

Effect of phosphorus levels on growth and yield of turmeric (*Curcuma longa* L.)

Rakesh Banwasi & Ajit Kumar Singh

Indira Gandhi Krishi Vishwavidyalaya
Regional Agriculture Research Station
Boirdadar, Raigarh – 496 001, Chattisgarh, India.

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Abstract

A field experiment was conducted at Raigarh (Chattisgarh) to study the effect of five levels of phosphorus (0, 50, 100, 150 and 200 kg P₂O₅ ha⁻¹) on growth and yield of turmeric (*Curcuma longa*) (var. TCP-1). A common dose of N @ 150 kg ha⁻¹ and K₂O @ 120 kg ha⁻¹ was applied in all the treatments. Application of phosphorus significantly influenced various growth characters and yield. The highest yield of fresh rhizome (156.3 q ha⁻¹) was recorded with application of 150 kg P₂O₅ ha⁻¹ followed by 149.2 and 147.9 ha⁻¹ rhizomes with application of 100 and 200 kg P₂O₅ ha⁻¹, respectively. These treatments were significantly superior over other treatments and on par with each other. However cost : benefit ratio was highest in the treatment with application of 150 kg P₂O₅.

Keywords: *Curcuma longa*, nutrition, phosphorus, turmeric, yield.

Turmeric (*Curcuma longa* L.) is grown in light textured soil of Raigarh District in Chattisgarh, which is generally considered poor in phosphorus. The crop is known to respond well to fertilizer application. Significant influence of major nutrients on growth and yield of turmeric was reported by Rao & Reddy (1977), Rao & Swami (1984) and Sheshgiri & Uthaiiah (1994). However, information on nutritional aspects of turmeric in this region is meagre. The present investigation was undertaken to study the effect of phosphorus on growth and yield of turmeric.

The experiment was conducted during 2004-05 and 2005-06 at Regional Agricultural Research Station, Indira Gandhi Krishi

Vishwavidyalaya, Raigarh (Chattisgarh) in a randomized block design consisting of five levels of phosphorus (0, 50, 100, 150 and 200 kg P₂O₅ ha⁻¹) and four replications. Raigarh is situated at 21° 20' to 22° 23' latitude and at 82° 55' to 83° 23' longitude; the average rainfall is 1350 mm, mostly during July – September. The soil is well drained sandy loam with pH 6.7, low in organic carbon (0.44%), available nitrogen (225.7 kg ha⁻¹) and available phosphorus (9.2 kg ha⁻¹) and medium in available potassium (288 kg ha⁻¹). Turmeric variety TCP-1 was planted at a spacing of 30 cm × 20 cm in a plot size of 3.0 m × 1.0 m. Farmyard manure was applied @ 20 t ha⁻¹ before planting. Single super phosphate fertilizer was used as source of phosphorus.

Recommended dose of nitrogen @ 150 kg ha⁻¹ as urea, and potassium @ 120 kg ha⁻¹ as muriate of potash were applied in all plots. Entire dose of phosphorous and half dose of potassium was applied 90 days after planting. The inorganic nitrogen fertilizer was applied in three splits at 30, 60 and 90 days after planting. The crop was raised in irrigated condition. Weeding was performed three times just before application of nitrogen. Five clumps were selected from each plot for observation of growth characters at 130 days after planting. The yield attributes and yield of rhizomes were recorded at harvest.

Growth characters:

Application of phosphorous significantly influenced various growth parameters of turmeric (Table 1). Maximum plant height (69.80 cm), number of tillers clump⁻¹ (2.60 cm),

leaf length (44.79 cm) and leaf width (9.93 cm) were recorded with application of 150 kg phosphorous ha⁻¹ (T4) which was on par with phosphorous @ 100 kg ha⁻¹ (T3) and phosphorous @ 200 kg ha⁻¹ (T5). The increase in growth parameters was not significant beyond 100 kg phosphorus ha⁻¹ indicating that the increase does not take place proportionately beyond a certain level. Although the treatments of phosphorus @ 100 kg, 150 kg and 200 kg ha⁻¹ with the common dose of 150 kg nitrogen and 120 kg potassium ha⁻¹ recorded similar growth, the treatment 100 kg ha⁻¹, being a lower level, seems optimum for attaining highest growth, ultimately contributing to the final yield. Similar results were also reported by Sheshgiri & Uthaiah (1994) in turmeric in Karnataka.

Table 1. Effect of different levels of phosphorus on growth characters of turmeric

Treatment	P ₂ O ₅ (kg ha ⁻¹)	Plant height (cm)	Tillers clump ⁻¹	Leaves clump ⁻¹	Leaf length (cm)	Leaf breadth (cm)
T ₁	0	52.04	2.02	10.20	31.07	7.24
T ₂	50	59.56	2.30	12.35	38.53	8.93
T ₃	100	64.12	2.47	12.92	42.09	9.28
T ₄	150	69.80	2.60	13.07	44.79	9.93
T ₅	200	64.27	2.45	12.62	40.73	9.18
CD (P=0.05)		7.51	0.28	1.86	4.08	0.93
SEm±		2.438	0.092	0.605	1.322	0.302

Values are pooled data for 2004-05 and 2005-06.

Table 2. Effect of different levels of phosphorus on yield attributes and yield of turmeric

Treatment	P ₂ O ₅ (kg ha ⁻¹)	No. of primary fingers clump ⁻¹	No. of secondary fingers clump ⁻¹	Yield of fresh rhizomes (q ha ⁻¹)			Cost : Benefit Ratio
				2004-05	2005-06	Pooled	
T ₁	0	4.65	6.36	116.83	96.98	106.90	1.30
T ₂	50	5.15	7.72	135.87	127.38	131.62	1.80
T ₃	100	5.67	8.54	153.21	145.22	149.21	2.12
T ₄	150	6.49	8.77	159.39	153.26	156.32	2.22
T ₅	200	5.39	8.19	151.25	144.47	147.86	2.00
CD (P=0.05)	0.47	0.99	12.40	15.83	10.27	-	
SEm±	0.152	0.320	4.024	5.138	3.278	-	

Values are pooled data for 2004-05 and 2005-06.

Yield attributes and yield

Application of various levels of phosphorus significantly influenced yield attributes and yield of turmeric (Table 2). Significantly higher number of primary fingers clump⁻¹ (6.49) was recorded in the treatment 150 kg phosphorus ha⁻¹. Maximum number of secondary fingers clump⁻¹ (8.77) was observed with application of 150 kg phosphorus ha⁻¹ which was on par with the treatments 100 and 200 kg phosphorus ha⁻¹. In turmeric, increased vegetative growth generally results in increased production and storage of photosynthates in rhizomes, which accounts for higher yield (Latha *et al.* 1995). All the treatments of phosphorus (50, 100, 150 and 200 kg ha⁻¹) significantly increased the yield over control. Maximum yield of fresh rhizomes (156.3 q ha⁻¹) was recorded with application of 150 kg phosphorus ha⁻¹ followed by 149.2 and 147.9 q ha⁻¹ rhizomes in the treatments 100 and 200 kg ha⁻¹ phosphorus, respectively. These treatments were significantly at par with each other and also significantly superior over rest of treatments. Increased rhizome yield with increase in levels of nutrients in turmeric were also reported by Sheshgiri & Uthaiah (1994),

Rao & Reddy (1977) and Rao & Swamy (1984). The study indicated that application of phosphorus @ 150 and 100 kg ha⁻¹ resulted in better vegetative growth as well as higher yield of turmeric under Raigarh conditions. However, application of phosphorus @ 150 kg ha⁻¹ was the best with respect to cost: benefit ratio (1:2.22).

References

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