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Effect of different growing media and varietal combinations on growth and yield of Turmeric (*Curcuma longa* L.) under grow bag condition

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ABSTRACT

The present investigation entitled “Effect of different growing media and varietal combinations on growth and yield of Turmeric (*Curcuma longa* L.) under grow bag condition” was carried out in the kharif season of 2025–26 at Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, Chhattisgarh. The research followed a Completely Randomized Design (CRD) with twelve treatment combinations replicated thrice. The experimental treatments consisted of three turmeric varieties: the Local cultivar, PDKV Waigaon and Roma, each paired with distinct growing media compositions. Among the treatment combinations, T_{12} (Black soil + Vermicompost + Sand + Paddy straw, 1:1:1:1 + Roma) exhibited superior performance across various parameters. Specifically at 60, 90, 120, and 150 days after planting (DAP), T_{12} demonstrated the highest plant height (34.33, 52.58, 57.83 and 62.08 cm, respectively), leaf count (9.67, 14.75, 17.25 and 18.58) and tiller numbers (2.75, 3.75, 4.50 and 4.58). Additionally, T_8 (Black soil + Vermicompost + Sand + Paddy straw, 1:1:1:1 + PDKV Waigaon) recorded the greatest primary finger length (8.72 cm), with T_{12} being statistically comparable (8.27 cm). T_{12} showcased the largest finger diameter (3.34 cm), primary rhizome count (9.58/plant), secondary rhizome count (14.08/plant) and rhizome yield (311.84 g/plant), equivalent to 2.82 kg/plot and 281.33 q/ha. The next best performer was T_8 , with values of 271.49 g/plant, 2.44 kg/plot and 244.33 q/ha. Moreover, T_{12} yielded the highest gross return (Rs. 310.20/m²), net return (Rs. 164.20/m²) and Benefit-Cost Ratio (B ratio) of 2.12, while T_1 exhibited the lowest returns (Rs. 104.50/m², Rs. 10.02/m² and 1.10, respectively). Hence, T_{12} (Black soil + Vermicompost + Sand + Paddy straw, 1:1:1:1 + Roma) emerged as the most promising treatment for augmenting the vegetative growth, rhizome development, yield and economic profitability of turmeric in grow bag environments.

Keywords: *Curcuma longa*, CRD, Grow bag, Growing media, Turmeric, Varietal combinations

Introduction

Turmeric, scientifically known as *Curcuma longa* L., is a significant spice crop with a long history. It comes from the Zingiberaceae family and has been grown for over 4,000 years in tropical areas of South and Southeast Asia, notably India, its place of origin. Throughout history, turmeric has played vital roles in traditional medicine, religious ceremonies and cooking practices. *Curcuma* is a genus with more than 80 species found in Asia, Australia and South America. Most cultivated types of Turmeric are from the *Curcuma longa* species, which is a sterile triploid plant ($2n = 3x = 63$) grown by planting rhizomes. Turmeric is a perennial plant with underground rhizomes that are the valuable part of the plant. The plant's growth, development and yield are affected by environmental factors, genetic traits of the varieties and farming methods used during cultivation.

Turmeric is a valuable plant widely used in food, pharmaceutical, cosmetic and dye industries. Its dried rhizomes are commonly used in food as a spice, colouring and preservative. The main active compound in turmeric is Curcumin, which gives it its yellow colour. Curcumin, part of a group called curcuminoids, offers antioxidant, anti-inflammatory, antibacterial and anticancer benefits. Turmeric rhizomes are rich in nutrients, 60–70% carbohydrates, 6–8% protein, 5–10% fat and 2–% fiber, with essential vitamins like Vitamin C (20–30 mg/100g), Vitamin E and B-complex Vitamins. Curcumin levels in Turmeric range from 2 to 6%, influenced by species and growth conditions. Essential oils (3–7%) provide fragrance and medicinal benefits. Flavonoids and phenolic substances enhance its therapeutic properties. Turmeric may reduce inflammation, boost immunity, and support overall health (Kadam et al., 2020) [1].

India is the top producer, consumer and exporter of Turmeric globally. In 2023–24, India cultivated Turmeric on 305.182 thousand hectares, yielding 1,074.526 thousand metric tonnes. In Chhattisgarh, Turmeric was grown on 11.488 thousand hectares, producing 101.884 thousand metric tonnes. Within Rajnandgaon district, Turmeric was cultivated on 0.269 thousand hectares, yielding 2.080 thousand metric tonnes in 2023–24. Turmeric's growth in grow bags depends on the type of soil and the variety used. Various soils offer dif

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ferent conditions, and turmeric varieties vary in growth, nutrient absorption, and yield potential. Matching the right soil with the right variety is crucial for optimal growth and rhizome output in grow bags (Agrawal *et al.*, 2024) [2].

Black soil is a type of soil rich in clay and organic matter, which helps it retain moisture and nutrients well, providing a stable base for plants to grow. Vermicompost is an organic material full of nutrients that are easily available to plants. It also enhances soil structure and promotes microbial activity (Mandavi *et al.*, 2025) [3]. Sand, on the other hand, is coarse-textured and porous allowing for good drainage and aeration when mixed with finer materials (Mai Thi Thuy *et al.*, 2013) [4]. Paddy husk is a lightweight organic material that enhances porosity, aeration, and drainage in the growing medium (Mai Thi Thuy *et al.*, 2013) [4]. Cut paddy straw is a fibrous material high in carbon that breaks down slowly, enriching the soil with organic matter and improving its physical condition (Kumar *et al.*, 2024) [5]. Cocopeat is another lightweight material with high water retention capacity, helping to keep the soil moist while ensuring the roots receive enough air. These different materials were combined to create growing media tested with three types of turmeric: Roma, PDKV Waigaon, and a local cultivar. Roma is a high-yielding commercial variety used to evaluate growth potential and yields (Ahrwar *et al.*, 2019) [6]. PDKV Waigaon is an early-maturing selection ideal for assessing yield qualities (Darekar *et al.*, 2022) [7] and the local cultivar is included for comparison purposes.

Materials and Methods

The experiment was carried out at the Department of Plantation, Spices, Medicinal and Aromatic Crops, Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon (C.G.) during the year 2025-26. The experiment was conducted in Completely Randomized Design with three replications and twelve treatments. (T₁) Black soil + Local cultivar, (T₂) Black Soil + Vermicompost + Sand + Paddy Husk (1:1:1:1) + Local cultivar, (T₃) Black Soil + Vermicompost + Sand + Cocopeat (1:1:1:1) + Local cultivar, (T₄) Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Local cultivar, (T₅) Black soil + PDKV Waigaon, (T₆) Black Soil + Vermicompost + Sand + Paddy Husk (1:1:1:1) + PDKV Waigaon, (T₇) Black Soil + Vermicompost + Sand + Cocopeat (1:1:1:1) + PDKV Waigaon, (T₈) Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon, (T₉) Black soil + Roma, (T₁₀) Black Soil + Vermicompost + Sand + Paddy Husk (1:1:1:1) + Roma, (T₁₁) Black Soil + Vermicompost + Sand + Cocopeat (1:1:1:1) + Roma, (T₁₂) Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma.

The experimental data relating to the various growth and yield parameters of Turmeric under growbag condition. During the study were subjected to statistical analysis by means of the method of analysis of variance (ANOVA) for a Completely Randomized Design (CRD), as described by Fisher and Yates (1963). The significant differences between the treatments were determined by referring to the critical differences at the 5% level of significance. Statistical analysis was performed using the OPSTAT portal, which is available on the CCS HAU website. The media for growth was formulated based on specific treatments, mixing components in equal proportions, ensuring uniformity before filling grow bags. Three turmeric varieties - Local, Roma, and PDKV Waigaon - were studied in this research. Properly mixed different growing media comprising of only Black soil, Black soil: Vermicompost: Sand: Paddy husk (1:1:1:1), Black soil: Vermicompost: Sand: Cocopeat (1:1:1:1), Black soil: Vermicompost: Sand: Cut paddy straw (1:1:1:1) respectively filled up in black polythene bags. Turmeric rhizomes of optimal health, consistency, and absence of diseases, ranging from 20 to 30 grams each, were selected as planting material for the study. The Roma and PDKV Waigaon varieties were acquired from Dr. Panjab Rao Deshmukh Krishi Vidyapeeth (PDKV), Nagpur, while the Local cultivar was directly obtained from a Rajnandgaon farmer. Turmeric seed rhizomes of Local cultivar and Roma, PDKV Waigaon, weighing 20–30 g each, were planted in black polythene grow bags (14"x16") with specific growing media treatments. Each bag accommodated one rhizome planted at the correct depth, followed by immediate irrigation. Each treatment received the recommended soluble NPK fertiliser dose for turmeric, with split fertigation every 30 days. Irrigation was applied every 3 to 4 days during the initial growth phase for proper establishment, adjusting later to every 5 to 6 days based on soil moisture levels. Continuous monitoring for shoot borer and prompt implementation of plant protection measures ensured crop health and stand preservation. Turmeric rhizomes were collected at physiological maturity, signaled by yellowing and drying leaves, 150 days post planting, following cessation of irrigation a week prior.

Table 1. Treatment details

T ₁	Black soil + Local cultivar
T ₂	Black Soil + Vermicompost + Sand + Paddy Husk (1:1:1:1) + Local cultivar
T ₃	Black Soil + Vermicompost + Sand + Cocopeat (1:1:1:1) + Local cultivar
T ₄	Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Local cultivar
T ₅	Black soil + PDKV Waigaon
T ₆	Black Soil + Vermicompost + Sand + Paddy Husk (1:1:1:1) + PDKV Waigaon
T ₇	Black Soil + Vermicompost + Sand + Cocopeat (1:1:1:1) + PDKV Waigaon
T ₈	Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon
T ₉	Black soil + Roma
T ₁₀	Black Soil + Vermicompost + Sand + Paddy Husk (1:1:1:1) + Roma
T ₁₁	Black Soil + Vermicompost + Sand + Cocopeat (1:1:1:1) + Roma
T ₁₂	Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma

Result and Discussion

Plant height (cm)

At 60 days after planting, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) recorded the maximum plant height (34.33 cm), which was followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (30.17 cm), while the minimum plant height (16.50 cm) was recorded under T₁ (Black soil + Local cultivar).

At 90 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) recorded the highest plant height (52.58 cm), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) (46.92 cm), whereas the lowest plant height (29.42 cm) was recorded under T₁ (Black soil + Local cultivar).

At 120 DAP, the maximum plant height (57.83 cm) was observed under T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) (51.80 cm), while the mini

mum plant height (33.50 cm) was recorded under T₁ (Black soil + Local cultivar).

At 150 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) recorded the highest plant height (62.08 cm), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) (56.39 cm), whereas the minimum plant height (35.42 cm) was recorded under T₁ (Black soil + Local cultivar).

Vermicompost could have supplied essential nutrients required for active vegetative development, while sand may have improved aeration and root-zone conditions, thereby facilitating root growth and nutrient uptake. The gradual decomposition of paddy straw may have contributed to the continued availability of nutrients during crop growth, supporting sustained shoot development and plant height. The inherent growth characteristics of Roma under the given medium may have further contributed to its better performance. Similar observations were reported in Turmeric by *Shwetha et al. (2019)* [8] and *Chandana et al. (2022)*.

Number of leaves per plant

At 60 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) recorded the maximum number of leaves per plant (9.67), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon), which recorded 8.42 leaves per plant. The minimum number of leaves (4.25) was observed under T₁ (Black soil + Local cultivar).

At 90 DAP, the highest number of leaves per plant (14.75) was again recorded under T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (12.25) leaves per plant. The lowest value (7.08) was recorded under T₁ (Black soil + Local cultivar).

At 120 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) maintained the highest number of leaves per plant (17.25), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (15.83) leaves per plant, whereas T₁ (Black soil + Local cultivar) recorded the lowest number of leaves (9.25).

At 150 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) recorded the maximum number of leaves per plant (18.58), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon), which produced (17.17) leaves per plant. The minimum number of leaves per plant (10.25) was recorded under T₁ (Black soil + Local cultivar).

The presence of vermicompost may have improved nutrient availability, while decomposing paddy straw could have supplied nutrients progressively during crop development. Sand may have maintained suitable physical conditions around the roots, encouraging root activity and efficient nutrient uptake. The combined effect of improved nutrition and root-zone conditions may therefore have promoted greater development of the photosynthetically active leaf area. Similar findings were reported in Turmeric by *Kumar et al. (2015)* [9] and *Agrawal et al. (2024)* [2].

Number of tillers per plant

At 60 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) recorded the highest number of tillers per plant (2.75), which was followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (2.50) tillers per plant. The lowest number of tillers (1.08) was observed in T₁ (Black soil + Local cultivar).

At 90 DAP, the maximum number of tillers per plant (3.75) was recorded under T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (3.17) tillers per plant. The minimum value (1.50) was recorded under T₁ (Black soil + Local cultivar).

At 120 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) produced the highest number of tillers per plant (4.50), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (3.83) tillers per plant. The lowest number of tillers (1.75) was recorded in T₁ (Black soil + Local cultivar).

At 150 DAP, treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) maintained the highest number of tillers per plant (4.58), followed by T₈ (Black soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon), which recorded (4.00) tillers per plant. The minimum number of tillers (1.83) was recorded under T₁ (Black soil + Local cultivar).

Adequate nutrient availability from vermicompost and the gradual release of nutrients during paddy straw decomposition may have supported vigorous vegetative growth. Improved aeration associated with the inclusion of sand could have enhanced root functioning and nutrient absorption, thereby creating suitable conditions for the initiation and development of tillers. The combined improvement in root activity and plant vigour may consequently have resulted in greater tiller production. Similar observations were reported in turmeric by *Shwetha et al. (2019)* [8] and *Chandana et al. (2022)*.

Length of fingers (cm)

A significant variation in primary finger length was observed among the treatment combinations. Harvest observations revealed significant differences in primary finger length among the treatments. Treatment T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon) recorded the maximum primary finger length (8.72 cm). Treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + Roma) was statistically at par with T₈ and recorded a primary finger length of (8.27 cm). The minimum primary finger length (4.73 cm) was recorded under T₁ (Black soil + Local cultivar).

The presence of vermicompost may have enhanced nutrient availability, whereas sand could have improved aeration and root development. Decomposition of paddy straw may have further supported nutrient release during the crop period. These conditions could have promoted efficient water and nutrient uptake and improved the supply of assimilates towards developing rhizomes, ultimately favouring primary finger elongation. The genetic characteristics of PDKV Waigaon may have additionally contributed to the production of longer fingers. Similar findings were reported in Turmeric by *Pariari et al. (2019)* [10].

Diameter of fingers (cm)

Significant variation was also evident in finger diameter at harvest. Treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + Roma) recorded the maximum finger diameter (3.34 cm), followed by T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon), which recorded a finger diameter of (3.14 cm). The minimum finger diameter (1.77 cm) was recorded under T₁ (Black soil + Local cultivar).

Vermicompost could have supported adequate nutrient availability, while the presence of sand may have created a more favourable root environment by improving aeration. Such conditions may have encouraged active root functioning and subsequent rhizome enlargement. In addition, the varietal characteristics of Roma may have favoured radiated growth, resulting in comparatively thicker fingers under T₁₂. Similar findings were reported in Turmeric by *Agrawal et al. (2024)* [2].

Number of primary rhizomes per plant

The treatment combinations differed significantly with respect to primary rhizome production. Treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + Roma) recorded the maximum number of primary rhizomes per plant (9.58), followed by T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon), which recorded (8.42) primary rhizomes per plant. The

minimum number of primary rhizomes per plant (5.25) was recorded under T₁ (Black soil + Local cultivar).

Improved nutrient availability through vermicompost may have enhanced photosynthetic activity and assimilate production, while the better physical condition of the growing medium could have facilitated root growth and nutrient acquisition. Efficient translocation of assimilates towards the underground portion of the plant may have encouraged the initiation and development of a greater number of primary rhizomes. The productive potential of Roma may have further supported this response. Similar results were reported in Turmeric by Dudekula *et al.* (2022) and Bindu *et al.* (2022) [11].

Number of secondary rhizomes per plant

A similar treatment-wise variation was observed for secondary rhizome formation. Treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + Roma) recorded the maximum number of secondary rhizomes per plant (14.08), followed by T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon), which recorded (12.67) secondary rhizomes per plant. The minimum number of secondary rhizomes per plant (7.17) was recorded under T₁ (Black soil + Local cultivar).

A continuous supply of nutrients from vermicompost and decomposing paddy straw could have promoted vigorous plant growth and assimilate accumulation. At the same time, improved aeration and root-zone conditions provided by sand may have facilitated nutrient and water uptake. Greater availability of assimilates for underground growth may consequently have encouraged secondary rhizome development. The inherent characteristics of Roma may also have contributed to its higher rhizome branching ability. Comparable results were reported in Turmeric by Dudekula *et al.* (2022) and Bindu *et al.* (2022) [11].

Rhizome yield per plant (gm)

Rhizome yield per plant showed marked differences among the treatment combinations. Treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + Roma) recorded the maximum rhizome yield per plant (311.84 g), followed by T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon), which recorded (271.49 g) per plant. The minimum rhizome yield per plant (148.42 g) was recorded under T₁ (Black soil + Local cultivar). The highest rhizome yield per plant obtained from T₁₂ appears to be the cumulative outcome of better vegetative development and favourable rhizome characteristics. Greater leaf production and tillering may have increased the photosynthetic capacity of the plants, resulting in enhanced assimilate production and assimilates, together with adequate nutrient availability and favourable root-zone conditions, could have been efficiently channelled towards rhizome development and biomass accumulation. The superior yield potential of Roma under the selected growing medium may have further contributed to the higher rhizome yield. Similar results were reported in Turmeric by Patil *et al.* (2022) [12].

Rhizome yield per plot (kg)

Treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + Roma) recorded the highest rhizome yield per plot (2.82 kg), followed by T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon), which produced (2.44 kg) per plot. The lowest rhizome yield per plot (1.33 kg) was recorded under T₁ (Black soil + Local cultivar).

The greater yield obtained per plant under this treatment directly contributed to higher cumulative production at the plot level. Better vegetative growth, higher rhizome number and favourable rhizome development collectively appear to have enhanced the harvestable biomass. Thus, the plot-wise performance of T₁₂ reflects the combined contribution of individual plant productivity and the suitability of the growing medium variety combination. Similar findings were reported in Turmeric by Kumar *et al.* (2015) [9] and Patil *et al.* (2022) [12].

Rhizome yield per hectare (qt/ha)

Treatment T₁₂ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + Roma) recorded the maximum rhizome yield (281.33 qt/ha), followed by T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon), which recorded (244.33 qt/ha). The minimum rhizome yield (132.33 qt/ha) was recorded under T₁ (Black soil + Local cultivar).

The greater yield per plant and corresponding plot yield formed the basis for its superior estimated productivity per hectare. The favourable growing environment provided by the selected medium, together with the better performance of Roma, may have promoted greater accumulation of harvestable rhizome biomass. Similar findings were reported in Turmeric by Kumar *et al.* (2015) [9].

Benefit-cost ratio (per m²)

The treatment combination T₁₂ (Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) recorded the highest Gross Return (Rs. 310.2/m²), followed by T₇ (Black Soil + Vermicompost + Sand + Cocopeat (1:1:1:1) + PDKV Waigaon) with a Gross Return of (Rs. 275.0/m²). The lowest Gross Return (Rs. 104.5/m²) was obtained under T₁ (Black Soil + Local Cultivar).

The highest Net Return was recorded under T₁₂ (Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) with (Rs. 164.20/m²), followed by T₈ (Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (Rs. 123.59/m²). Treatment T₁ (Black Soil + Local Cultivar) recorded the lowest Net Return of (Rs. 10.02/m²).

In relations of B:C ratio, T₁₂ (Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + Roma) showed the highest value of (2.12), followed by T₈ (Black Soil + Vermicompost + Sand + Paddy Straw (1:1:1:1) + PDKV Waigaon) with (1.85). The lowest B:C ratio of (1.10) was recorded under T₁ (Black Soil + Local Cultivar).

The use of paddy straw as a component of the growing medium may hold assisted reduce the cost associated with the media, while the superior yield of Roma increased the gross and net returns acquired from the treatment. Consequently, the balance among production cost and economic output was more favourable in T₁₂, resulting in the highest profitability between the treatment combinations.

Table 2. Effect of different growing media and varietal combinations on plant height, number of leaves and number of tillers per plant at different days after planting (DAP) of turmeric

Treatments	PH (DAP)				NLP (DAP)				NTP (DAP)			
	60	90	120	150	60	90	120	150	60	90	120	150
T1	16.50	29.42	33.50	35.42	4.25	7.08	9.25	10.25	1.08	1.50	1.75	1.83
T2	21.94	36.48	41.17	43.38	6.08	9.17	12.33	13.08	1.67	2.42	3.17	3.25
T3	26.83	41.95	46.37	49.68	7.58	11.33	14.58	15.92	2.25	3.00	3.50	3.58
T4	23.17	37.58	42.83	45.64	7.00	10.25	13.42	14.42	2.00	2.75	3.33	3.50
T5	20.37	34.57	39.13	41.52	5.75	8.08	10.67	11.67	1.25	2.42	3.25	3.33
T6	24.40	38.80	43.50	46.43	5.92	8.92	11.58	12.58	1.50	2.00	2.58	2.75

(continued on next page)

Treatments	PH (DAP)					NLP (DAP)				NTP (DAP)		
T7	21.93	35.17	40.73	43.38	6.17	9.50	12.25	13.33	1.58	2.25	2.75	2.83
T8	30.17	46.92	51.80	56.39	8.42	12.25	15.83	17.17	2.50	3.17	3.83	4.00
T9	22.90	33.30	38.83	41.26	5.58	8.42	11.08	12.08	1.42	2.25	2.67	2.75
T10	25.20	39.88	44.30	47.67	6.42	9.83	12.50	13.92	1.75	2.50	3.00	3.00
T11	27.57	42.65	47.60	51.14	7.33	10.58	13.83	15.00	2.03	2.75	3.42	3.50
T12	34.33	52.58	57.83	62.08	9.67	14.75	17.25	18.58	2.75	3.75	4.50	4.58
C.D. (5%)	1.73	2.43	1.98	1.75	0.35	0.44	1.56	0.45	0.14	0.17	0.17	0.16
SE±(m)	0.59	0.83	0.67	0.59	0.12	0.15	0.53	0.15	0.05	0.06	0.06	0.05
C.V.	4.16	3.67	2.65	2.17	3.06	2.57	2.09	1.88	4.65	3.98	3.24	2.87

*PH = Plant Height, NLP = Number of leaves per plant, NTP = Number of tillers per plant

Table 3. Effect of different growing media and varietal combinations on finger characteristics, rhizome development and yield of turmeric

Treatments	LF (cm)	DMF (cm)	NPR	NSR	RYPL (gm)	RYP (kg)	RYH (q.)
T1	4.73	1.77	5.25	7.17	148.42	1.33	132.33
T2	6.36	2.34	5.92	8.25	177.15	1.60	159.33
T3	7.13	2.64	6.58	9.50	202.63	1.82	182.67
T4	6.66	2.69	7.17	10.33	227.28	2.04	203.33
T5	6.02	2.35	6.08	8.58	180.54	1.62	161.00
T6	6.29	2.51	6.83	9.75	204.18	1.85	184.00
T7	6.41	2.57	7.50	10.42	225.61	2.03	202.00
T8	8.72	3.14	8.42	12.67	271.49	2.44	244.33
T9	6.52	2.47	6.67	8.92	188.05	1.69	169.67
T10	7.08	2.75	7.33	10.58	238.82	2.15	214.67
T11	7.06	2.72	7.92	10.83	254.91	2.29	228.00
T12	8.27	3.34	9.58	14.08	311.84	2.82	281.33
C.D. (5%)	0.51	0.18	0.46	0.72	14.73	0.11	0.11
SE±(m)	0.17	0.06	0.15	0.24	5.02	0.03	0.04
C.V.	4.49	4.26	3.84	4.23	3.96	3.43	3.54

*LF = Length of finger, DMF = Diameter of finger, NPR = Number of primary rhizomes, NSR = Number of secondary rhizomes, RYPL = Rhizome yield per plant, RYP = Rhizome yield per plot, RYH = Rhizome yield per hectare

Conclusion

In the present investigation, treatment combination T₁₂ (Black soil + Vermicompost + Sand + Cut paddy straw (1:1:1:1) + Roma variety) recorded the maximum plant height, number of leaves per plant, number of tillers per plant, finger diameter, number of primary and secondary rhizomes, rhizome yield per plant, rhizome yield per plot, rhizome yield per hectare and benefit-cost ratio. However, T₈ (Black soil + Vermicompost + Sand + Paddy straw (1:1:1:1) + PDKV Waigaon variety) recorded the maximum primary finger length. Thus, T₁₂ can be considered the most promising treatment combination for growth, yield and economic performance of Turmeric under grow bag conditions. Therefore, T₁₂ may be recommended as a promising growing medium–variety combination for Turmeric cultivation under grow bag conditions.

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