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A Sustainable approach: The in luence of organic and inorganic nutrients on the growth, yield, and yield characteristics of yellow capsicum (Orobelle var.) (*Capsicum annuum* L) grown under controlled conditions.

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ABSTRACT

Improving agricultural sustainability is a prominent topic of discussion around the world. Because of this, organic fertilizers, which help reduce the negative effects of synthetic fertilizers, have become more widely used. One such organic fertilizer is called vermicompost. It is essentially a compost that has been improved by using earthworms. This study details the effects of cow dung vermicompost on the development and blooming of yellow capsicum plants var. Orobelle. Eight different potting media were generated by combining different amounts of soil and vermicompost, and the experiment was carried out in a plastic pot setup. The present investigation was conducted using a randomized, triple-blind, placebo-controlled design. Based on the findings of the current study, it can be concluded that adding vermicompost to potting soil significantly improves yellow capsicum yields across all capsicum cultivars compared to the control. It also led to the discovery of the optimal ratio of soil to vermicompost for plant growth by comparing the effects of different treatments containing different proportions of vermicompost on plant height, stem girth, leaf area, leaf count, number of fruits, weight of fruits, etc. In general, for practically all metrics, T6(Soil+ V.C+ FYM+ RDF)(25% Vermicompost + 25% Farmyard Manure + 50% RDF) performed the best.

Keywords- *life on land, responsible consumption, and production, vermicompost, carotenoids, organic and inorganic fertilizer*

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Introduction

As a member of the nightshade family Solanaceae, the yellow capsicum (*Capsicum annuum*; 2N= 24), also known as bell pepper, Shimla Mirch, and sweet pepper, is cultivated in more than 40 countries. When it comes to edible garden plants, it comes in at number two. Its pungency ranges from very pungent to non-pungent, and it is said to have originated in tropical and temperate America. Capsaicinoids are a type of secondary metabolite found only in plants belonging to the Capsicum genus. Of the several species in the genus Capsicum, five are far more common in cultivation: *Capsicum annuum, C. frutescens, C. chinense, C. baccatum, and C. pubescens*. Bell peppers range in color from red to green to orange to yellow depending on their ripeness and their ability to produce chlorophylls or carotenoids. *C. annum* is highly prized for its delicious and healthy taste [1]. The crop is loaded with beneficial nutrients like fiber, antioxidants, vitamins, ascorbic acid, carotenoids, and phenolic compounds. It also includes vitamins A, B, C, and E, as well as pyridoxine, thiamine, beta-carotene, proteins, iron, and Ca^{2+}, all of which are beneficial to human health. Consumption and the impact of antioxidants on human health are major factors in determining how long fruits will keep. More research on the antioxidant and nutraceutical properties of fruits and vegetables has been undertaken in recent years due to the rising demand and customer desire for healthy, non-additive, safe, and nutritious food.

Sustainable agriculture that prioritizes the production of healthy, organic food is an increasing concern around the world. The overuse and underapplication of inorganic fertilizers have led to a decline in soil health and fertility. Although inorganic fertilizers boost production per unit area, they can cause water pollution, nutrient imbalance, soil acidification, and even human carcinogenesis. Organic farming is a modern option for growing nutrient-rich food rich in polyphenols, sugars, and other beneficial components. Since organic fertilizers reduce pollution and improve environmental sustainability, they have become increasingly popular. Therefore, researchers are exploring the potential benefits of using organic fertilizers made from materials such as plant residues, animal manures, and even bird droppings. Two easily accessible organic components are vermicompost and farmyard manure (FYM) [2]. Earthworms turn organic waste into nutrient-rich vermicompost, which can be used for a variety of purposes. Vermicompost can be made from FYM, kitchen garbage, and agricultural scraps. One of the most popular wastes used to create vermicompost is farmyard manure (FYM), which can also aid in plant growth and development when applied alone. Vermicompost Crushed mud, when processed in a special way, has the potential to become an organic fertilizer that is both environmentally friendly and highly effective at helping plants absorb their nutrients. In addition, recent studies show that growing fruits and vegetables using vermicompost in the soil or on growth substrates increases production. Increased microbial activity brought about by vermicompost enhances soil properties such as oxygen content, porosity, water infiltration rate, and temperature [3]. Soil amendments made from vermicompost are very nutritious. When compared to alternative media, it has several advantages, including its ability to prevent plant diseases caused by soil-borne pathogens and pests, its ability to increase the C/N ratio and other soil indicators like nitrogen, and its ability to lessen the detrimental impacts of heavy metals. Both fruit yield and the antioxidant quality of cool fruits can benefit from using vermicompost. However, research into the development and output of capsicum in organic potting material is limited. The purpose of this research was to determine the optimal potting media for maximizing chili growth, productivity, and quality by observing the effects of adding vermicompost and FYM produced from cow dung on Capsicum development and blooming.

Materials and Methodology

As part of the Hi-tech protected cultivation initiative, the Department of Agronomy and Horticulture at LPU's School of Agriculture conducted the pot experiment. The 2023 rabi season saw the research. The experiment was 244 m above sea level at 31°14'38.8''N latitude and 75°42'02.0''E longitude. Monsoons account for 70% of the annual 1152 mm rainfall. Since Punjab is subtropical, summer temperatures reached 47°C and winter temperatures 0°C. Punjab's average humidity ranged from 38% in summer to 82% in monsoon (September) due to weather. September humidity ranged from 57.7% to 97.7%. The experiment's pot was 23 cm wide, 18 cm tall, and 0.449 m^2. The study pots contained Punjab, India's Lovely Professional University's sandy loam soil. Lovely Professional University in Punjab, India, pitted vermicompost for the study. Soil and vermicompost samples were chemically analyzed using standard laboratory methods., and the results are shown in Table 1.

Table 1. Chemical characteristics of soil and vermicompost used as a growth medium in the cultivation of Capsicum annum.

Substrate	Nitrogen (%)	Phosphorus (%)	Potassium (%)	pH	EC (dS m^{-1})
Soil	0.98	0.777	0.076	7.40	0.633
Vermicompost	1.12	1.652	1.256	7.89	0.27

Using a randomized block design with eight treatments and three replicates, we mixed soil, vermicompost, farmyard manure, and the suggested amount of fertilizer to see what would happen. The following categories of patients received treatment: T0 = control, T1 = 100%Soil and farmyard manure (FYM), T2 = 100%Soil and vermicompost, T3 =Soil and 100% of the NPK-based RDF, T4= Soil +50% FarmyardManure and 50% Vermicompost , T5= Soil and 50% FarmyardManure and 50% RDF, T6= Soil + V.C + FYM + RDF(25% Vermicompost+ 25% Farmyard Manure + 50% RDF), and T7= Soil + V.C (50%) + RDF (50%). Urea, Muriate of Potash (MOP), and Single Super Phosphate (SSP) were used to supply the necessary amounts of nitrogen (N), phosphorus (P), and potassium (K). On March 6, 2023, seedlings of the yellow capsicum "Orobelle" variety were purchased from a local market in Phagwara, Punjab, and transplanted into pots with potting media. This cultivar stood out from the rest because of its superior height, thick stem, and increased number of branches and leaves. The average relative humidity and temperature at the study site during the transplanting time were approximately 39 ± 2% and 24 ± 3°C, respectively. Plant growth and yield parameters, including plant height, number of leaves per plant, number of branches per plant, stem girth, chlorophyll index, leaf area, number of buds per plant, fruit count, fruit length, fruit diameter, and fruit weight, were recorded at 30, 60, days after transplanting (DAT), as well as at harvest stage.

Plant height (cm)-The length from the base of the stem to the tip of the highest leaf was determined by employing a ruler and measuring tape, with the centimeter (cm) serving as the unit of measurement.

Number of leaves and the number of branches plant^{-1}: The number of leaves and branches per plant was determined by conducting manual observations. To calculate the number of branches per plant, we counted the branches that emerged from the main stem of the capsicum plant.

Stem girth (cm): To determine the stem girth a thread was wrapped around the stem, and the point where it overlapped was indicated with a pen. Subsequently, the length of the thread was measured using a ruler.

Chlorophyll index (SPAD): The chlorophyll index in leaves was determined with an SPAD meter. The Average chlorophyll index of three leaves, specifically the upper, middle, and lower ones, was measured to assess the overall chlorophyll index of the plant.

Leaf Area Index (cm^2): The length and width of the selected leaf were measured and multiplied to obtain the leaf area. For each plant, the leaf area of three leaves, namely the upper, middle, and lower leaves, was calculated, and then the average leaf area was determined. The unit of measurement used for leaf area was square centimeters (cm^2).

Dry matter accumulation (g): The selected plants were uprooted at different day intervals at 30, 60, and at harvest stages. All the samples were sun-dried for 2 days due to their more length and water absorption. After that samples were oven dried at 70°C to a constant weight for the measurement of dry matter accumulation and preserved for further lab analysis.

Number of buds plant^{-1}: The total number of flowers produced by the capsicum plant was determined through manual observation and counting. All the buds were counted at once only as few buds were having very less life on the plant.

Root dry weight (g): The uprooted plants were taken to measure the root dry weight. The roots were separated from the plant and oven-dried at 50°C as few were sensitive and thin like thread to a constant weight. Then measured on an electronic machine.

Root length (cm): The root length was measured from the uprooted plants. In the two opposite directions, root growth was measured with a measuring scale from base to longest root tip. As capsicum is a fibrous root system plant so most of the roots were bushy.

Root shoot ratio: The root shoot ratio measurement was an important parameter as the shoot growth always depends upon the healthy root system. The crop canopy will help to enhance the root-shoot ratio due to CO_2. It was measured by using the below formula:

$$\text{Root shoot ratio} = \frac{Root\ dry\ weight}{Plant\ dry\ weight}$$

Fruit count, fruit length, fruit diameter, fruit weight, and seed count: The capsicum fruits were manually counted, and the weight of each individual fruit was measured using an electronic weighing balance in grams. The length of the fruit was measured using a ruler, with the unit of measurement being centimeters (cm), and the diameter of the fruit was also measured in centimeters (cm). Similarly, the seed count also had been counted carefully.

Data analysis: Data collected from field experiments were subjected to analysis of variance using SPSS statistics (software) and the mean observed to be significantly different were however, separated by Least Significant Difference (LSD) at 5 probability level using Duncan's Multiple Range Test (DMRT).

RESULT AND DISCUSSION

Effect of organic and inorganic nutrients on the growth parameters of yellow capsicum

Plant height (cm): The minimum plant height (cm) was recorded in T0 (Control- only Soil) ($47.2^h \pm 0.5$) and the maximum was observed in the T6 (Soil + V.C + FYM+ RDF) (50% RDF, 25% V.C, 25% FYM), which is 1.8% time more than the controlled treatment under the controlled condition.In the result, it has been concluded that where the surface area was increased the plant height was genuinely increased. As vermicompost hold nutrient and water for long time then FYM, alone FYM will give a warm effect to plant roots[4]. So, the incorporation of vermicompost along with RDF + FYM was gave the best result shown in Table 2.

No. of leaves plant^{-1}: The mineralized soil was used for the bell pepper under controlled conditions. Where the bell pepper canopy was maintained carefully. The highest no. of leaves plant^{-1} was observed in T6 (Soil + V.C + FYM+ RDF) ($25.7^a \pm 0.5$) and the minimum no. of leaves plant^{-1} was found in T0 (Control) ($12.08^g \pm 0.9$). The values of T6, T7, and T4 were statistically significant as they were different in the total no. of leave plant^{-1}. Due to the availability of nutrients in the soil for a long time whenever the plant required proper nutrients for growth and development. The same result was given by [5].which was considered as a positive relationship of vermicompost with other growing media shown in Table 2.

No. of branches plant^{-1}: The maximum no. of branches plant^{-1} ($20.60^a \pm 0.4$) was recorded in T6 (Soil + V.C + FYM + RDF). Vermicompost contained maximum essential nutrients (micro-macro) which gave a good impact on plant height as well as bearing healthier no. of branches plant^{-1} of the bell pepper [6]. The minimum no. of branches was recorded in T0 (Control) ($10.9^f \pm 0.7$) where no other growing media was used except soil. On the other hand, all the treatments were statistically significant except T5, T3, T2 and T1 shown in Table 2.

Stem Girth (cm): As per the variation within the given treatments, stem girth (cm) showed very positive response. The maximum stem girth ($8.3^a \pm 0.6$) was observed in the T6 (Soil + RDF + V.C + FYM) and in the case of the lowest stem girth value recorded in T0 (Control) ($1.5^g \pm 0.1$) [7]. Nutrients absorption was the primary source of increased stem girth/development. The availability of different amounts of soil nutrients gave significant variation between the treatments shown in Table 2. The bark of Orobelle yellow capsicum was also recorded thick as in comparison to normal green capsicum.

Chlorophyll index (SPAD): The capsicum crop had more crop canopy due to more leaf area. The highest chlorophyll was recorded in T6 (Soil + V.C + FYM + RDF) ($56.6^a \pm 0.6$). The carbon content was mainly responsible for the highest chlorophyll index which was measured with SPAD (Soil and Plant analysis development) meter. Synthetic nitrogen requirement fulfilled with the application of urea as RDF and organic nitrogen through V.C and FYM. Organic and inorganic nitrogen boost chlorophyll biosynthesis, leaf activity, formation, and assimilation [8].For the early plant growth inorganic nitrogen helped and later organic nitrogen. All the other treatments were statistically significant from each other except T7, T4, T2 and T1, and the minimum SPAD was measured in T0 (Control) ($34.2^f \pm 0.5$)shown in Table 2.

Leaf area index: The leaf area of yellow capsicum, grown in a mixture of soil with another growing media (vermicomposting and farmyard manure), the plants showed the highest values than the controlled treatments. The maximum leaf area was recorded in T6 (Soil + V.C + FYM + RDF) ($105.3^a \pm 0.5$) while the lowest leaf area was recorded in T0 (Control) ($82.3^g \pm 0.6$). The values of treatments were statistically significant with each other. The positive relation with vermicompost was suggested by [9] shown in Table 2.

Dry matter accumulation (g): The dry matter accumulation was closely related to the absorption of solar radiation or photosynthesis ratio. The maximum plant dry matter accumulation was recorded in T6 (Soil + V.C + FYM + RDF) ($39.06^a \pm 0.50$). The plants' weight was directly related to LAI and LAI was closely associated with plant dry matter accumulation was observed in T0 (Control) ($9.08^h \pm 0.47$). A similar result was suggested by [10] shown in Table 3.

Root dry weight (g): The maximum root dry weight was recorded in T6 (Soil + V.C + FYM + RDF) ($7.15^a \pm 0.47$). The vermicompost provided more soil surface area and the porosity was increased [5]. The plant roots were developed easily under more aeration and nutrient availability. The lowest root dry weight was observed in T0 (Control) ($1.78^f \pm 0.48$). The treatments were statistically significant with each other shown in Table 3.

Root length (cm): The root length was recorded maximum in T6 (Soil + V.C + FYM + RDF) ($37.72^a \pm 0.51$) and the minimum was recorded in T0 (Control) ($21.67^g \pm 0.41$). The reason for the maximum root length was vermicompost with more porosity availability after the mixture of soil with different growing media [4]. The plant roots grew well in the soil. Vermicompost leads to a decrease in the hulk density and an increase the soil pH and SOC (soil organic carbon). This leads to a change the soil property and improved the soil aeration and water which increased the root depth in the to absorb more nutrients from the depth of the soil and roots expand near the surface as a lateral root system. Which gave the better result in the growth and yield parameters shown in Table 3.

Root Shoot ratio: The maximum root shoot ratio was recorded in T6 (Soil + V.C + FYM + RDF) ($0.26^a \pm 0.01$). Similar result was suggested by [1]. Due to the healthier seedlings planted all the plants survived but a few treatments were not significant except

T6 and T0. The minimum root shoot ratio was obtained in T0 (Control) ($0.11^{e}\pm0.06$) shown in Table 3.

Effect of organic and Inorganic nutrients on the yield parameters of yellow capsicum

No. of flower buds' plant^{-1}: Light for photosynthesis, available nutrients, leaf area and hormones are important parameters for flower bud initiation in the plants [11]. The highest no. of flower buds' plant^{-1} was recorded in treatment T6 (Soil + V.C + FYM + RDF) ($22.23^{a}\pm1.98$) at par with T7 (Soil + V.C + RDF) ($21.01^{a}\pm1.01$) and followed by T4 (Soil + FYM + V.C) ($20.00^{ab}\pm0.1$) shown in Table 4. Salicylic acid (SA) was more responsible for the regulation of physiological activities like respiration, photosynthesis, flower initiation, and seed germination, along with vegetative growth and development activities of plants [12].

No. of fruits plant^{-1}: No. of fruits, plant^{-1} was significantly higher in the vermicompost treatments than in the controlled treatment. The maximum number of fruits plant^{-1} was recorded in T6 (Soil + V.C + FYM + RDF) ($10.11^{a}\pm1.00$) and the minimum was recorded in T0 (Control) ($1.45^{d}\pm0.47$). Due to the soil microbial biomass in all the vermicompost treatments, plants bear the maximum fruits [4] shown in Table 4.

Fruit weight (g): Individually fruit weight was significantly higher in the vermicompost treatment. The maximum fruit was recorded in T6 (Soil + V.C + FYM + RDF) ($153.12^{a}\pm4.12$) at par with T7 (Soil + V.C + RDF) ($133.54^{ab}\pm7.86$) and followed by T4 (Soil + FYM + V.C) ($124.58^{b}\pm15.9$) and the lowest fruit was counted in T0 (Control) ($19.26^{d}\pm6.48$) shown in Table 4. The vermicompost enhanced the fruit yield significantly [2]. Without the application of vermicompost and FYM the porosity was reduced. Soil gave compactness and hardpan.

Fruit girth (g): The maximum fruit girth was recorded in T6 (Soil + V.C + FYM + RDF) ($18.01^{a}\pm0.52$) at par with T7 (Soil + V.C + RDF) ($15.12^{ab}\pm0.58$) and followed by T4 (Soil + FYM + V.C) ($14.76^{b}\pm0.26$) and lowest recorded in T0 (Control) ($12.33^{C}\pm0.61$) shown on Table 4. The observed rise in fruit girth with the increasing vermicompost level can be attributed to the abundant availability of essential nutrients necessary for optimal plant growth, supplied by vermicompost. This nutrient-rich environment contributed to increased photosynthate formation, enabling the plant to enhance its vegetative growth, and consequently leading to an expansion in fruit girth by [13].

Seed count: The maximum fruit girth was recorded in T6 (Soil + V.C + FYM + RDF) ($194.67^{a}\pm2.87$) and lowest recorded in T0 (Control) ($145.33^{f}\pm2.05$) shown in Table 4. Vermicompost application significantly changed the number of seeds per fruit. Capsicum plants grown in the higher level of vermicompost had the higher seed number, while the least value was observed in the control [14].

Conclusion: Finally, the treatment of varying levels of vermicompost had an effect on plant development and yield characteristics. T6 (Soil+V.C+ FYM + RDF) vermicompost demonstrated the greatest ability to improve performance, capsicum development, and fruiting characteristics of all treatments tested. These trials, along with others described in the literature, demonstrate that incorporating vermicompost into horticulture soil or container medium can significantly boost plant development. As a result, vermicompost application is advised as a simple bio-treatment for boosting capsicum plant development and flowering.

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Conflicts of Interest: The authors declare no conflict of interest.

Table 2 Effect of organic and inorganic nutrients on growth parameters of bell pepper viz. Plant height (cm), No. of leaves plant^{-1}, No. of branches plant^{-1}, Stem girth (cm), Chlorophyll index and Leaf area index

Treatments	Plant height (cm)	No. of leaves plant^{-1}	No. of branches plant^{-1}	Stem girth (cm)	Chlorophyll index (SPAD)	Leaf area index
T0 (Control)	$47.2^{h}\pm0.5$	$12.08^{g}\pm0.9$	$10.9^{f}\pm0.7$	$1.5^{g}\pm0.1$	$34.2^{f}\pm0.5$	$82.3^{g}\pm0.6$
T1 (Soil+ FYM)	$61.1^{g}\pm0.4$	$15.00^{f}\pm0.7$	$12.8^{e}\pm0.6$	$2.6^{f}\pm0.4$	$41.9^{e}\pm0.3$	$88.1^{f}\pm0.4$
T 2(Soil+ V.C)	$73.9^{e}\pm0.5$	$17.06^{e}\pm1.0$	$13.9^{de}\pm0.5$	$3.4^{e}\pm0.3$	$42.7^{e}\pm0.4$	$90.9^{e}\pm0.6$
T3 (Soil+ RDF)	$68.8^{f}\pm0.3$	$19.03^{d}\pm0.7$	$14.4^{d}\pm0.9$	$3.7^{e}\pm0.4$	$45.7^{d}\pm0.5$	$94.6^{d}\pm0.8$
T4 (Soil+ FYM+ V.C)	$78.8^{c}\pm0.5$	$20.03^{c}\pm1.0$	$16.8^{c}\pm0.6$	$5.5^{c}\pm0.3$	$50.2^{b}\pm0.7$	$98.0^{c}\pm0.3$
T5 (Soil+ FYM+ RDF)	$74.9^{d}\pm0.3$	$18.02^{e}\pm0.7$	$15.00^{d}\pm0.4$	$4.6^{d}\pm0.3$	$47.0^{c}\pm0.6$	$95.0^{d}\pm0.6$
T6 (Soil+ V.C + FYM+ RDF)	$88.1^{a}\pm0.6$	$25.7^{a}\pm0.5$	$20.60^{a}\pm0.4$	$8.03^{a}\pm0.6$	$56.6^{a}\pm0.6$	$105.3^{a}\pm0.5$
T7 (Soil+ V.C + RDF)	$81.9^{b}\pm0.4$	$22.3^{b}\pm0.7$	$18.8^{b}\pm0.5$	$7.20^{b}\pm0.5$	$52.2^{b}\pm0.2$	$102.0^{b}\pm0.4$

*Data is in the form of mean ± SDM at $p \leq 0.05$. the mean followed by different letters was significantly different at $p \leq 0.05$, according to DMRT for separation of means.

Table 3 Effect of organic and inorganic nutrients on growth parameters of bell pepper viz. Dry matter accumulation (g), Root dry weight (g), Root length (cm), Root shoot ratio.

Treatments	Dry matter accumulation (g)	Root dry weight (g)	Root length (cm)	Root shoot ratio
T0 (Control)	$9.08^{h}\pm0.47$	$1.78^{f}\pm0.48$	$21.67^{g}\pm0.41$	$0.11^{e}\pm0.06$
T1 (Soil+ FYM)	$14.53^{g}\pm0.25$	$2.48^{de}\pm0.33$	$27.14^{f}\pm0.56$	$0.15^{d}\pm0.03$
T 2(Soil+ V.C)	$21.56^{f}\pm0.20$	$2.90^{cd}\pm0.57$	$28.74^{e}\pm0.62$	$0.15^{d}\pm0.03$
T3 (Soil+ RDF)	$23.61^{e}\pm0.28$	$3.53^{d}\pm0.33$	$30.82^{d}\pm0.58$	$0.17^{cd}\pm0.01$

T4 (Soil+ FYM+ V.C)	30.58^{c}±0.14	5.36^{b}±0.29	34.16^{c}±0.53	0.20^{cd}±0.01
T5 (Soil+ FYM+ RDF)	28.90^{d}±0.63	4.41^{c}±0.23	31.96^{d}±0.63	0.18^{bcd}±0.01
T6 (Soil+ V.C + FYM+ RDF)	39.06^{a}±0.50	7.15^{a}±0.47	37.72^{a}±0.51	0.26^{a}±0.01
T7 (Soil+ V.C + RDF)	35.31^{b}±0.53	5.82^{b}±0.27	36.16^{b}±0.74	0.21^{b}±0.01

*Data is in the form of mean ± SDM at $p \leq 0.05$. the mean followed by different letters was significantly different at $p \leq 0.05$, according to DMRT for separation of means.

Table 4 Effect of organic and inorganic nutrients on yield parameters of yellow capsicum viz. no. of flower buds' plant^{-1}, No. of fruits plant^{-1}, Fruit weight (g), Fruit girth (g), and Seed count.

Treatments	No. of flower buds plant^{-1}	No. of fruits plant^{-1}	Fruit weight (g)	Fruit girth (g)	Seed count
T0 (Control)	5.12^{d}±0.41	1.45^{d}±0.47	19.26^{d}±6.48	12.23^{c}±0.61	145.33^{f}±2.05
T1 (Soil+ FYM)	10.25^{c}±0.56	2.12^{d}±0.54	19.8^{d}±6.370	12.44^{c}±0.43	153.00^{a}±1.63
T 2(Soil+ V.C)	17.26^{b}±1.02	5.67^{c}±1.17	63.21^{c}±11.98	12.57^{c}±1.11	156.67^{e}±1.25
T3 (Soil+ RDF)	18.00^{b}±1.00	8.49^{ab}±1.12	114.52^{b}±8.25	14.36^{b}±0.71	163.00^{d}±1.63
T4 (Soil+ FYM+ V.C)	20.00^{ab}±1.00	8.12^{b}±1.00	124.58^{b}±15.9	14.76^{b}±0.26	168.67^{c}±1.25
T5 (Soil+ FYM+ RDF)	18.00^{b}±1.00	7.42^{b}±0.47	109.9^{8}±9.21	13.56^{b}±0.54	169.00^{c}±1.63
T6 (Soil+ V.C + FYM+ RDF)	22.23^{a}±1.98	10.11^{a}±1.00	153.12^{a}±4.12	18.01^{a}±0.52	194.67^{a}±2.87
T7 (Soil+ V.C+ RDF)	21.01^{a}±1.01	8.69^{ab}±1.17	133.54^{ab}±7.86	15.12^{ab}±0.58	189.67^{b}±1.25

*Data is in the form of mean ± SDM at $p \leq 0.05$. the mean followed by different letters was significantly different at $p \leq 0.05$, according to DMRT for separation of means.

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