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Title: Influence of Bio-based Nutrient Sources on Organic Cherry Tomato cv. Golden Purna Cultivation

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ABSTRACT

The experiment was conducted from October 2025 to February 2026 at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh, to investigate the effects of different organic substrates on the growth, yield, and quality of Golden Purna cherry tomato. The experiment consisted of six treatment combinations, namely: T_1 = Cow dung ; T_2 = Vermicompost ; T_3 = Cow dung + Mustard oilcake; T_4 = Vermicompost + Mustard oilcake; T_5 = Cow dung + Mustard oilcake + Bone meal; and T_6 = Vermicompost + Mustard oilcake + Bone meal. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Significant variations were observed among the treatments for growth, yield, and quality parameters of cherry tomato. Among the treatments, combination of Vermicompost + Mustard oilcake + Bone meal exhibited the superior performance in terms of growth and yield attributes, recording the maximum plant height (209.0 cm), number of branches (7.0 plant^{-1}), number of fruits (1050.4 plant^{-1}), number of fruits per cluster (131.3), fruit yield (11.7 kg plant^{-1}), and yield (36.4 t ha^{-1}). In contrast, the lowest fruit yield (3.2 kg plant^{-1} and 9.4 t ha^{-1}) was observed in cow dung alone. Considering the overall performance, T_6 (Vermicompost + Mustard oilcake + Bone meal) was found to be the most effective treatment for improving the growth, yield, and quality attributes of Golden Purna Cherry Tomato.

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INTRODUCTION

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is an economically important vegetable crop valued for its attractive appearance, pleasant flavor, and high nutritional quality. The fruit is rich in antioxidants, vitamin C, and vitamin A, all of which are essential for preserving physical health and strengthening the immune system (Armando et al., 2024). Due to increasing consumer awareness regarding food safety and nutrition, the demand for organically produced vegetables has risen considerably in recent years. Crop growth, yield, and fruit quality are highly influenced by nutrient management practices (Souri and Hatamian, 2019). However, long-term excessive use of chemical fertilizers in intensive agriculture has caused deterioration in soil fertility, a reduction in soil organic matter, and environmental pollution, particularly in developing countries like Bangladesh (Islam and Rahman, 2024). Organic farming systems are considered more sustainable because they improve soil health, enhance biodiversity, and reduce dependence on synthetic agrochemicals (Drinkwater and Snapp, 2007). Among various organic amendments, vermicompost, cow dung, mustard oilcake, and bone meal are recognized as valuable bio-based nutrient sources for supplying essential nutrients and improving soil physical, chemical, and biological properties (Atiyeh et al., 2000; Arancon et al., 2004). Vermicompost has been reported to enhance plant growth, nutrient uptake, yield, and fruit quality in vegetable crops through improved microbial activity and nutrient availability (Arancon et al., 2004). Similarly, organic nutrient sources contribute to better soil structure, moisture retention, and sustainable crop production (Lazcano and Domínguez, 2011). Despite these advantages, limited information is available regarding the combined effects of different bio-based nutrient sources on the growth, yield, fruit quality, and shelf life of cherry tomato under greenhouse conditions in Bangladesh. Therefore, the present study was undertaken to evaluate the effectiveness of different bio-based nutrient sources on the growth, yield, fruit quality, and shelf life of the organic cherry tomato cv. Golden Purna under greenhouse conditions.

MATERIALS AND METHODS

The experiment was conducted at the Horticulture Farm, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh, during the period from October 2025 to February 2026. Healthy and uniform planting materials of cherry tomato (golden purna cultivar) was collected from Horticulture Innovation Lab., Bangladesh and 21 days old seedlings were used for the experiment. The experiment was laid out in Randomized Complete Block Design (RCBD) with 6 treatments and 3 replications. Each experimental unit consisted of 12 plants maintaining a spacing of 60 cm × 50 cm. The treatments used in the experiment were as; T_1**:** Cow dung, T_2: Vermicompost, T_3: Cow dung + Mustard Oil Cake, T_4: Vermicompost + Mustard Oil Cake, T_5: Cow dung + Mustard Oil Cake + Bone Meal, and T_6: Vermicompost + Mustard Oil Cake + Bone Meal. The total experimental area was divided into three equal blocks, each containing six unit plots with proper intercultural spacing and drainage facilities. The experimental land was prepared thoroughly by repeated ploughing followed by laddering to obtain a fine tilth condition. The bio-based nutrient sources were applied according to the treatment combinations on a hectare basis, and the corresponding quantity for each experimental plot was calculated proportionately based on the plot size. The required amount of each nutrient source for individual plots was measured accurately and incorporated into the soil during final land preparation (Table 1).

Intercultural operations such as irrigation, weeding, mulching, staking/pruning, and plant protection measures were carried out uniformly for all treatments throughout the growing period. Yellow sticky traps and light traps were used to control insect infestation to maintain healthy crop growth. Data were collected from randomly selected sample plants of each treatment multiple times and yield-contributing parameters were measured during the first harvest period at the mature fruiting stage. The collected data were subjected to statistical analysis using STATISTIX 10 (USA) software. Analysis of variance (ANOVA) was performed to determine the significance of treatment effects. Mean separation among treatments was carried out using Least Significant Difference (LSD) along with Duncan's New Multiple Range Test (DMRT) at 5% level of significance.

Table 1. The treatment-wise dose per hectare along with the corresponding application amount per plot.

Treatment	Dose	Amount / Plot (1.8 m^2)
T_1: Cow dung (CD)	5 ton/ha	900 g CD
T_2: Vermicompost (VC)	5 ton/ha	900 g VC
T_3: Cow dung + Mustard oilcake (MOC)	5 ton/ha CD + 300 kg/ha MOC	900 g CD + 54.0 g MOC
T_4: Vermicompost + Mustard oilcake	5 ton/ha VC + 300 kg/ha MOC	900 g VC + 54.0 g MOC
T_5: Cow dung + Mustard oilcake + Bone meal (BM)	5 ton/ha CD +300 kg/ha MOC + 250 kg/ha BM	900 g CD + 54.0 g MOC + 45.0 g BM
T_6: Vermicompost + Mustard oilcake + Bone meal	5 ton/ha VC + 300 kg/ha MOC + 250 kg/ha BM	900 g VC + 54.0 g MOC + 45.0 g BM

RESULTS AND DISCUSSION

The experiment was carried out to assess the vegetative growth and yield performance and quality of Golden cherry tomato under different levels of organic fertilizer treatments. The research work's findings on growth and yield parameters are presented as follows;

Plant height: Plant height was significantly influenced by the combined application of different organic nutrient sources at all growth stages (Figure 1a). Plant height increased progressively with crop age and nutrient availability, indicating the positive effect of integrated organic fertilization on vegetative growth. Plant height was recorded at 20, 30, 40, 50, 60, and 70 days after transplanting (DAT), at 20 DAT, the highest plant height (55.0 cm) was obtained from T_6 (Vermicompost + Mustard oilcake + Bone meal) treatment, whereas the lowest plant height (37.7 cm) was recorded from T_1 (Cow dung). Treatments T_2 (Vermicompost, 46.0 cm) and T_3 (Cow dung + Mustard oilcake, 49.0 cm) showed statistically similar performance. Finally, at 70 DAT, T_6 (Vermicompost + Mustard oilcake + Bone meal) produced the tallest plants (209.0 cm), whereas the minimum plant height (53.5 cm) was observed from T_1 (Cow dung) treatment. The enhanced plant height under T_6 might be attributed to the balanced and continuous supply of essential nutrients, which improved vegetative growth, photosynthetic activity, and root development. Organic nutrient sources, particularly vermicompost-based combinations, improve soil physical condition, microbial activity, and nutrient availability, thereby promoting vigorous plant growth. Vermicompost is considered a rich source of macro- and micronutrients as well as growth-promoting substances that enhance nutrient uptake efficiency and stimulate shoot elongation (Atiyeh et al., 2000; Arancon et al., 2004; Lazcano and Domínguez, 2011). The present findings are in agreement with the reports of Singh et al. 2018, who observed significant improvement in tomato plant height due to balanced nutrient management. Furthermore, Najar and Khan (2013) observed maximum shoot length in tomato with vermicompost application at 6.0 t ha^{-1}.

Number of leaves per plant: The number of leaves per plant in cherry tomato varied significantly due to the application of different levels of organic fertilizers (Figure 1b). The leaves were counted at 10-day intervals from 20 DAT to 70 DAT. At 20 DAT, the maximum number of leaves per plant (15.0) was recorded from T_6 (Vermicompost + Mustard oilcake + Bone meal), followed by T_4 and T_5 (14.0), whereas the minimum number (10.0) was observed in T_1. At 70 DAT, T_6 produced the highest number of leaves per plant (25.0), while T_1 showed the lowest value (20.0). Vermicompost improves soil physical condition, water-holding capacity, and nutrient availability to plants (Mukta *et al.* 2015). Abbott and Parker (1981) reported that nutrients from vermicompost become more readily available to plants, thereby enhancing plant growth and promoting rapid nutrient uptake through foliage, ultimately increasing leaf production.

Leaf area: Leaf area was significantly influenced by the different bio-based nutrient treatments (Table 2). Among the treatments, the highest leaf area (130.6 cm^2) was recorded in vermicompost + mustard oil cake + bone meal, whereas the lowest leaf area (103.3 cm^2) was observed in cow dung The increased leaf area under T_6 might be attributed to the balanced and continuous supply of essential nutrients from vermicompost, mustard oil cake, and bone meal, which enhanced vegetative growth and photosynthetic efficiency. Vermicompost is known to improve soil physical properties, microbial activity, and nutrient availability, thereby promoting cell division and leaf expansion. In addition, mustard oil cake supplies organic nitrogen and micronutrients, while bone meal provides phosphorus and calcium that support vigorous plant growth and leaf development. Similar findings were also reported by Atiyeh et al. (2002), who observed enhanced vegetative growth and leaf expansion in tomatoes due to vermicompost application. Likewise, Arancon et al. (2004) reported that integrated organic nutrient sources significantly increased leaf area and overall plant vigor in vegetable crops.

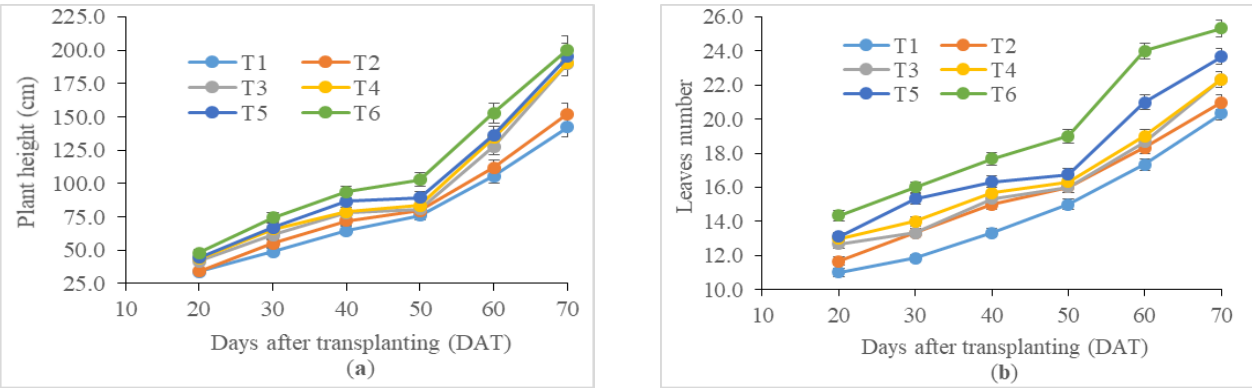

Figure 1. Influence of bio-based nutrient sources on (a) plant height and (b) leaves number of organic cherry tomato production. Here T_1: Cow dung Alone, T_2: Vermicompost Alone T_3: Cow dung + Mustard Oil Cake, T_4: Vermicompost + Mustard Oil Cake, T_5: Cow dung + Mustard Oil Cake + Bone Meal and T_6: Vermicompost + Mustard Oil Cake + Bone Meal.

Table 2. Influence of bio-based nutrient sources on growth and yield of cherry tomato cultivation

Treatments	Leaf area (cm^2)	SPAD value	No. of brunch	Fruit dia (mm)	Single fruit weight (g)	Clusture /plant	No. of fruits /clusture	Yield/ plant (kg)	Yield (t/ha)
T_1	103.3d	45.0cd	3.3d	19.0e	8.5c	5.7c	66.0c	3.2d	9.4d
T_2	113.2c	42.1cd	4.0cd	20.3d	8.5c	6.3bc	66.7c	3.6d	11.1d
T_3	117.8c	45.8c	5.0bc	22.0c	8.5c	6.4bc	91.7b	5.0c	16.0c
T_4	119.5bc	41.0d	5.0bc	24.0b	8.8c	6.7b	96.3b	5.7c	18.9c
T_5	125.4ab	52.4b	5.3b	25.7a	10.0b	7.0b	125.7a	8.8b	28.2b
T_6	130.6a	63.4a	7.0a	26.5a	11.2a	8.0a	131.3a	11.7a	36.4a
CV(%)	3.0	4.8	14.6	3.0	4.3	7.0	5.1	9.2	10.2
LSD	6.5	4.22	1.3	1.3	0.7	0.9	9.0	1.1	3.7

T_1: Cow dung alone; T_2: Vermicompost alone; T_3: Cow dung + Mustard oilcake; T_4: Vermicompost + Mustard oilcake; T_5 Cow dung + Mustard oilcake + Bone meal and T_6: Vermicompost + Mustard oilcake + Bone meal. Means followed by different letters within a column are significantly different at $p \leq 0.05$ according to Duncan's Multiple Range Test (DMRT)

SPAD value: Significant variation in SPAD value was observed due to the different nutrient treatments (Table 2). At the vegetative stage, the highest SPAD value (63.4) was recorded in vermicompost + mustard oil cake + bone meal, while the lowest SPAD value was found in cow dung. The higher SPAD value in T_6 might be associated with the improved availability of nitrogen and other essential nutrients supplied from the combined organic sources, which enhanced chlorophyll synthesis and leaf greenness. Mustard oil cake is a rich source of organic nitrogen that directly contributes to chlorophyll formation, whereas bone meal supplies phosphorus and calcium that support better root growth and nutrient absorption. Consequently, the integrated application of these organic nutrient sources might have enhanced photosynthetic activity and chlorophyll accumulation, resulting in higher SPAD readings. Similar results were reported by Arancon et al. (2004), who observed increased chlorophyll content and improved vegetative growth following vermicompost application in vegetable crops. Atiyeh et al. (2002) also stated that organic amendments significantly improve nutrient availability and physiological performance of plants, leading to increased chlorophyll concentration and SPAD values.

Number of branches per plant: The number of branches per plant showed significant variation due to the application of different bio-based nutrient treatments (Table 2). Among the treatments, the highest number of branches (7.0 plant^{-1}) was recorded in T_6 (Vermicompost + Mustard oil cake + Bone meal), whereas the lowest number of branches (3.3 plant^{-1}) was found in T_1 (cow dung alone). The increased branching in T_6 might be attributed to the balanced and continuous supply of essential nutrients from vermicompost, mustard oil cake, and bone meal, which enhanced vegetative growth and stimulated the development of lateral buds. Vermicompost improves soil microbial activity, nutrient availability, and plant growth regulators, resulting in better plant architecture and branching. Similarly, mustard oil cake supplies organic nitrogen and other micronutrients, while bone meal acts as a slow-release source of phosphorus that promotes root growth and overall plant vigor. Comparable findings were also reported by Arancon et al. (2004), who observed enhanced vegetative growth and branching due to vermicompost application. Similar results were further supported by Atiyeh et al. (2002), who stated that organic amendments improve nutrient uptake and plant growth characteristics through improved soil physical and biological properties.

Fruit diameter: Fruit diameter showed significant variation due to the application of different bio-based nutrient treatments (Table 2). The maximum fruit diameter (26.5 mm) was recorded in T_6 (Vermicompost + Mustard oil cake + Bone meal), whereas the minimum fruit diameter (19.0 mm) was observed in T_1 (cow dung alone). The increased fruit diameter in T_6 might be attributed to the balanced availability of macro- and micronutrients along with improved soil physical and biological properties provided by the combined application of vermicompost, mustard oil cake, and bone meal. Vermicompost enhances nutrient mineralization, microbial activity, and the production of plant growth-promoting substances, which ultimately improve cell division and cell enlargement during fruit development. In addition, mustard oil cake serves as an important source of organic nitrogen, while bone meal provides slow-release phosphorus and calcium that contribute to better fruit growth and development. Similar findings were reported by Arancon et al. (2004), who found that vermicompost application significantly improved fruit size and quality attributes in horticultural crops. Likewise, Atiyeh et al. (2002) reported that organic nutrient sources enhance soil fertility and nutrient uptake, leading to improved fruit growth and yield performance.

Single fruit weight: Significant variation was observed among the treatments in respect of single fruit weight of cherry tomato (Table 2). The highest individual fruit weight (11.2 g) was recorded in T_6 (Vermicompost + Mustard oil cake + Bone meal), whereas the lowest single fruit weight (8.5 g) was obtained from T_1 (cow dung alone). However, T_1, T_2, T_3, and T_4 produced statistically identical fruit weights. The increased fruit weight in T_6 might be attributed to the synergistic effect of vermicompost, mustard oil cake, and bone meal, which ensured a balanced and sustained supply of nutrients throughout the fruit development period (Plate 1). Vermicompost improves nutrient availability, microbial activity, and the synthesis of plant growth regulators, which promote better photosynthetic efficiency and assimilate translocation towards developing fruits. Moreover, mustard oil cake provides organic nitrogen and essential micronutrients, while bone meal supplies phosphorus and calcium that play important roles in fruit enlargement and biomass accumulation. The statistically similar performance among T_1, T_2, T_3, and T_4 might be due to comparatively lower nutrient availability and less efficient nutrient release patterns under those treatments. Similar findings were reported by Arancon et al. (2004), who observed increased fruit weight following vermicompost application in vegetable crops. Likewise, Atiyeh et al. (2002) stated that organic nutrient amendments improve nutrient uptake efficiency and fruit development, ultimately enhancing fruit weight and yield attributes.

Number of cluster/plant: Significant variation was observed among the treatments in terms of the number of clusters per plant of cherry tomato (Table 2). The highest number of clusters per plant (8.0) was recorded in T_6 (Vermicompost + Mustard oil cake + Bone meal), whereas the lowest number of clusters (5.7) was obtained from T_1 (cow dung alone). The superior performance of T_6 might be attributed to the combined effect of vermicompost, mustard oil cake, and bone meal, which provided a balanced and continuous supply of essential nutrients necessary for enhanced vegetative and reproductive growth. Improved nutrient availability and better soil microbial activity under vermicompost application might have stimulated flowering and cluster formation in cherry tomato. In addition, mustard oil cake supplies organic nitrogen and other nutrients that promote vigorous plant growth, while bone meal provides phosphorus that plays an important role in flower initiation and reproductive development. Consequently, plants under T_6 produced more flower clusters compared to the other treatments. Similar findings were reported by Arancon et al. (2004), who observed improved flowering and reproductive growth in vegetable crops following vermicompost application. Likewise, Atiyeh et al. (2002) reported that organic nutrient sources improve soil fertility and nutrient uptake, leading to enhanced growth and yield-contributing characters in horticultural crops.

Number of fruits per cluster: A significant variation was observed in the number of fruits per cluster of cherry tomato due to the application of different bio-based nutrient sources (Table 2). The highest number of fruits per cluster (131.3) was recorded in T6 treatment comprising vermicompost + mustard oil cake + bone meal, whereas the lowest number of fruits per cluster (66.0) was obtained from T_1 treatment receiving cow dung alone. The superior performance of T_6 might be attributed to the balanced and continuous supply of macro- and micronutrients from integrated organic nutrient sources, which enhanced flower initiation, fruit setting, and assimilate translocation towards developing fruits. Vermicompost improves soil microbial activity, nutrient availability, and root growth, while mustard oil cake and bone meal provide essential nutrients, particularly nitrogen, phosphorus, calcium, and organic compounds that positively influence reproductive development and fruit formation in tomato plants. Similar findings were also reported by Atiyeh et al. (2002), who observed enhanced flowering and fruit production due to vermicompost application. Likewise, Arancon et al. (2004) stated that vermicompost-based nutrient management significantly increased yield-contributing characters in tomato through improved nutrient uptake and plant physiological activities. The comparatively lower number of fruits per cluster in T1 might be due to the slower nutrient mineralization and comparatively lower nutrient availability from cow dung applied alone. Similar results were also reported by Singh et al. (2018), who found that integrated application of organic nutrient sources significantly improved flowering, fruit set and yield contributing characters in tomato due to enhanced nutrient availability and improved soil biological activity.

Yield per plant: Fruit yield per plant of cherry tomato was significantly influenced by the application of different bio-based organic fertilizer combinations. Among the treatments, the highest fruit yield per plant (11.7 kg) was recorded in vermicompost + mustard oil cake + bone meal, followed by T5 (8.8 kg), T4 (5.7 kg), and T3 (5.0 kg), whereas the lowest yield per plant (3.2 kg) was obtained from T_1 treatment receiving cow dung alone. The increased yield observed in T_6 might be attributed to the synergistic effect of integrated organic nutrient sources, which ensured balanced nutrient availability, improved soil physical properties, enhanced microbial activity, and better uptake of essential nutrients throughout the crop growth period. The combined application of vermicompost, mustard oil cake, and bone meal possibly enhanced photosynthetic efficiency, flower retention, fruit set, and translocation of assimilates towards developing fruits, ultimately resulting in higher fruit yield per plant (Rahman et al., 2018). In contrast, the lower yield recorded in T_1 may be due to comparatively slower nutrient release and insufficient nutrient availability from cow dung alone. Similar findings were reported by Singh et al. (2018), who observed the maximum fruit yield per plant in tomato from the integrated application of 50% recommended fertilizer dose along with 25% farmyard manure and 25% vermicompost, indicating the positive role of integrated nutrient management in enhancing tomato productivity.

Yield of fruits per hectare: Fruit yield per hectare of cherry tomato was significantly influenced by the application of different bio-based organic fertilizer combinations (Table 2). Among the treatments, the highest fruit yield (36.4 t ha^{-1}) was recorded in T_6 treatment consisting of vermicompost + mustard oil cake + bone meal, followed by T_4 (28.2 t ha^{-1}), T5 (18.9 t ha^{-1}), and T_3 (16.0 t ha^{-1}), while the lowest yield (9.4 t ha^{-1}) was obtained from T_1 treatment where cow dung alone was applied. The enhanced yield performance observed in T_6 might be due to the synergistic effect of integrated organic nutrient sources, which ensured balanced nutrient availability, improved soil physicochemical properties, enhanced microbial activity, and increased nutrient uptake efficiency throughout the crop growth period. Vermicompost is known to improve soil structure, enzymatic activity, and nutrient mineralization, whereas mustard oil cake and bone meal provide slow and sustained release of nitrogen, phosphorus, calcium, and other essential nutrients that favor flowering, fruit setting, and fruit development. Improved photosynthetic activity and efficient translocation of assimilates towards reproductive organs might also have contributed to higher fruit yield per hectare under the integrated nutrient treatment (Lim et al., 2015; Rahman et al., 2018; Usmani et al., 2019). Conversely, the lower yield recorded in T_1 could be attributed to comparatively slower decomposition and limited nutrient availability from cow dung applied alone. The present findings are consistent with the observations of Singh et al. (2018), who reported that integrated nutrient management involving vermicompost and organic manures significantly increased tomato yield through improved nutrient uptake and soil biological activity. Similar results were also reported by Ronga et al. (2020), who demonstrated that organic nutrient combinations enhanced tomato productivity by improving soil fertility and physiological efficiency of plants. Furthermore, Kumar et al. (2021) stated that integrated application of organic nutrient sources improved yield attributes and total fruit yield of tomato through sustained nutrient release and improved rhizosphere conditions.

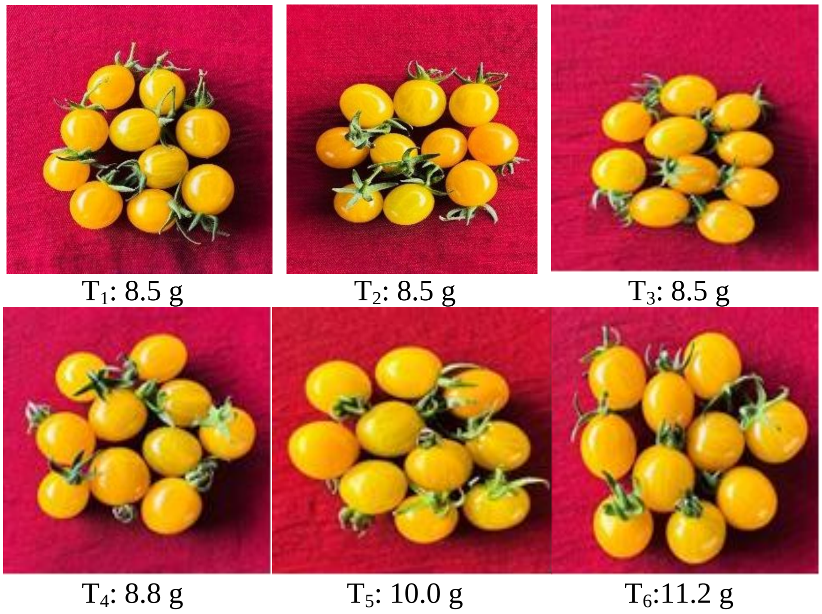

Plate 1. Influence of bio-based nutrient sources on individual fruit weight of Cherry Tomato Cv. Golden purna Cultivation. Here, T_1: Cow dung Alone, T_2: Vermicompost Alone T_3: Cow dung + Mustard Oil Cake, T_4: Vermicompost + Mustard Oil Cake, T_5: Cow dung + Mustard Oil Cake + Bone Meal and T_6: Vermicompost + Mustard Oil Cake + Bone Meal.

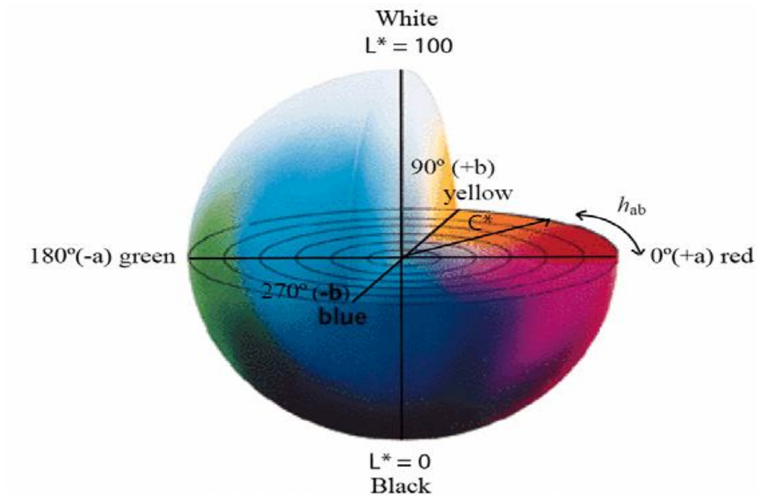

Plate 2. CIELab color measurement coordinates, McGuire, R. C. (1992). The L* value represents lightness, ranging from 0 (black) to 100 (white). The a* coordinate indicates the green (−) to red (+) axis, whereas the b* coordinate represents the blue (−) to yellow (+) axis. Furthermore, chroma (C*) and hue angle (h°) were calculated to provide a more comprehensive description of color characteristics. Chroma (C*) reflects the intensity or saturation of color, while the hue angle (h°) indicates the actual color tone or shade.

Table 3. Skin color of SAU Yellow cherry tomato as influenced by different levels of organic fertilizers

Treatments	Color attributes				
	L*	a*	b*	C*	h_{ab}
T_1	60.93	30.85	50.33	59.04	58.49
T_2	58.13	37.02	53.2	64.81	55.17
T_3	58.76	30.01	47.03	53.06	61.25
T_4	54.19	26.81	53.84	60.14	62.53
T_5	53.74	29.33	53.43	65.06	62.40
T_6	49.22	24.58	57.73	60.97	63.53

T1: Cow dung Alone, T2: Vermicompost Alone T3: Cow dung + Mustard Oil Cake, T4: Vermicompost + Mustard Oil Cake, T5: Cow dung + Mustard Oil Cake + Bone Meal and T6: Vermicompost + Mustard Oil Cake + Bone Meal.

The L* value represents lightness, ranging from 0 (black) to 100 (white). The a* coordinate indicates the green (−) to red (+) axis, whereas the b* coordinate represents the blue (−) to yellow (+) axis. Furthermore, chroma (C*) and hue angle (h°) were calculated to provide a more comprehensive description of color characteristics. Chroma (C*) reflects the intensity or saturation of color, while the hue angle (h°) indicates the actual color tone or shade.

The chroma (C*) value was also highest in T_6 (60.97), indicating higher color intensity and vividness of the fruit skin. In addition, the higher hue angle (63.53°) suggested the development of a bright golden-yellow appearance in the fruits; as McGuire, (1992) color measurement (Plate 2). The improved color development under T_6 might be attributed to the balanced nutrient supply and enhanced availability of micronutrients from vermicompost, mustard oil cake, and bone meal, which positively influenced pigment synthesis and fruit maturation. On the other hand, T_1 treatment produced lighter yellow color of cherry tomatoes. Similar findings regarding the positive effect of organic nutrient sources on tomato fruit color and quality were also reported by Premuzic et al. (1998) and Toor et al. (2006), who stated that organic amendments enhance carotenoid accumulation and improve fruit pigmentation in tomato.

CONCLUSION

In conclusion, the combined application of vermicompost, mustard oil cake, and bone meal significantly improved the growth, yield, and fruit quality of organic cherry tomato cv. Golden Purna. Among the treatments, T6 produced superior performance in terms of fruit yield and attractive golden skin coloration. Therefore, the integrated use of these bio-based nutrient sources can be considered an effective and sustainable nutrient management approach for quality organic cherry tomato production under Bangladesh conditions.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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