Influence of Microben and /or Compost Tea and Vermicompost Tea on Pepper (*Capsicum annuum* L.)

Heba Salim*, Ebrahim Shehata[1]

ABSTRACT

An afield experiment was conducted to study using compost tea and vermicompost tea as alternates for mineral fertilizers used in the production of pepper (*Capsicum annuum* L.). Agronomic trials were conducted in the 2024 season in a pot of silty clay soil. The experimental design was a randomized complete block; it consisted of seven treatments with three replicates, and it was like this: control, NPK, tea compost (CT), vermicompost tea (VT), tea compost + vermicompost tea (CT+VT), tea compost + microben (CT+M), and vermicompost tea + microben (VT+M). Results showed that the compost tea added with vermicompost tea gave the highest values for plant characteristics, including fresh and dry plant weight, number of leaves and branches, plant length, and chlorophyll content. The compost tea added with vermicompost tea gave the highest values for plant characteristics, including fresh and dry plant weight, number of leaves and branches, plant length, chlorophyll content, and available nitrogen concentration in soil (280 ppm). The plant's nitrogen content recorded the highest value (3.9%) in treating vermicompost tea with microben. The acidity values increased under the influence of vermicompost tea, and the highest value was 8.37. Therefore, adding compost tea with vermicompost tea is preferable to taking advantage of its nutrient content and minimizing its effect on soil pH and salt concentration. Compost tea and vermicompost tea can be effective in improving pepper plant growth and soil fertility with the potential to add microbes to enhance nutrient uptake.

Keywords: Biofertilizers، Nutrient Uptake, Organic Matter, Vegetative Growth.

INTRODUCTION

In recent years, there has been a significant focus on research on the productivity and growth stimulation of crops induced by compost tea and vermicompost tea. The effectiveness of compost tea in causing bio-stimulant effects on plants to increase productivity, efficiency, and input usage has been confirmed by field tests. By recycling and reusing biodegradable waste, vermicomposting and aerobic composting have positive effects on both the environment and human health (Lazcano & Domínguez, 2011 and Domínguez *et al.*, 2019). In addition to creating nutrient-rich, pathogen-free compost and vermicompost to improve soil fertility and lessen dependency on chemical fertilizers, increasing output while reducing the use of chemical pesticides and fertilizers is a common problem in modern, organic agriculture. Because it helps to improve overall soil fertility and provide good yield and health, the use of compost and vermicompost in organic agriculture is crucial (Abou El-Hassan *et al.*, 2017 and Abou El- Goud, 2020). Compost tea has been shown to improve soil quality by increasing microbial diversity and nutrient availability. It also has been shown to increase crop growth and production through improved nutrient availability and uptake, particularly when sprayed as a foliar treatment (Eudoxie and Martin, 2019). Furthermore, an organic liquid product known as compost tea (CT) might be produced by mixing mature compost with running water in a 1:5 or 1:10 (v/v) ratio over a period of time ranging from 2 to 15 days (Morales-Corts *et al.*, 2018). Water-extractable ingredients like organic acids, mineral supplements, and active microorganisms—mostly bacteria, fungus, protozoa, and other microbial metabolites—make up compost tea (Gómez-Brandón *et al.*, 2015). Zaccardelli *et al.* (2018) proved that CT is an organic liquid product derived from quality compost carrying useful microorganisms and molecules capable of protecting and stimulating the growth of plants. It is gaining a lot of interest in improving the productivity of conventional and/or organic vegetable crops. In other studies, Spaccini and Piccolo (2007) showed that aerated compost extracts contain most of the low-weight compounds associated with a compost matrix, most of which are of microbial origin and therefore potentially bioactive. The existence of bioactive compounds linked to the low molecular weight percentage of humic acids in vermicompost, which can alter the morphology and physiology of plants (Pant *et al.*, 2012). Vermicompost application produced the same results as inorganic fertilizer application, suggesting that it is a good substitute for chemical fertilizer application (Singh *et al.*, 2008). Vermicomposting is the result of organic materials biodegrading due to earthworm decomposition (Márquez-Quiroz *et al.*, 2014). The effects of vermicomposting tea on plant growth are almost certainly due to plant growth regulators (PGRs) or hormones produced by the high microbial activity in vermicompost; they yield either solid (vermicompost) or

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[1]Department of Natural Resources and Agricultural Engineering, Faculty of Agriculture, Damanhour University, Damanhour, Egypt
*Corresponding author: heba.zaghloul2@agr.dmu.edu.eg.

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liquid (vermiwash or vermicomposting tea) organic fertilizers. Humic acid in vermicomposting tea can improve the quality of soil (Arosha and Sarvananda, 2022). The most important reason for applying vermicomposting tea is to supply microbial biomass, fine particulate organic matter, and soluble chemical components of vermicomposting to plant surfaces and soils in a way that is not possible with solid vermicomposting (Márquez-Quiroz *et al.*, 2014). The development of sustainable agriculture systems centered on fertilizer reduction can greatly benefit from the usage of compost tea (Zaccardelli *et al.*, 2018). An improved plant physiological status brought on by transported nutrients (fertilization action), humic substances, dissolved organic moieties, and hormone-like molecules released by microbes (hormonal action) are thought to be the mechanisms behind these compost tea based bio-stimulation functions (Zaccardelli *et al.*, 2012). Sujesh *et al.* (2017) found that the major characteristics of compost tea evaluated, and the results suggested the absence of phytotoxic compounds in the compost tea. Compost and vermicompost teas have been found to provide manifold benefits when used as total or partial substitutes for mineral fertilizers in peat-based artificial greenhouse potting media and as soil amendments, as shown by Pant *et al.* (2012) and Naidu *et al.* (2013). Bekele and Yilma (2021) found that their associative N_2-fixing bacteria were found to be capable of producing growth regulators like gibberellins and cytokines, which were thought to contribute to stimulated plant growth. Inoculation of crops with *Azospirillum* or other diazotrophs often resulted in enhanced plant growth or nitrogen content under environmental conditions and improved nutrient assimilation. The best plant helpers for maintaining a healthy phosphorus level are thought to be phosphate-dissolving bacteria. Additionally, it can contribute significantly to increased plant development and phosphate uptake efficiency by liberating phosphorus from tri-calcium phosphate or rock (El-Gizawy and Mehasen, 2009). Also, Zaki *et al.* (2012), in the results of the study investigation, used sweet pepper (cv. El Mader) with the application of phosphate bio-fertilizer (B. *megaterium*) to obtain the highest fruit yield and good nutritional value of sweet pepper plants. Cultivated pepper production and consumption have continuously expanded globally during the twentieth century due to their roles as both vegetables and spices, and they have quickly become a major component of varied cuisines around the world (Crosby, 2008). The study aimed to explore the potential of using compost tea and vermicompost tea as alternatives to mineral fertilizers in pepper (*Capsicum annuum* L.) production. The focus was on assessing whether these organic options could effectively replace synthetic fertilizers, potentially offering a more sustainable approach to cultivating peppers.

MATERIAL AND METHODS

A greenhouse potting experiment was carried out at Damanhour University's Faculty of Agriculture. The experiment started on May 6, 2024 and continued for 40 days until harvest on June 15, 2024. The study included seven treatments, each replicated three times, and was arranged in a randomized complete block design (RCBD) to ensure statistical accuracy. The treatments were as follows: Control, NPK, Tea Compost (CT), Vermicompost Tea (VT), Tea Compost+ Vermicompost Tea (CT + VT), Tea Compost + Microben (CT + M), and Vermicompost Tea + Microben (VT + M). The microben inoculum was sourced from the Agricultural Research Center in Giza Governorate, Egypt. It was applied at a rate of 2 grams per pot. Sweet pepper plants were cultivated in pots equipped with drainage holes to allow excess irrigation water to escape. Each pot contained 1 kilogram of silt clay soil, the physicochemical properties of which are detailed in Table (1). In the control treatment, irrigation was carried out using water alone, supplemented only with mineral fertilization. For the remaining treatments, irrigation was conducted using either compost tea or vermicompost tea, depending on the specific treatment protocol.

Preparing Compost Tea and Vermicompost Tea

Compost tea (CT) and Vermicompost tea (VT) were made by mixing compost with tap water in a 1:10 (W/V) ratio in non-degradable 1000 L containers at room temperature (20 ºC) for three days. The water had previously been aerated for 8 hours to lower the chlorine concentration. This mixture was aerated every day with circular stirring.

Table 1.The soil's physicochemical characteristics

pH (1:2.5)	EC dS/m	Available-N ppm	Available-P ppm	Available-K ppm
8.2	1.31	74.52	1.43	6.104
O.M %	**Clay %**	**Silt %**	**Sand %**	**soil texture classification**
1.28	39	42	19	Silty Clay

After filtering with layered burlap, the aerated CT and VT were stored in a dark container (50 L capacity at room temperature) until use (Singh *et al.*, 2008 and Martin & Braithwaite, 2012).

Vegetative Growth Characteristics

The plant's vegetative growth traits were assessed by measuring the fresh and dry weight, plant height, leaf count, number of branches, and chlorophyll content using a chlorophyll meter (SPAD) to estimate leaf chlorophyll concentration (Süß *et al.*, 2015). For each treatment, five random readings were taken, with SPAD values recorded from the youngest fully expanded leaves, counted: from the top of the plants (Markwell *et al.*, 1995).

Characteristics of Chemical Analysis

The nutritional status of the plants was evaluated by analyzing the percentages of nitrogen (N %) (Bremner, 1965), phosphorus (P %) (Olsen and Sommers, 1982), and potassium (K %) (Chapman and Pratt, 1961). Additionally, soil samples were collected from each pot after the experiment concluded to measure soil pH, salt concentration (EC, dS/m), soil organic matter (%) and the levels of available nitrogen (N) (ppm), phosphorus (P) (ppm), and potassium (K) (ppm) in the soil (Chapman and Pratt, 1961).

Statistical Analysis

A statistical analysis of all collected data was conducted using Costat software (version 6.4), with the Least Significant Difference (LSD) test applied at a 5% significance level.

RESULT AND DISCUSSION

Vegetative Growth Characters of Pepper

The data in Figure (1) demonstrate the impact of different treatments on the fresh and dry weight of the plants. The highest values for both fresh and dry weight were observed when compost tea and vermicompost tea were applied together. Applying these treatments individually resulted in lower fresh and dry plant weights compared to the combined application, with the control treatment showing the lowest values. Additionally, the Figure (1) indicates no significant differences between the effects of vermicompost tea with microben and mineral fertilizer (NPK), both of which outperformed the compost tea treatment with microben. The superior performance of vermicompost tea (VT) when combined with microben, compared to compost tea (CT), may be attributed to its higher concentration of beneficial microorganisms, enzymes, and plant growth regulators. Vermicompost is sure to contain a dynamic, diverse and multi-active microbial community, which can promote plant growth, suppress disease and improve nutrient mineralization. However, despite its advantages, CT might not have as diverse a microbial community or as many growth-promoting substances as VT (De Castro *et al.*, 2023). Zaccardelli *et al.* (2018) conducted field trials to evaluate the effects of compost tea (CT) on pepper cultivation under organic management in greenhouse conditions.

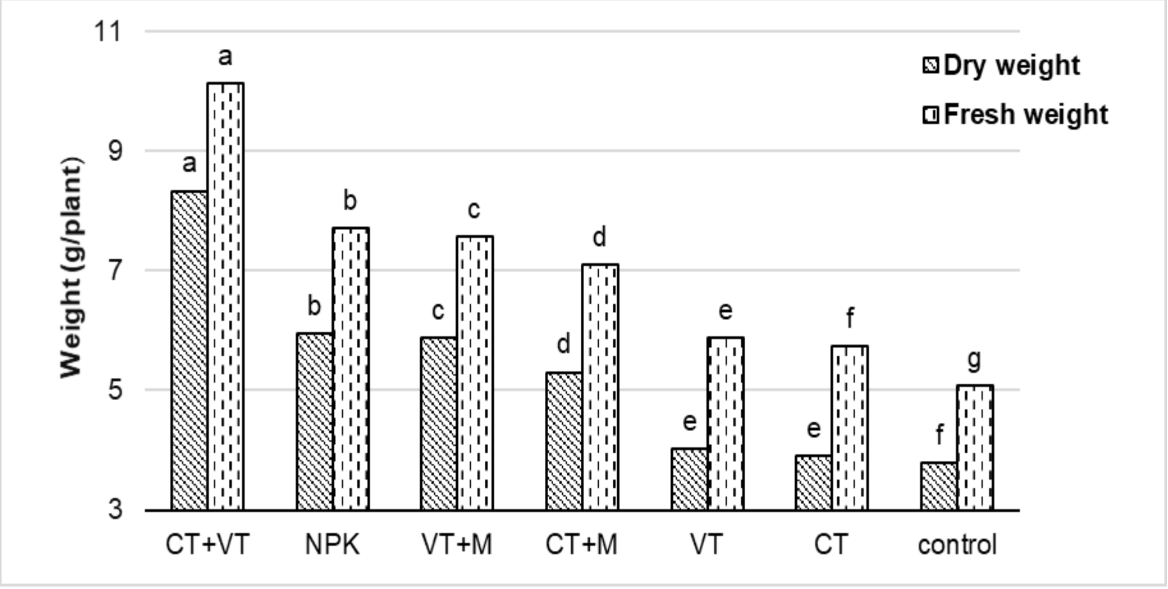

Fig. 1. Effect of treatments fresh and dry weight of the plant

Their results revealed that compost tea (CT) significantly improved agronomic performance, especially in pepper production. Over a two-year period, pepper yields in CT-treated plots increased by an average of 21.9% and 16.3% compared to control plots. This underscores the potential of compost tea as a valuable organic amendment for enhancing crop productivity in sustainable farming systems. These findings align with the conclusions presented by Abubaker *et al.* (2024). Studies by Naidu *et al.* (2013) suggest that microbial-enriched compost tea has the potential to enhance crop growth and quality while reducing reliance on synthetic fertilizers. By combining compost tea with half-strength fertigation, farmers can achieve results comparable to or even superior to full-strength fertigation, thus lowering agricultural costs and reducing the adverse environmental impact associated with heavy use of fertilizers (El-Moneim and El-Ghamry, 2019) and El-Gizawy *et al.* (2014) showed that the sugar yield and juice quality characteristics of sugar beet were significantly increased with compost tea treatments, especially in the plots treated with compost tea foliar application in three batches. In a field-scale experiment conducted by Fritz *et al.* (2012), the effects of tea compost on wheat and barley were evaluated. The study noted improvements in crop quality, as confirmed by sensory tests. This indicates that applying tea compost could enhance specific qualitative attributes of crops, even if it does not lead to a significant increase in yield. Pane *et al.* (2016) explored the application of compost teas as an organic solution to improve the sustainability of lettuce, kohlrabi, and tomato cultivation systems. Their findings indicated that compost tea could act through physiological and/or nutritional bio-stimulation, fostering plant growth and health in an environmentally sustainable way. The results proved that all treatments (Vermicompost tea spray and Vermicompost tea application) had a positive effect on the pomegranate juice volume and juice weight, and there was an insignificant difference between them and significant differences between all treatments with the control (Abdel-Salam and Roshdy, 2022). Compost tea contains all the beneficial soluble bioactive components, serving as a powerful source of compounds that stimulate plant growth and enhance defense mechanisms (Eudoxie and Martin, 2019).

Figure(2) illustrates the impact of compost tea, vermicompost tea, and microbial inoculants (microben) on the branch count of pepper plants. The combined application of compost tea and vermicompost tea produced the highest number of branches, highlighting a synergistic effect. Furthermore, the use of mineral fertilizer (recommended for pepper plants) showed no significant differences when compared to treatments involving microbes combined with either compost tea or vermicompost tea. This suggests those organic amendments, particularly when combined, can effectively enhance plant growth, potentially reducing reliance on synthetic fertilizers. All the previous results are consistent with Kumari *et al.* (2020).

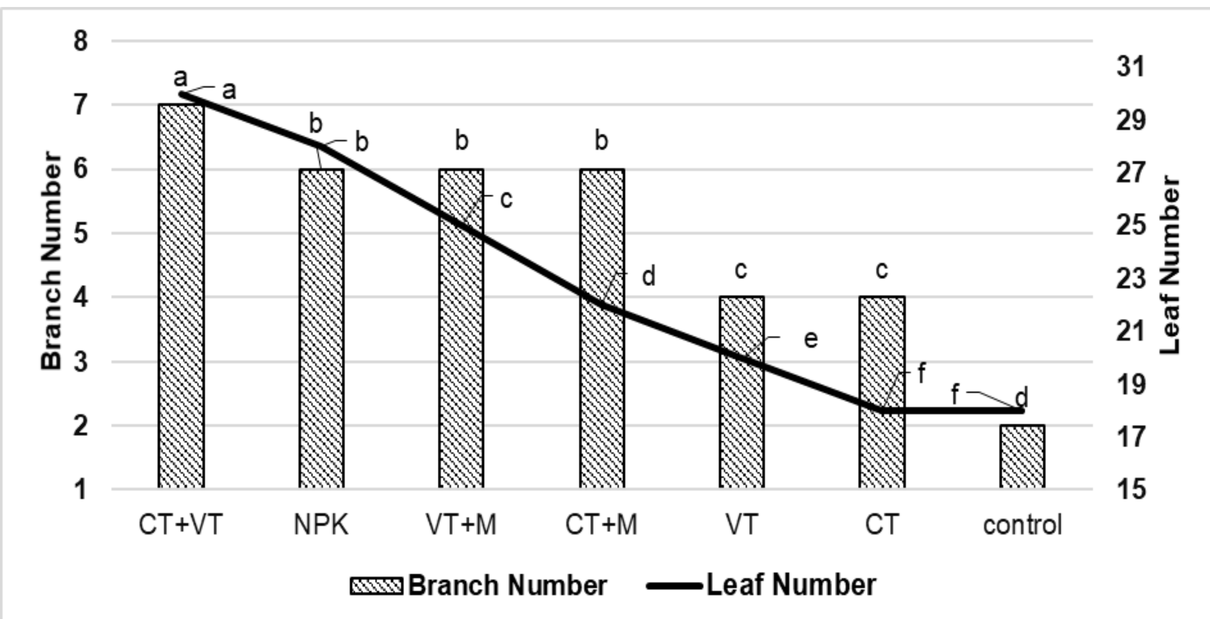

Fig. 2. Effect of treatments on Branch and Leaves number

Compared to the control, the number of branches with the addition of compost tea or vermicompost tea was much higher than with the control treatment. It is also clear from Figure (2) that the number of pepper plant leaves is very high with the combined addition of compost tea and vermicompost tea, and the lowest value was recorded in the control treatment. Huerta *et al.* (2010) demonstrated a significant correlation between the final weight, height, and number of leaves per Amashito pepper plant, with vermicompost tea significantly enhancing these parameters. Vermicompost tea was identified as the substrate that produced the highest plant weight, height, and leaf production.

Figure (3) shows that the chlorophyll content in pepper plants was notably higher when irrigated with compost tea and vermicompost tea compared to the recommended mineral fertilizer treatment. Among the organic treatments, vermicompost tea led to greater chlorophyll content than compost tea, suggesting it is more effective at boosting chlorophyll levels in pepper plants. This trend is consistent with Abdel-Salam and Roshdy's study (2022), which proved that the highest value of chlorophyll was recorded in leaves that were sprayed with vermicompost tea on pomegranate, and the lowest value was recorded in the control. In the research conducted by Zaccardelli *et al.* (2018), plants treated with compost tea exhibited enhanced physiological and nutritional conditions, as demonstrated by temporal SPAD assessments. SPAD values, which reflect leaves chlorophyll content, were consistently higher in compost tea-treated plants compared to untreated ones throughout most of the cultivation cycle. Madan and Rathore (2015) studied the effect of compost and vermicompost on the growth of and found that the added of 40% from vermicompost treatment had significant improving effects on total chlorophyll, and carotenoids. Xu *et al.* (2012) also documented the enhancement of cucumber growth and increased chlorophyll content in leaves following treatments with compost extracts. Additionally, in this figure, it is evident that the combined application of compost tea and vermicompost tea resulted in greater pepper height compared to other treatments. However, no significant difference was observed between the mineral fertilizer treatment and the vermicompost tea treatment with microbes. The control treatment showed the lowest plant height values.

Characteristics of chemical analysis

Figure(4) demonstrates the effects of irrigation using compost tea and/or vermicompost tea with microben (a biofertilizer) on plant nutrient content of N, P and K. The findings reveal that the highest nitrogen uptake (3.95% of dry plant weight) occurred with the application of vermicompost tea combined with microben. This was closely followed by the treatment of compost tea with microben, which showed no significant difference compared to the combined use of compost tea and vermicompost tea. In contrast, the use of compost tea alone led to a decrease in nitrogen uptake, averaging 2.9% of the dry weight of pepper plants. Arancon *et al.* (2004) investigated how vermicompost can improve soil microbial activity and crop nutrient uptake. Likewise, Lazcano *et al.* (2010) observed that the incorporation in the growing media of vermicompost tea produced from rabbit manure increased the germination percentage of maritime pine seedlings.

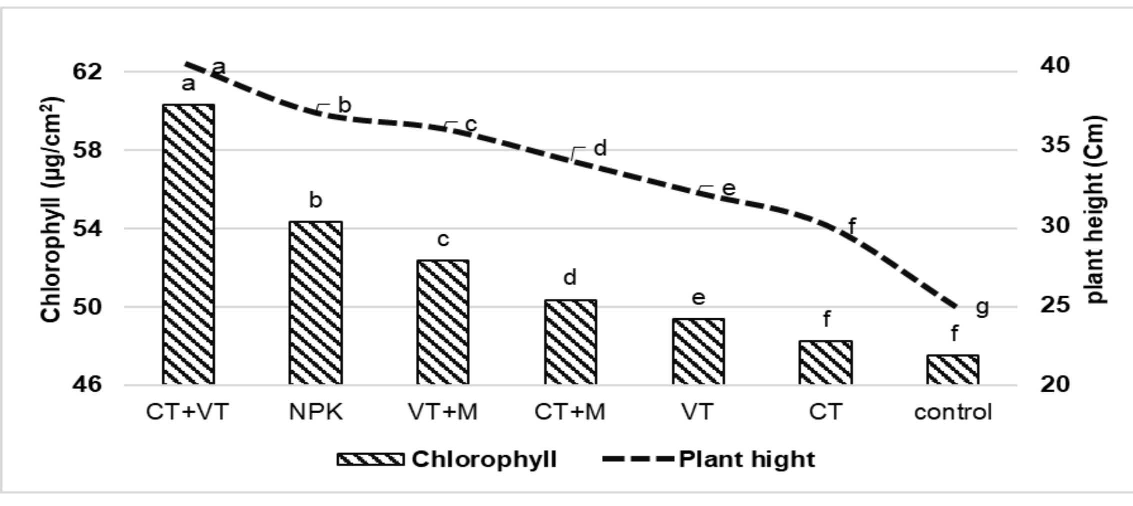

Fig. 3. Effect of treatments on plant height and Plant content of chlorophyll

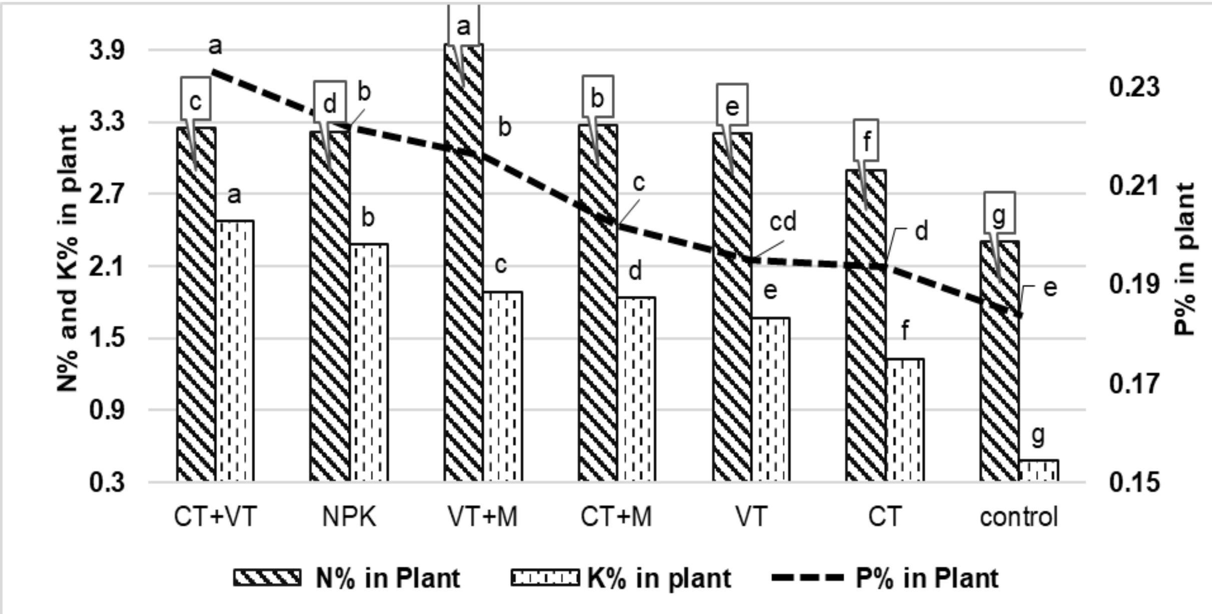

Fig. 4. Effect of treatments on N, P and K uptake by pepper

The N content in plants treated with compost tea and/or vermicompost tea was higher compared to control plants grown on perlite. This increased N content likely contributed to the faster maturation of the treated seedlings. Higher N content in treated plants compared to control plants, potentially accelerating seedling maturation. Figure (4) also highlights that the combined application of compost tea and vermicompost tea yielded the highest potassium uptake (2.47%) and phosphorus uptake (0.233%). Pant *et al.* (2009) demonstrated that using a liquid extract of vermicompost, known as vermicompost tea, can enhance crop production, promote plant health, and increase the nutritional content of plants. Vermicomposting tea is also rich in macro-micronutrients, and growth regulators (Arosha and Sarvananda, 2022). Vermicompost tea is utilized as a substrate in hydroponics systems since its expected nutrient levels, particularly for ammonium and sulphate, are comparable to those of commercial fertilizers (Manthei, 2021). Eudoxie and Martin (2019) noted that compost tea contain a significant quantity of total nutrients, with the majority being primary macronutrients. Also, Taha *et al.* (2018) found that applying compost tea significantly boosted soil bacteria (including nitrogen-fixing bacteria) and fungi populations, while also enhancing the uptake of N, P, and K in radish leaves by 150%, 90%, and 253%, respectively, compared to the control.

Figure (5) illustrates the impact of compost tea and vermicompost tea, either alone or in combination with microben, on soil salinity and pH. The application of vermicompost tea led to an increase in soil pH from an initial reading of 8.2. The highest pH value of 8.37 was observed when vermicompost tea was used alone. When vermicompost tea was combined with compost tea, the pH decreased slightly to 8.25, and when combined with microben, it further dropped to 8.21. Manyuchi *et al.* (2013) confirmed that the increasing the amount of vermicompost while holding the duration of application constant for 25 days decreased the pH to less than 5.2, while increasing the amount of vermiwash increased the pH to more than 5.5. However, increasing both the amount of vermicompost and vermiwash stabilized the soil pH at around 5.4. In addition, increasing the duration of the wormer application increased the pH when the amount of vermiwash was kept constant at 750 grams. On the other hand, compost tea reduced soil pH, with the lowest value of 7.98 recorded when compost tea was applied alongside microben. In terms of soil salinity, vermicompost tea increased these levels, with the highest salinity of 1.98 dS/m noted when both compost tea and vermicompost tea were applied together. Vermicompost tea applied alone resulted in a salinity level of 1.54 dS/m. Also, Manyuchi *et al.* (2013) found that the electrical conductivity of the soil decreased by increasing the amount of vermicompost to less than 1000 µS/cm, while increasing the amount of vermiwash increased to more than 5000 µS/cm with a constant application time of 25 days. Increasing both vermicompost and vermiwash amount resulted in a constant electrical conductivity of about 4000 µS/cm.

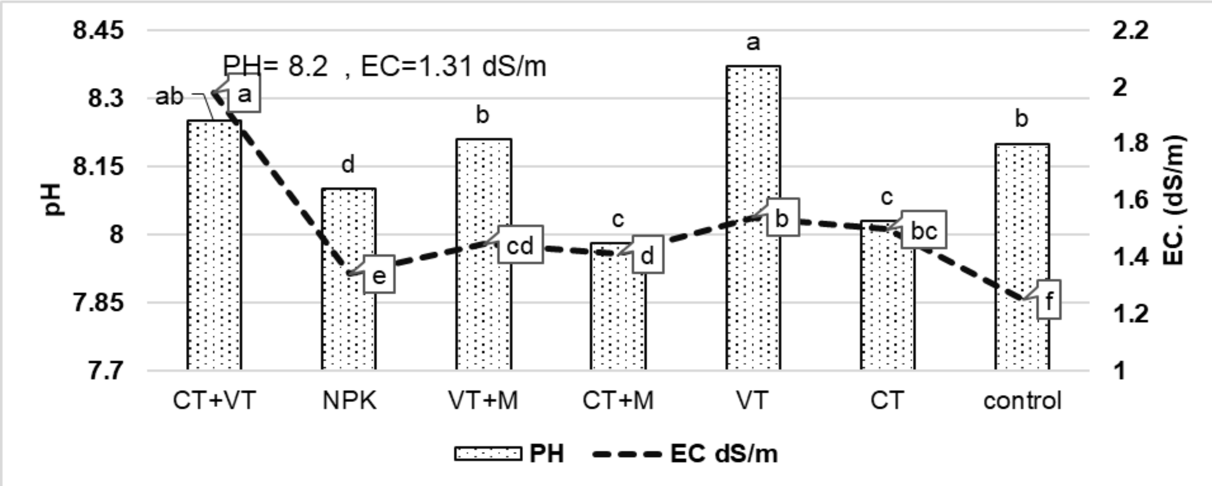

Fig. 5. Effect of treatments on pH and EC in soil

Moreover, increasing the vermicompost application period with a fixed amount of vermiwash of 750 g increased the soil conductivity by more than 4000 µS/cm. However, increasing both vermicompost and vermiwash application duration resulted in a constant soil electrical conductivity of about 4000 µS/cm. In comparison, the recommended mineral fertilization treatment exhibited a lower salinity concentration of 1.34 dS/m, while the control treatment had the lowest salinity value overall. All the above results are consistent with what was stated by Tejada *et al.* (2006). According to Arosha and Sarvanand (2022), while compost and compost tea typically enhance soil health and boost plant productivity, their inappropriate use over extended periods may result in adverse effects.

Table(2) demonstrates the effects of different treatments on the availability of essential soil nutrients (N, P, K) in forms that plants can utilize at the end of the experiment. The treatment that combined compost tea with vermicompost tea resulted in the highest level of available nitrogen, reaching 248 ppm. This was followed by treatments that paired vermicompost tea with microben and compost tea with microben, respectively. These findings suggest that blending organic amendments such as compost tea and vermicompost tea, particularly when supplemented with microbial inoculants like microben, can significantly enhance soil fertility by boosting the availability of nitrogen, an essential nutrient for plant growth. Dávalos *et al.* (2025) highlighted the benefits of vermicompost and vermicompost tea in improving soil nutrient availability, particularly nitrogen, phosphorus, and potassium. Hakimi *et al.* (2024) discussed how compost tea enhances soil fertility and nutrient availability, with a focus on nitrogen, phosphorus, and potassium. The Vermicompost contains plant nutrients such as N, P, K, Fe, Ca, Mg, S, B, Cu, Zn, and Mn, which contribute to the nutrient content of various plant components such as roots, shoots, and fruits (Theunissen *et al.*, 2010). Gómez-Brandón *et al.* (2015) stated that both compost and vermicompost teas improve soil organic matter content and nutrient availability. However, the trend for available phosphorus differed from other nutrients. The highest levels of available phosphorus were observed in treatments involving compost tea with microben, compost tea without microben, and the recommended mineral fertilization for pepper, with no significant differences among these treatments. In contrast, the treatment combining compost tea with vermicompost tea showed a lower value of 1.345 ppm for available phosphorus. This trend aligns with previous studies that have reported enhanced soil fertility and nutrient availability following the application of compost tea (Luo *et al.*, 2022). Vermicompost can also promote the establishment of nitrogen-fixing bacteria in the rhizosphere, which increases N availability by releasing biologically fixed nitrogen through close contact between ingested particles and soil. They discovered that after applying the vermicompost, the soil NH_4 and NO_3 levels improved instantly (Singh and Varshney, 2013). Table (2) also indicates that there are no significant differences in available K levels among the treatments involving the combination of compost tea and vermicompost tea, the mineral fertilization treatment, and the vermicompost tea treatment with microben, all of which yielded the highest values.

Table 2. Effect of treatments on soil available N, P and K

Treatments	Available-N (ppm)	Available- P (ppm)	Available- K (ppm)
CT+VT	248 [a]	1.35 [b]	8.1[a]
NPK	140 [d]	1.75 [a]	7.9 [a]
VT+M	221. 7 [b]	1.01 [c]	7.9 [a]
CT+M	175 [c]	1.82 [a]	7.13 [b]
VT	102. 7 [e]	1.043 [c]	6.4 [c]
CT	72.8 [f]	1.63 [a]	6.4 [c]
Control	70 [f]	0.98 [c]	5.97 [c]

These were followed by the compost tea treatment with microben, which recorded a slightly lower value of 7.13 for available-K. Hakimi *et al.* (2024), found highlight the efficacy of compost tea treatments in promoting nutrient availability and balance in the soil, thereby contributing to improved plant growth and productivity. Goswami *et al.* (2017) documented a significant enhancement in soil health, nutrient availability, physical stability, and microbial diversity as a result of applying organic fertilizers such as compost and vermicompost.

Figure (6) illustrates the increase in soil organic matter content following the initiation of the treatments, with the exception of the control treatment, where the organic matter content decreased to below 1.28%. Notably, the treatment combining compost tea and vermicompost tea achieved the highest value of 2.66% for soil organic matter. Additionally, the vermicompost tea treatment resulted in higher organic matter content compared to compost tea, regardless of whether microben was added or not. These findings agree with Becagli *et al.* (2022) found that the addition of vermiwash and especially biochar to the soil increased the total organic carbon (TOC) content, while rhizosphere soil values were approximately 40% higher in the presence of B. However, 88% of the initial TOC was found in the control, whereas 92% and 94% were found in V and BV, respectively, and only 80% in B, thus indicating a faster mineralisation of the soil organic matter, a further explanation could be a positive priming effect. The % of organic C was significantly higher in the rhizosphere soil than in bulk soil in all the treatments, to which probably contributed root exudates in the form of easily decomposable polysaccharides (O/N-alkyl C). The figure also reveals that the recommended mineral fertilizer for pepper provided a greater increase in organic matter content than either vermicompost tea or compost tea applied alone. Vermicompost tea is very beneficial to the soil, as it increases the formation and accumulation of soil organic matter (SOM), which in turn helps maintain good soil aggregation, protects against erosion of soil layers, improves soil aeration, and increases nutrient availability (Abdel-Salam and Roshdy, 2022). Gómez-Brandón *et al.* (2015) explained that the advantages of compost and vermicompost teas as soil amendments include their capacity to maintain soil organic matter content and increase soil microbial diversity. Eudoxie and Martin (2019) stated that the application of compost tea in agriculture and horticulture contributes to crop nutrition both directly and indirectly, while also enhancing soil quality. This improvement is characterized by an increase in soil organic matter and microbial diversity, along with the various benefits associated with these changes.

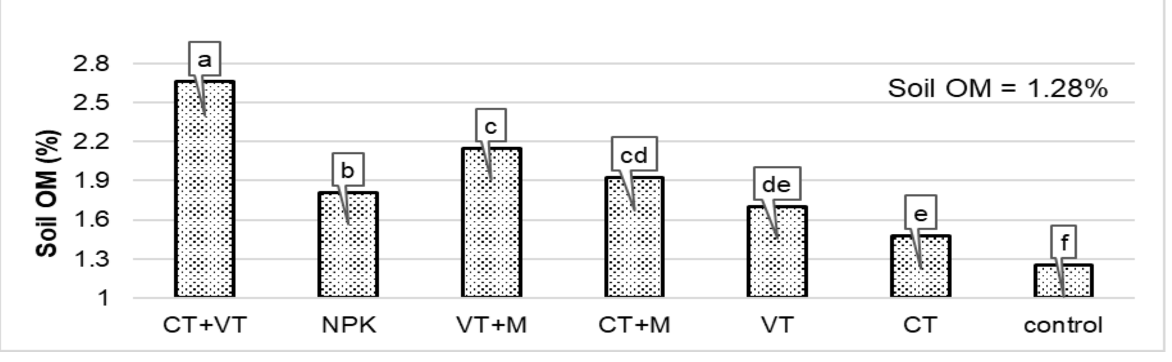

Fig. 6. Effect of treatments on soil organic matter content

CONCLUSION

To preserve soil fertility and reduce the negative impacts of mineral fertilizers on crops and human health, compost tea and vermicompost tea can serve as effective alternatives. Studies have shown that vermicompost tea outperforms compost tea in enhancing the vegetative growth of pepper plants and increasing the availability of nitrogen (N), phosphorus (P), and potassium (K) in the soil. Additionally, vermicompost tea raises soil pH and electrical conductivity (EC), indicating improved soil conditions. To further explore these benefits, future research should focus on: conducting applied tests to understand the effects of compost tea and vermicompost tea on a wider range of vegetable crops. Investigating the combined use of vermicompost tea or compost tea with other biofertilizers to promote sustainable agriculture. Evaluating the long-term impacts of compost tea and vermicompost tea on crop yield, soil health, and the overall sustainability of agricultural systems. These steps will help optimize the use of compost tea and vermicompost tea as sustainable alternatives to mineral fertilizers.

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الملخص العربي

تأثير الميكروبين و/أو شاي الكمبوست وشاي سماد الديدان على الفلفل (*Capsicum Annuum* L.)

هبه سالم، ابراهيم شحاته

أجريت تجربة حقلية لدراسة إمكانية استخدام شاي السماد العضوي وشاي السماد الدودي كبدائل للأسمدة المعدنية المستخدمة في إنتاج الفلفل (*Capsicum Annuum* L.). أُجريت التجربة الزراعية في موسم ٢٠٢٤ في أصص من التربة السلتية الطينية، وكان التصميم التجريبي عبارة عن كتلة كاملة العشوائية (RCBD)، وتتكون التجربة من ٧ معاملات مع ٣ مكررات وكانت المعاملات كالتالي: كنترول، NPK (تسميد معدني موصى به للفلفل فقط)، شاي الكمبوست (CT)، شاي سماد الديدان (VT)، شاي سماد الديدان + شاي السماد الكمبوست (CT+VT)، شاي السماد الدودي + ميكروبين (CT+M)، شاي سماد الديدان + ميكروبين (VT+M). زُرعت نباتات الفلفل في ٦ مايو ٢٠٢٤ في أصص يحتوي كل على ١ كجم من التربة وتم ري الأصص بشاي الكمبوست وشاي سماد الديدان والماء فقط حسب المعاملات. يتضح من النتائج أن الري بشاي الكمبوست مع شاي سماد الديدان أعطى أعلى القيم لخصائص النبات من وزن النبات الطازج والجاف، وعدد الأوراق والأغصان، وطول النبات، ومحتوى الكلوروفيل ومحتوى النيتروجين المتاح في التربة 280 جزء فى المليون ومن الواضح أيضًا أن محتوى النيتروجين في النبات سجل أعلى قيمة (٣,٩%) في معالجة شاي سماد الديدان مع الميكروبين. وايضا زادت قيم الحموضة (pH) تحت تأثير شاي سماد الديدان وكانت أعلى قيمة (٨,٣٧) بينما كانت ٨,٢ قبل بداية التجربة. لذلك يفضل إضافة شاي الكمبوست مع شاي سماد الديدان للأستفادة من محتواه من المواد الغذائية وتقليل تاثيره على حموضة التربة (pH) وتركيز الأملاح. شاي الكمبوست وشاي سماد الديدان يمكن أن يكون فعالًا في تحسين نمو نبات الفلفل وخصوبة التربة مع إمكانية إضافة الميكروبين لتعزيز امتصاص العناصر الغذائية.

الكلمات الدالة: الأسمدة الحيوية، امتصاص العناصر الغذائية، المادة العضوية، النمو الخضري.