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Effect of organic manures and micronutrient foliar application on the growth attributes of turmeric (*Curcuma longa* L.) cv. Konkan Halad-1 raised by pro tray seedling method

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ABSTRACT

The experiment was carried out during Kharif season of 2025-26 at College of Horticulture, Dapoli, Dist. Ratnagiri (M.S.). The experiment was laid out in FRBD having sixteen treatment combinations with three replications. These combinations includes four organic manures levels viz. O₁: Vermicompost 10 t/ha + Jeevamrut 10%, O₂: Vermicompost 10 t/ha + Cow Urine 10%, O₃: FYM @ 20 t/ha + Jeevamrut 10%, O₄: FYM @ 20 t/ha + Cow Urine 10% and four micronutrient foliar sprays viz. M₁: Borax 0.2%, M₂: Borax 0.3%, M₃: ZnSO₄ 0.50%, M₄: ZnSO₄ 0.75%. Among organic manures treatment, vermicompost 10 t/ha + cow urine 10% (O₂) recorded highest values of growth attributes including plant height (113.08 cm), number of leaves (11.50), leaf length (48.90 cm), leaf width (16.84 cm) and number of tillers (3.27). In case of micronutrient foliar sprays, Borax 0.3% (M₂) recorded highest values of plant height (104.90 cm), number of leaves (11.55), leaf length (46.58 cm) and number of tillers (3.32). The treatment combination of O₂M₂: Vermicompost @ 10 t/ha + Cow urine 10% + Borax 0.3% found superior, recording highest plant height (124.13 cm), number of leaves (11.93), leaf length (52.20 cm), leaf width (18.21 cm) and number of tillers (3.60). Thus, from the results obtained, application of vermicompost 10 t/ha + cow urine 10% with foliar application of Borax 0.3% was found to be superior in Konkan region.

Keywords: Turmeric, Organic manures, Micronutrients, Growth attributes, Vermicompost

Introduction

Turmeric serves wide range of uses such as spice, cosmetics, colouring agent, flavouring and has aromatic, stimulative and carminative properties. Commercially, turmeric is traded as a spice, dye, oleoresin and source of industrial starch. Turmeric is used in preparation of curry; it is not only used for colouring but also add flavour to curries. It holds significant spiritual importance in Hindu religion and applied to wounds as well as cuts as an antiseptic property. The key active component in turmeric is curcumin for its antioxidant and therapeutic properties. Turmeric is used in traditional medicine as a household remedy for various diseases including cough, biliary disorders, diabetic wounds, sinus, rheumatism, hepatic disorders and sinus hence turmeric is known as "Kitchen Queen". India is the largest producer, consumer and exporter of curcumin, accounting for over 80% of global production. Turmeric holds significant value in India's spice trade, ranking third in total spice exports.

Turmeric is a nutrient-intensive crop, extracting significant nutrients from the soil. Therefore, adequate nutrient application is essential to meet its requirements and achieve higher yield and quality.

In developing countries land application of organic manures has been the traditional means of maintaining soil fertility, ecological balance and in recent years there has been a great demand for organically produced turmeric worldwide, especially in European countries. The adverse effects of continuous use of high dose of chemical fertilizers on soil health and environment like contaminating the water, air and food, inhibiting growth of soil microorganism, decrease soil fertility were realized; hence the farmers are also showing considerable inclination towards traditional farming with least usage of fertilizers practices which are environment friendly and ecologically balanced (Ronya *et al.*, 2020) [1].

Turmeric responds well to organic cultivation practices, especially the use of organic manures and organic formulation as alternatives to synthetic fertilizers. According to Hossain *et al.* (2007) [2], organic nutrient sources improve soil fertility, maintain productivity, reduce reliance on chemical fertilizers and lessen environmental impacts. Organic manures enhance soil microbial activity and nutrient availability, while organic formulation by spraying or drenching supplies readily available nutrients and growth-promoting compounds. Together, they improve plant growth, root development and rhizome yield in turmeric.

Turmeric is highly responsive to chemical fertilizers and application of micronutrients fertilizers has been shown to reduce disease incidence and enhance post-harvest durability of ginger and turmeric (Halder *et al.*, 2007) [3]. Moreover, the lateritic soil of Konkan is deficient in Datta *et al.* (2017) [4] also reported the positive effect of various micronutrients on turmeric growth and yield.

2. Material and methods

The experiment was carried out during *Kharif* season of 2025-26 under climatic conditions of Konkan region at the No. 4 Nursery, College of Horticulture, Dapoli. The experiment was laid out in FRBD having sixteen treatment combinations with three replications. These combinations includes four organic manures levels viz. O₁: Vermicompost 10 t/ha + Jeevamrut 10%, O₂: Vermicompost 10 t/ha + Cow Urine 10%, O₃: FYM @ 20 t/ha + Jeevamrut 10%, O₄: FYM @ 20 t/ha + Cow Urine 10% and four micronutrient foliar sprays viz. M₁: Borax 0.2%, M₂: Borax 0.3%, M₃: ZnSO₄ 0.50%, M₄: ZnSO₄ 0.75%.

Different cultural practices were carried out in the experiment field as and when required. The ploughing process was done to achieve a fine tilth in field. For each treatment, the raised bed of size 3m×1m was prepared under a FRBD design comprising 16 treatment combinations with three replications. Vermicompost @ 10 t/ha and FYM @ 20 t/ha was uniformly applied to the respective plot and mixed thoroughly into the soil at the time of planting. Jeevamrut @ 10% and Cattle urine 10% was applied in the form of drenching 30, 60 and 90 days after transplanting. Micronutrients foliar spraying of Borax 0.2%, Borax 0.3%, ZnSO₄ 0.50%, ZnSO₄ 0.75% was done early in the morning using knapsack sprayer. Spraying was done at 30, 60 and 90 days after transplanting.

To record biometric observations, ten plants were randomly chosen from each net plot. The selected plants were labeled properly. The data obtained during research work was analyzed statistically as per the design and procedure suggested by the Panse *et al.* (1995) [5].

3. Results and Discussion

3.1 Plant height (cm)

Application of organic manures and micronutrient foliar sprays showed significant effect on plant height of the turmeric at 150 DAP and the results are presented in Table 1. Among the various organic manures treatments, application of Vermicompost @ 10 t/ha + Cow Urine 10% (O₂) showed the significantly highest plant height (113.08 cm) whereas, the minimum plant height (95.79 cm) was observed in FYM @ 20 t/ha + Jeevamrut 10% (O₃). The increase in plant height indicating that the higher nutrient availability and improved soil fertility due to the treatment O₂. The similar results were observed by Tania *et al.* (2021) [6]. Micronutrient foliar application of borax 0.3% (M₂) showed the highest plant height (104.90 cm) which was found at par with M₁: Borax 0.2% and M₄: ZnSO₄ 0.75% (104.85 cm and 103.08 cm, respectively) however, the minimum plant height (101.82 cm) was recorded with the application of ZnSO₄ 0.50% (M₃). Boron facilitates cell wall formation and improves the transport of nutrients and sugar which directly supporting rapid vertical growth. Zinc essential for producing growth hormone, auxin synthesis, photosynthesis which promote stem and internode elongation. The adequate foliar application enhanced the vegetative growth. The similar results found by the Manna *et al.* (2016) [7]. Among the different treatment combinations, O₂M₂: Vermicompost @ 10 t/ha + Cow urine 10% + Borax 0.3% recorded highest plant height (124.13 cm) whereas, the minimum plant height (92.97 cm) was recorded in O₄M₃: FYM @ 20 t/ha + Cow Urine 10% + ZnSO₄ 0.50%.

3.2 Number of leaves per plant

The data showed that the number of leaves per plant were significantly affected by application of organic manures and micronutrient foliar spray at 150 DAP (Table 1). The application of organic manures *i.e.*, vermicompost @ 10 t/ha + Cow Urine 10% (O₂) showed the significantly

maximum number of leaves (11.50) which was found at par with the O₁: Vermicompost @ 10 t/ha + Jeevamrut 10% and O₄: FYM @ 20 t/ha + Cow Urine 10% (11.41 and 11.42, respectively) whereas, the minimum number of leaves per plant (11.28) was recorded with the application FYM @ 20 t/ha + Jeevamrut 10% (O₃). The integrated use of organic manure sources promotes soil biological activity, improves nutrient uptake, promote vegetative growth and leaf development which contribute to production of more leaves. The similar results were found by Vadiraj *et al.* (1998) [8] and Patel *et al.* (2018) [9]. Among micronutrient foliar sprays, the maximum number of leaves per plant (11.55) were recorded with the M₂: Borax 0.3% which was found at par with the M₁: Borax 0.2% (11.48), whereas the M₄: ZnSO₄ 0.75% recorded minimum number of leaves (11.26). The increased in number of leaves might be due to the role of micronutrients in growth of the plant. Boron plays an important role in cell wall formation and elongation, translocation of carbohydrates, auxin synthesis which enhanced leaf initiation. However, zinc is essential for the enzyme activation, protein synthesis which improved photosynthesis efficiency and growth of the plant. The similar result was reported by Datta *et al.* (2017) [4]. The interaction effect of O₂M₂: Vermicompost @ 10 t/ha + Cow urine 10% + Borax 0.3% recorded maximum number of leaves (11.93), whereas the minimum number of leaves (11.07) recorded with the treatment O₂M₄.

3.3 Leaf length (cm)

The data regarding the leaf length of turmeric showed the significant results by the application of organic manures and micronutrient foliar sprays at 150 DAP which is presented in Table 2. Among the various treatments of organic manures, application of Vermicompost @ 10 t/ha + Cow Urine 10% (O₂) showed the significantly maximum leaf length (48.90 cm), whereas the minimum leaf length (43.20 cm) was observed in FYM @ 20 t/ha + Jeevamrut 10% (O₃). Vermicompost provides lower C:N ratio compared to FYM, promoting quick and steady supply of macro and micronutrients. Cow urine provides nitrogen in the form of Urea, provides plant growth promoting substance like auxins. This quick nutrient release promotes vegetative elongation of leaf sheath and leaf blades. The similar result has also been reported by Sarma *et al.* (2015) [10] and Patel *et al.* (2018) [9]. Foliar application of Borax 0.3% (M₂) showed the maximum leaf length (46.58 cm) which was found at par with the M₄: ZnSO₄ 0.75% and M₁: Borax 0.2% (45.45 cm and 46.15 cm, respectively), whereas minimum leaf length (44.53) recorded with treatment M₃: ZnSO₄ 0.50%. Foliar application of boron absorbed by the expanding leaves and helps in transport of carbohydrates and sugars to growing apical and intercalary meristem of the leaves. Carbohydrates and sugar availability helps in cell division and elongation and increasing leaf length. The results corresponding to the observation are also reported by the Hnamte *et al.* (2018) [11]. Among the different treatment combinations application of Vermicompost @ 10 t/ha + Cow urine 10% + Borax 0.3% (O₂M₂) recorded maximum leaf length (52.20 cm), however application of FYM + Cow Urine 10% + ZnSO₄ 0.50% (O₄M₃) recorded minimum leaf length (40.86 cm).

3.4 Leaf width (cm)

The data on effect of organic manures, micronutrient foliar sprays and their interaction on leaf width of turmeric at 150 DAP is given in the Table 2. The leaf width of turmeric plant significantly influence by the application of organic manures. The results showed that the application of Vermicompost @ 10 t/ha + Cow Urine 10% (O₂) recorded maximum leaf width (16.84 cm), however the minimum leaf width (15.19 cm) observed with application of FYM @ 20 t/ha + Jeevamrut 10% (O₃). The combining application of vermicompost with a cow urine provides optimal nutritional availability for leaf expansion. The similar results were reported by the Sarma *et al.* (2015) [10]. Among different foliar sprays of micronutrients Borax 0.2% (M₁) showed the maximum leaf width (16.36 cm) which was found at par with Borax 0.3% (M₂) and ZnSO₄ 0.50% (M₃) *i.e.*, 15.90 cm and 15.60 cm, respectively. However, foliar application of ZnSO₄ 0.75% (M₄)

recorded minimum leaf width (15.20 cm). Application of boron also accelerates translocation of sugar and carbohydrates which helps in cell division and elongation across the leaf blades width and promotes vegetative growth of the turmeric plant. Similar findings reported by the Hnamte *et al.* (2018) [11]. Among all treatment combinations, Vermicompost @ 10 t/ha + Cow urine 10% + Borax 0.3% (O₂M₂) recorded the maximum leaf width (18.21 cm), which was found at par with the O₁M₁, O₂M₁, O₄M₁ and O₃M₃ *i.e.*, 17.21 cm, 16.68 cm, 17.22 cm and 16.63 cm, respectively. However, application of FYM + Cow Urine 10% + ZnSO₄ 0.50% (O₄M₃) recorded minimum leaf width (14.02 cm).

3.5 Number of tillers per plant

Application of organic manures and micronutrient foliar sprays showed significant effect on number of tillers per plant of the turmeric at 150 DAP and the results are presented in Table 3. Among organic manures treatments application of vermicompost @ 10 t/ha + Cow Urine 10% (O₂) showed the significantly maximum number of tillers per plant (3.27) which was found at par with the O₁: Vermicompost @ 10 t/ha + Jeevamrut 10% and O₃: FYM @ 20 t/ha + Jeevamrut 10% (3.23 and 3.23, respectively), however the minimum

number of tillers (3.17) recorded with the application of FYM @ 20 t/ha + Cow Urine 10% (O₄). Vermicompost improves the physical and biological properties of soil which helps in better nutrient uptake and root development. Organic formulations like cow urine and Jeevamrut are rich in beneficial microbes and plant growth promoting substance like auxins and gibberellins that stimulates active bud development and cell division, ultimately leading to higher tiller production per plant. The result corresponding to the observations were also reported by Tania *et al.* (2021) [6] and Parikh *et al.* (2023) [12]. Foliar application Borax 0.3% (M₂) recorded the maximum number of tillers per plant (3.32) which was found at par with ZnSO₄ 0.75% (M₄) *i.e.*, 3.28. However, the minimum number of tillers per plant recorded with the application of M₃: ZnSO₄ 0.50% (3.14). Boron plays important role in strengthening cell wall, cell division, regulating hormonal imbalance, enhance uptake of nutrient which helps in development of tillers. While, zinc plays role in protein synthesis, chlorophyll formation, enzyme activation. Together, these micronutrients optimize plant structure, metabolism activities, leading to increased tillers production. Similar, outcome reported by the Gawit (2024) [13] and Shadap *et al.* (2018) [14]. Among different treatment combinations Vermicompost @ 10 t/ha+

Table 1. Effect of organic manures, micronutrient foliar sprays and their interaction on plant height and number of leaves per plant of turmeric cv. Konkan Halad-1 raised by pro tray seedling method

At 150 DAP										
Treat	Plant height (cm)					Number of leaves per plant				
	M ₁	M ₂	M ₃	M ₄	Mean	M ₁	M ₂	M ₃	M ₄	Mean
O ₁	108.07	105.03	108.43	104.53	106.52	11.47	11.37	11.33	11.47	11.41
O ₂	107.53	124.13	105.63	115.00	113.08	11.53	11.93	11.47	11.07	11.50
O ₃	94.37	93.97	100.23	94.60	95.79	11.30	11.40	11.20	11.20	11.28
O ₄	109.43	96.47	92.97	98.20	99.27	11.60	11.50	11.27	11.30	11.42
Mean	104.85	104.90	101.82	103.08		11.48	11.55	11.32	11.26	
	S.Em±		C.D at 5%		Result	S.Em±		C.D at 5%		Result
O	0.84		2.44		SIG	0.05		0.13		SIG
M	0.84		2.44		SIG	0.05		0.13		SIG
OXM	1.68		4.88		SIG	0.09		0.26		SIG

Table 2. Effect of organic manures, micronutrient foliar sprays and their interaction on leaf length and leaf width of turmeric cv. Konkan Halad-1 raised by pro tray seedling method

At 150 DAP										
Treat	Leaf length (cm)					Leaf width (cm)				
	M ₁	M ₂	M ₃	M ₄	Mean	M ₁	M ₂	M ₃	M ₄	Mean
O ₁	46.37	44.62	45.77	46.08	45.71	17.21	15.27	15.24	15.16	15.72
O ₂	48.96	52.20	47.08	47.37	48.90	16.68	18.21	16.53	15.93	16.84
O ₃	41.46	43.61	44.41	43.32	43.20	14.32	15.06	16.63	14.73	15.19
O ₄	47.80	45.88	40.86	45.03	44.89	17.22	15.07	14.02	14.97	15.32
Mean	46.15	46.58	44.53	45.45		16.36	15.90	15.60	15.20	
	S.Em±		C.D at 5%		Result	S.Em±		C.D at 5%		Result
O	0.45		1.32		SIG	0.28		0.82		SIG
M	0.45		1.32		SIG	0.28		0.82		SIG
OXM	0.91		2.63		SIG	0.59		1.65		SIG

(continued on next page)

Table 3. Effect of organic manures, micronutrient foliar sprays and their interaction on number of tillers per plant of turmeric cv. Konkan Halad-1 raised by pro tray seedling method

At 150 DAP					
Number of tillers per plant					
Treat	M ₁	M ₂	M ₃	M ₄	Mean
O ₁	3.27	3.33	3.20	3.13	3.23
O ₂	3.13	3.60	3.17	3.17	3.27
O ₃	3.13	3.20	3.27	3.33	3.23
O ₄	3.13	3.13	2.93	3.47	3.17
Mean	3.17	3.32	3.14	3.28	
	S.Em±		C.D at 5%		Result
O	0.02		0.06		SIG
M	0.02		0.06		SIG
OXM	0.04		0.13		SIG

Cow urine 10% with foliar spray Borax 0.3% (O₂M₂) recorded maximum number of tillers per (3.60) which was found at par with the O₄M₄ (3.47). The minimum number of tillers per plant (2.93) recorded with the O₄M₃: FYM + Cow Urine 10% + ZnSO₄ 0.50%.

4. Conclusion

On the basis data obtained from the present investigation, it may be concluded that among the different treatments of organic manures, application of vermicompost 10 t/ha + cow urine 10% (O₂) recorded highest values of growth attributes (plant height, number of leaves, leaf length, leaf width and number of tillers per plant). Among micronutrients foliar spray, application of Borax 0.3% (M₂) showed the significant impact on growth parameters (plant height, number of leaves, leaf length and number of tillers per plant) and recorded highest values. In case of interaction effect between organic manures and micronutrient foliar sprays, application of vermicompost 10 t/ha + cow urine 10% with foliar application of Borax 0.3% (O₂M₂) showed the promising results on growth attributes like plant height, number of leaves, leaf length, leaf width and number of tillers per plant.

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