produced by the produced by the earthworm species Eisenia fetida, has been widely receiving attention as it is used to produce a type of compost known as

vermicompost, which benefits from the interaction of Eisenia fetida with associated microorganisms (Peng et al., 2024). Vermicompost is characterized by its high nutrient content and greater microbial activity compared to other types of fertilizer (Khan et al., 2024). It is produced by using large numbers of earthworms through the accelerated bio-oxidation of organic matter without a thermophilic phase (Dominguez et al., 1997). Vermicompost provides the soil

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with essential macro and micronutrients, improves its chemical and physical properties, and promotes plant growth through the release of enzymes and hormones (Pathma and Sakthivel, 2012). The of vermicompost extract effect on the germination and growth of early vegetable seedlings has been investigated. Several studies have evaluated the improvement of tomato and cucumber seed germination and growth rates using vermicompost extracts in growth media. one a study demonstrated the positive effect
of vermicompost extract on the germination and growth of pine trees in their early stages of growt (Oyege and Balaji-Bhaskar, 2025) Vermicompost extract is considered an effective organic fertilizer due to its content of metabolites similar to plant growth hormones, leading to increased seed germination, plant height, number of leaves,
leaf area, plant dry weight, root length, and chlorophyll content (Joshi et al., 2015).
Furthermore, it was found that the best responses to worm compost were observed when using a small percentage of the extract, compared to higher percentages, which had a negative effect (Atiyeh et al., 2000). This study aimed to determine the effect of vermicompost made from sheep
manure and palm fronds, through soaking seeds and irrigating seedlings, on the germination rate and growth of tomato seedlings under saline stress conditions

2. Materials and Methods

2.1. Preparing Vermicompost The trials of the study were conducted at the College of Agriculture, University of
Misan, Iraq (31°.922337 N latitude and 47°.212747 E longitude) during the fall semester of 2023-2024, to determine the effect of treatment with vermicompost extract on seed germination and seedling characteristics of tomatoes. Vermicompost was prepared using woody basins measuring 2x10 m and 0.50 m deep (Haruna et al., 2020). The basin was filled with a mixture of 80% partially

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fermented sheep manure and 20% dry palm frond powder and stirred periodically for three weeks to improve decomposition and aeration. One hundred and fifty red earthworms (Eisenia foetida) were transferred to the surface of the mixture in the basin and the basins were set up under greenhouse, maintaining moisture content of 60% throughout the composting period. The worm droppings were harvested and cleaned of any remaining compost mixture and then dried at laboratory temperature for 10 days. The vermicompost was prepared as an extract by dissolving it in distilled water and leaving it for 48 hours under an oxygen pump (SEA STAR-HXA 108) to activate the microorganisms in the solution. Chemical analyses were then performed on the vermicompost produced 20 and 40 days after the fertilization process. PH and EC (ms/cm^3) values were measured using pH and salinity meters available at the College of Agriculture.

The organic matter (OM%) and total carbon (C%) were measured using the ash fertilization method, following the equations below:

OM% = (Y-M)/(Y-Z), where Y is the weight of the container with the sample before incineration (g), Z is the weight of the container with the incinerated sample (g), and M is the weight of the empty container (g).

C% = X × 0.58, where X is OM%.

Total N was measured using a scaler, P was measured using the molybdate blue method at a wavelength of 888 nm with a spectrophotometer, and K was measured using the flame spectrophotometer.

2.2. Tools and Materials

Plastic seed germination trays (Black Bootstrap Farmer) measuring 54 cm by 29 cm, with a capacity of 50 cells, were prepared. Their surfaces were sterilized twice with 70% ethyl alcohol and then rinsed with sterile distilled water. Tomato seeds of the S-22 variety were sterilized twice with a 10% sodium hypochlorite solution, then rinsed with sterile distilled water and dried on filter paper.

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Commercial sodium chloride (99% purity) was purchased from local markets. To prepare the
brine solutions, 57.44 g of NaCl was dissolved in 1 liter of distilled water and then prepared to levels of 50, 100, and 150 mmol/L, coded S1, S2, and S3, respectively.

The growing medium was prepared as a 1:2 mixture of potting soil and peat moss, then autoclaved at 121°C and a pressure of 1.5 kg/cm² for half an hour twice. The chemical, physical, and phytochemical properties of the growing medium were analyzed and measured as shown in Table 1.

Table 1. Chemical, physical, and phytochemical properties studied in soil.

Properties	Soil Characters	Unit	Value
Chemical	electrical	Des.m^{-1}	*3.21*
	PH		6.5
	P	mg/l	3 - 7
	K	mg/l	1-2
	N	mg/l	8-20
Physical	Density	kg/m^3	140-160
	Absorption	d.m.	7-8
	dry substance	g/l	80
	moisture	%	40-60
Phytochemical	species	Sphagnum Sp	
	Decompostion	H2-H4	
	Organic matter content	%	30 min
	Ash content	%	15

2.3. Experiments

2.3.1 Seed Soaking Trial

Sterile soil was distributed evenly in the cells of the trays. The soil in the plastic trays was then watered with salt solutions (S1, S2, and S3) to saturation. Tomato seeds (seed/cell) soaked for 24 hours were then planted in the treatment solutions

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at the specified concentrations as follows:
Treatment 1: Seeds were soaked in distilled water only, coded (S0).
Treatment 2: Seeds were soaked in a 50% vermicompost extract, coded (V1).
Treatment 3: Seeds were soaked in a 100% vermicompost extract, coded (V2).
Treatment 4: Seeds were soaked in sterile distilled water and then planted in trays without any salt solution as a control treatment, coded (C).

2.3.2. Tray Soil Irrigation Trial:

The growing soil was prepared as described in section (2.3.1). The sterile soil was distributed evenly in the tray cells, and the soil was then irrigated with the NaCl solutions (S1, S2, and S3) to saturation. Sterile tomato seeds were then planted at a rate of one seed per cell. After planting, the trays were irrigated with 5 ml of the following solutions:
Treatment 1: The trays were irrigated with distilled water only, coded (S0).
Treatment 2: The trays were irrigated with 50% vermicompost extracts at a concentration of 50%, coded (V1).
Treatment 3: The trays were irrigated with vermicompost extract at a concentration of 100%, coded (V2).
Treatment 4: Untreated soil from trays was used as a control treatment and irrigated with sterile distilled water, coded (C).
The trays were transferred to a greenhouse at a temperature of 27 ± 5°C, a light duration of 12 hours, and a relative humidity not exceeding 60%.

2.4. Measurements

In the seed soaking trial, the germination percentage, hypocotyl length, and radicle length (cm) were measured two weeks after sowing. The germination percentage was calculated according to the equation:

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Percentage of seed germination = Number of germinated seeds / Total number of sown seeds × 100. Hypocotyl and
radicle length were measured using a graduated ruler. In the tray soil irrigation, seedling length, number of branches, seedling fresh weight, and total leaf chlorophyll content (mg/l) were measured seven weeks after sowing. Chlorophyll concentration in the sample was measured by absorbance using UV-Vis spectroscopy at wavelengths (λ) of 646 nm and 663 nm, with the measurement repeated three times for each sample.

2.5. Statistical Analysis

The trial was designed according to a completely randomized design (CRD). The 50 experimental units with three replicates were used in both trials (soaking trial and irrigation trial). The GENSTAT statistical software was used to analyze the data. Least Significant Difference (LSD) with a 0.05 probability level was applied to compare among means.

3. Results and discussion

3.1. Properties of the produced vermicompost

Red worms were isolated from the surface of the mixture after the fertilization period and vermicompost were harvested. Physical and chemical analysis showed that the vermicompost produced 40 days after fertilization contained valuable nutrients, representing a good addition (Table 2). the Analysis of vermicompost revealed a pH value of 7.57 indicating that the pH falls within the moderate range of 7.5 - 8, this number considered optimal for maturing materials and decomposing (Jagadabhi et al., 2019). The analysis also showed an EC value of 1.66 ms/cm, which is suitable for seed germination (Mylavarapu et al., 2020). In addition to the high organic matter and total carbon content in vermicompost (48.76% and 28.91%, respectively), this is attributed to the plant-based organic

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components in the mixture that the worms fed on (Haruna et al., 2020). The high nitrogen content (1.53) results from the
mineralization of proteins in the organic matter and the release of nitrates from ammonium nitrogen (Suthar and Singh, 2008).

Table 2. Physical and chemical properties of the produced vermicompost

Parameters	Fertilization Period	
	20 day	40 day
PH	8.02	7.57
EC	2.40	1.22
OM%	32.87	48.76
C%	19.93	28.91
N%	0.78	1.53
C/N	25.55	18.89
P%	0.14	0.16
K%	0.22	0.23

3.2. Effect of the interaction between vermicompost and salinity levels in the first trial

3.2.1. Seed Germination Rate

in the seed soaking experiment, the Vermicompost data showed an increase in tomato
seed germination under different salinity levels (Table 3). The results showed a high germination rate (100%) when seeds were soaked in a 100% vermicompost extract at a salinity level of 50 (mmol/L). This was followed by germination rates of 80% and 60% when seeds were soaked in a 100% vermicompost extract at salinity levels of 100 and 150 (mmol/L), respectively.

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3.2.2. Hypocotyl Length

The (table 3) indicate The a significant differences in this trait of the hypocotyl length of tomato seedling stems when seeds were soaked in vermicompost extract at different salinity levels. The highest average length of the hypocotyl was 4.00 cm in the treatment that used 100 percent vermicompost at a salinity level of 50 mmol/L.

The length of the hypocotyl was 2.93 cm when seeds were treated with vermicompost extract that was one hundred percent pure. This was at a salinity level of 100 mmol/L in the vermicompost extract.

The length of the hypocotyl was 2.43 cm when seeds were treated with vermicompost extract that was one hundred percent pure. This was at a salinity level of 150 mmol/L, in the vermicompost extract.

The length of the hypocotyl was 2.00 cm, in the treatment that used 50 percent vermicompost at a salinity level of 150 mmol/L. The table 3 also shows the superiority of the control treatment (C), which produced the highest hypocotyl length of 5.22 cm, outperforming all other treatments. Despite the effect of saline water on plant growth parameters, the addition of vermicompost led to an increase in the hypocotyl length of tomato seedlings (Joshi et al., 2015).

3.2.3. Radicle Length

The results indicate that soaking seeds in vermicompost extract concentrations led to significant differences in radicle length of seedlings (Table 3). The results showed that the highest average radicle length was 3.98 cm in the 100% vermicompost treatment at a salinity level of 50 (mmol/L), while the lowest average radicle length was 2.17 cm in the 100% vermicompost treatment at a salinity level of 150 mmol/L. The table (3) also shows the superiority of the control treatment (C), which gave the highest radicle length of seedlings, reaching 5.07 cm, surpassing all other vermicompost soaking treatments and salinity levels.

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The effect of salinity levels on seedling roots is consistent with the findings of (Ahmed et al., 2017). However, the potassium and phosphorus content of the vermicompost helps the plant adapt to salt stress (Bates et al., 1973). The effect of vermicompost on longer roots has been reported previously (Joshi et al., 2015).

Table (3) Effect of the interaction between vermicompost and salinity levels in the first trial.

Salinity levels mmol/L	Treatments	% Germination	Hypocotyl Length/cm	Radicle Length/cm
50	S0	20±0.0 e	2.00±0.0	1.40±0.81
	V1	40±0.0 c	2.15±0.56	2.67±0.76
	V2	100±0.0 a	4.00±0.0 a	3.98±0.67
100	S0	20±0.0 e	1.67±0.33	1.83±0.13
	V1	30±0.0 d	2.07±0.46	2.80±0.23
	V2	80±0.0 a	2.93±0.76 b	3.43±0.73
150	S0	20±0.0 e	1.22±0.13	1.67±0.66
	V1	25±0.53 d	2.00±0.0	2.17±0.53
	V2	60±0.0 b	2.43±0.33	3.37±0.77
	C	100±0.0 a	5.22±0.97 a	5.07±0.99
L.S.D		22.14	2.21	2.28

3.3. Effect of the interaction between vermicompost and salinity levels in the Second trial

3.3.1. Seedling length

Plant length is an important morphological characteristic in tomatoes, as it is directly related to the number of fruits and, consequently, maximum tomato yield. The trial data of irrigating tray soil with vermicompost showed an effect on the length of tomato seedlings under different salinity levels (Table 4). The results showed the highest seedling length was (16.47 cm) in the tray soil irrigated with 100% vermicompost extract at a salinity level of 50 mmol/L, followed by 12.83 and 15.00 cm when the tray soil was irrigated with 50% and 100% vermicompost

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extracts at a salinity level of 100 mmol/L, respectively. The results of the trial showed that irrigating the tray soil with 100% vermicompost extract led to an increase in seedling length compared to the treatments with individual salinity levels, where seedling length decreased. As shown in Table 4, irrigating the soil in the trays with a 100% vermicompost extract at salinity levels of 50 and 100 mmol/L had a significant effect on seedling height, exceeding the height of the seedlings in the control treatment, which recorded 12.63 cm. Vermicompost produced from feeding on sheep dung on the soil leads to an increase in the stem length of tomato seedlings (Gutiérrez-Miceli et al., 2007).

3.3.2. Branches Number in Seedling

The results showed a significant effect of irrigating with vermicompost on the branches number (Table 4). Irrigating the tray soil with 100% vermicompost increased the branches number in seedlings to 9.33, 7.93, and 7.13, respectively, at salinity levels of 50, 100, and 150 (mmol/L) compared to treatments using only the salinity levels 4.00, 3.33, and 2.67, respectively. The results also showed that irrigating with vermicompost to the tray soil increased the branches number at the salinity levels compared to the control treatment. It was found that the branches number of okra, chili peppers, eggplants, and tomatoes increased when grown in soil treated with vermicompost (Dhanalakshmi et al., 2014). Our results agree on the effectiveness of vermicompost in improving the growth characteristics of pepper seedlings due to its high content of nutrients such as Nitrogen, Phosphorus, and Potassium (Büyükaslan and Demir, 2024).

3.3.3. Fresh weight of seedlings

The impact of vermicompost extract is directly evident on the fresh weight of seedlings (Table 4). The 100% vermicompost treatment at a salinity level of 50 mmol/L resulted in the highest fresh weight of 4.75 g, while the lowest fresh weight was 2.83 g in the 50% vermicompost treatment at a salinity level of 150

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mmol/L. Compared to the effect of NaCl levels, the fresh weights were 2.17 g and 1.85 g at salinity levels of 50 and 150 mmol/L, respectively. Furthermore, the fresh weight of seedlings in the 100% vermicompost treatment was found to be higher than in the control treatment of 3.52 g. A study revealed that the addition of vermicompost resulted in a significant increase in the fresh weight of the vegetative mass in eggplant plants (Ebrahimi et al., 2021).

Table (4) Effect of the interaction between vermicompost and salinity levels in the Second trial

Salinity levels mmol/L	Treatments	Seedling length/cm	Branches Number	Fresh weight /g
	S0	09.43±0.16 d	4.00±1.16 f	2.17±0.33 b
50	V1	11.80±0.39 a	7.33±1.09 b	4.02±0.76 a
	V2	16.47±0.23 a	9.33±0.16 a	4.75±0.27 a
	S0	05.27±0.09 e	3.33±0.93 g	2.08±0.87 b
100	V1	12.83±0.19 a	5.00±0.97 e	3.39±0.96 a
	V2	15.00±0.33 a	7.93±1.03 a	4.67±0.77 a
	S0	04.27±0.07 f	2.67±0.99 h	1.85±0.13 b
150	V1	10.57±0.11 c	6.67±1.06 c	2.83±0.33 a
	V2	11.60±0.16 a	7.13±1.11 b	4.49±0.57 a
	C	12.63±0.21 a	5.67±0.36 d	3.52±0.36 a
L.S.D		**5.36**	**2.05**	**2.12**

3.3.4. Chlorophyll Concentration

The results indicated that the total chlorophyll content in the leaves increased significantly with increasing vermicompost concentration (Figure 1).The results showed that irrigating the tray soil with vermicompost extract that concentration 100% shares to an increase in the total chlorophyll content in the seedling leaves to 15.42, 12.40 and
11.23 mg/L compared to 50% vermicompost treatments of 10.54, 8.87 and 7.53 mg/L at salinity levels of 50, 100, and 150 mmol/L respectively. The results detect

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that irrigating with vermicompost extract at 50 and 100 increased the total chlorophyll content in the leaves Compared to treatments that rely solely on salt treatments, where the total chlorophyll content decreased to 5.35, 3.24, and 2.79 mg/L at salt levels of 50, 100, and 150 (mmol/L) respectively. Sodium chloride is one of the most soluble and damaging salts in saline soils, significantly impacting photosynthesis and chlorophyll production (Kawanabe and Zhu, 1991. Hnilickova et al., 2021). Our results show that irrigating with the vermicompost extract to the tray soil increased the chlorophyll level in
the leaves. A study reported that adding vermicompost extract increased the chlorophyll content in cauliflower and lettuce leaves (Bhat et al., 2013). also that was found when irrigating the soil with vermicompost extract it's improved the physiological indicators in the leaves of plant seedlings such as cucumbers (Jankauskienė et al0., 2022). The increase in chlorophyll content in the leaves is attributed to the increased nutrient content of the vermicompost and its role in increasing the activity of the anabolic process, which is consistent with the findings of (Ahmadpour and Armand., 2020).

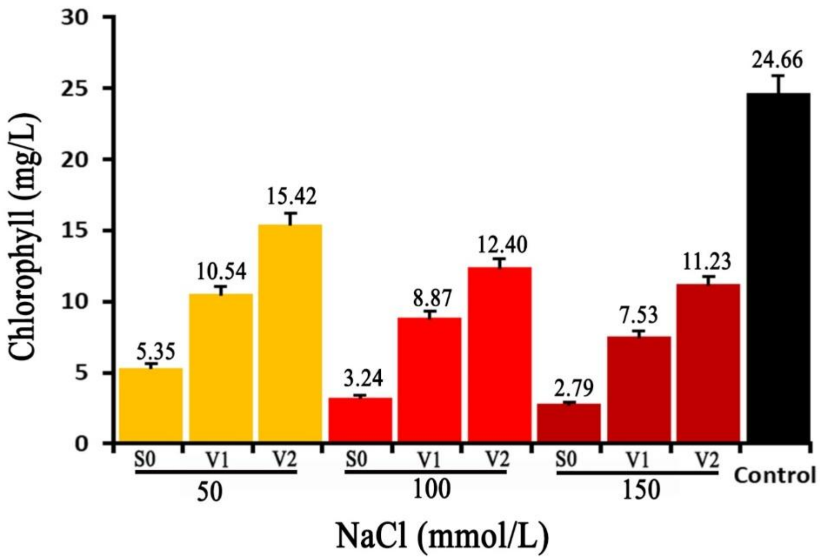

Figure (1) Impact of the interaction between vermicompost and salinity levels in the Chlorophyll concentration. (L.S.D=2.41; $P < 0.05$)

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4. Conclusion

This study showed that vermicompost extract produced sheep manure and dry palm fronds are containing of organic matter total carbon, nitrogen, phosphorus, and potassium. The vermicompost concentration of 100% at a salinity level of 50 (mmol/L) was noted to be most effective in improving the germination of seeds and improving growth characteristics in Tomato seedlings. Mitigating the effects of salt stress using worm compost is a promising and sustainable tool; therefore, further research is needed on its application in open-field agriculture.

References

1. Agricultural Statistics (2023) Crop and Vegetable Production for the year 2023. Directorate of Agricultural Statistics - Statistics and Geographic Information Systems Authority/Iraq.
2. Ahmadpour, R., and Armand, N. (2020). Effect of ecophysiological characteristics of tomato (Lycopersicon esculentum L.) in response to organic fertilizers (compost and vermicompost). Notulae Botanicae Horti Agrobotanici Cluj-Napoca 48(3): 1248-1259 DOI:10.15835/nbha48311834
3. Ahmed, R., Howlader, M.H.K., Shila, A., Haque, M.A. (2017). Effect of salinity on germination and early seedling growth of maize. Progressive Agriculture 28 (1): 18-25. DOI: 10.3329/pa.v28i1.32855
4. Alhadidi, K. E. N., Abdulsalam, A. K., and Alhadede, A. A. (2024). The causes and degree of salinization of Iraqi lands and the possibility of treating them biologically. Kirkuk University Journal for Agricultural Sciences, Vol. 15, No. 1, 142-150. https://doi: 10.58928/ku24.15114
5. Atiyeh, R.M., Arancon, N.Q., Edwards, C.A. and Metzger, J.D. (2000). Influence of earthworm-processed pig manure on the growth and yield of greenhouse tomatoes. Bioresource Technology. 75 (3):175-180. https://doi.org/10.1016/S0960-8524(00)00064-X

Eureka Journal of Agricultural Science & Bio-Innovation (EJASB)
ISSN 2760-4969 (Online) Volume 2, Issue 5, May 2026

https://eurekaoa.com/index.php/7

6. Bates, L.S.; Waldren, R.P.; Teare, I.D. (1973). Rapid determination of free proline for water-stress studies. Plant Soil, 39, 205–207
7. Bhat, N.R.; Suleiman, M.S.; Al-Mulla, L.; Albaho, M. (2013). Comparison of growing substrates for organic Tomato, Cauliflower and Iceberg Lettuce production under greenhouse conditions. Scholars Journal of Agriculture and Veterinary Sciences, 1(1):6-12. DOI: 10.36347/sjavs.2014.v01i01.002
8. Büyükarslan, D., and Demir, H. (2024). Effects of vermicompost as an alternative substrate on yield and quality of cauliflower and pepper seedlings. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 52(2), 13587. https://doi.org/10.15835/nbha52213587
9. Cuartero, J. and Fernandez-Munoz, R. (1999). Tomato and Salinity. Science Horticulture, 78:83-125.
10. Dhanalakshmi, V., Remia, K. M., Shanmugapriyan, R., and Shanthi, K. (2014). Impact of addition of Vermicompost on vegetable plant growth. International Research Journal of Biological Sciences, 3(12), 56-61. www.isca.me
11. Dominguez, J., Edwards, C.A. and Sulber, S. (1997). A comparison of vermicomposting and composting methods to process animal wastes. Biocycle 38:57-59.
12. Ebrahimi, M., Souri, M.K., Mousavi, A., Sahebani, N. (2021). Biochar and vermicompost improve growth and physiological traits of eggplant (Solanum melongena L.) under deficit irrigation. Chemical and Biological Technologies in Agriculture. 8, 19. https://doi.org/10.1186/s40538-021-00216-9
13. Espinosa-Antón, A. A., Hernández-Herrera, R. M., Velasco-Ramírez, S. F., Ramírez-Anguiano, A. C., and Salcedo-Pérez, E. (2025). Productivity and quality characteristics of Tomato fruits (Solanum lycopersicum) are improved by the application of a green Seaweed (Ulva ohnoi). Agriculture, 15(7), 750. https://doi.org/10.3390/agriculture15070750

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ISSN 2760-4969 (Online) Volume 2, Issue 5, May 2026

https://eurekaoa.com/index.php/7

14. Gutiérrez-Miceli, F.A.; Santiago-Borraz, J.; Molina, J.A.M.; Nafate, C.C.; Abud-Archila, M.; Llaven, M.A.O.; Rincón-Rosales, R.; Dendooven, L. (2007). Vermicompost as a soil supplement to improve growth, yield and fruit quality of tomato (Lycopersicum esculentum). Bioresource Technology, 98, 2781–2786. https://doi.org/10.1016/j.biortech.2006.02.032
15. Haruna, S. G., Mahmud, B. A. and Dawakiji, A. Y.(2020). Evaluation of vermicomposts from three selected agricultural wastes on seed germination and seedling growth of tomato (Solanum lycopersicum l). ADAN Journal of Agriculture. 1 (1): 55-64. DOI:10.36108/adanja/0202.10.0160
16. Hnilickova, L.H.; Kraus, K.; Vachova, P.; Hnilicka, F. (2021). Salinity stress affects photosynthesis, malondialdehyde formation, and proline content in Portulaca oleracea. Plants, 10(5), 845; https://doi.org/10.3390/plants10050845
17. Jagadabhi, P. S., Wani, S. P., Kausha, M., Patil, M., Vemula, A. K., Rathore, A. (2019). Physico chemical, microbial and phytotoxicity evaluation of composts from sorghum, finger millet and soybean straws, International Journal of Recycling of Organic Waste in Agriculture, 8:279–293 https://doi.org/10.1007/s40093-018-0240-8
18. Jankauskienė, J., Laužikė, K., and Kavaliauskaitė, D. (2022). Effects of Vermicompost on quality and physiological parameters of Cucumber (Cucumis sativus L.) seedlings and plant productivity. Horticulturae, 8(11), 1009. https://doi.org/10.3390/horticulturae8111009
19. Joshi, R., Singh, J. and Vig, A.P. (2015). Vermicompost as an effective organic fertilizer and biocontrol agent: effect on growth, yield and quality of plants. Reviews in Environmental Science and Bio/Technology,14, 137–159. https://doi.org/10.1007/s11157-014-9347-1
20. Kawanabe, S.; Zhu, T.C. (1991). Degeneration and conservation of Aneurolepidium chinense grassland in Northern China. Journal of Japanese Society of Grassland Science, 37, 91–99.

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ISSN 2760-4969 (Online) Volume 2, Issue 5, May 2026

https://eurekaoa.com/index.php/7

21. Khan. I., kurovsky, A.V., babenko, A.S. (2024). The role of microbial enzymes in vermicomposting of organic wastes. Science and innovation international scientific journal, 3 (4): 74-85. https://doi.org/10.5281/zenodo.10975242
22. Mylavarapu, R., Bergeron, J., Wilkinson, N., and Hanlon, E. A. (2020). Soil pH and Electrical Conductivity: A County Extension Soil Laboratory Manual: CIR1081/SS118, rev. 1/2020. EDIS, (1). https://doi.org/10.32473/edis-ss118-2020
23. Oyege, I., and Balaji-Bhaskar, M. S. (2025). The role of vermicompost and vermicompost tea in sustainable corn production and fall armyworm suppression. Agriculture, 15(13), 1433. https://doi.org/10.3390/agriculture15131433
24. Pathma, J., and Sakthivel, N. (2012). Microbial diversity of vermicompost bacteria that exhibit useful agricultural traits and waste management potential. SpringerPlus, (26): 1-19. https://doi.org/10.1186/2193-1801-1-26
25. Peng, W., Wang, Y., Cui, G., Xu,Q., Zhang, H., He. P., and Lü, F. (2024). Compost quality, earthworm activities and microbial communities in biochar-augmented vermicomposting of dewatered activated sludge: the role of biochar particle size. Biochar 6 (73): 2024. https://doi.org/10.1007/s42773-024-00365-8
26. Suthar, S. and Singh, S. (2008). Vermicomposting of domestic waste by using two epigeic earthworms (Perionyx excavatus and Perionyx sansibaricus). International Journal of Environment Science and Technology, 5 (1): 99 –106. https://doi.org/10.1007/BF03326002
27. Zhu, X., Lian, B., Yang, X., Liu, C., Zhu, L. (2013). Biotransformation of earthworm activity on potassium-bearing mineral powder. Journal of Earth Science. 24, 65–74. https://doi.org/10.1007/s12583-013-0313-6