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Influence of different levels of nitrogen and potassium on growth and yield of turmeric (*Curcuma longa* L.)

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Abstract

A nutritional trial on turmeric (*Curcuma longa* L.) variety Suvarna, conducted with three levels of nitrogen (45, 60 and 75 kg ha^{-1}) and three levels of potassium (90, 120 and150 kg ha^{-1}) at Horticulture Research Farm, Allahabad Agricultural Institute, indicated that the growth and yield potential of the crop under Allahabad agro climatic condition can be increased by applying NPK at the rate of 75 : 60 : 150 kg ha^{-1}.

Key words: *Curcuma longa*, growth, fertilizer, turmeric, yield.

Turmeric is an important spice as well as medicinal plant, which thrives well at higher elevation and also under rainfed conditions. Cultivation of turmeric on commercial scale in the plains of Uttar Pradesh could be possible with the development of indigenous technology. The crop is known to respond well to fertilizer application (Rao & Reddy 1977; Rao & Swamy 1984). The chief consideration for increasing the growth and yield is by increasing the availability of nitrogen and potassium (Muthuvel *et al.* 1989). Hence, the present investigation reports some preliminary findings on the influence of different levels of nitrogen and potassium on growth and yield of turmeric and also the most suitable fertilizer combination for this region.

The trial was conducted at Horticulture Research Farm, Allahabad Agriculture Institute in *kharif* season during 2000-2001. The soil of the experimental plot was clay loam, low in nitrogen and potassium, medium in phosphorus and a pH of 7.4. The experiment was laid out in 3 x 3 factorial (arranged in RBD) design with three replications. The treatments consisted of all possible combinations of three levels of nitrogen (45, 60 and 75 kg ha^{-1}) and three levels of potassium (90, 120 and 150 kg ha^{-1}). Phosphorus was supplied uniformly @ 60 kg ha^{-1}. These levels of N and K are 25% less and more of the recommended dose (60 : 60 : 120 kg NPK ha^{-1}), in order to find out the best combination of fertilizer for Allahabad agro climatic conditions.

The rhizomes were sown directly on the prepared plot (2.5 x 1 m) in the first week of July 2000, with a spacing of 50 cm x 50 cm. FYM was applied @ 40 t ha^{-1}, during land preparation; nitrogen, phosphorus and potassium were supplied in the form of urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. Observations on growth characters of 5 plants, randomly selected from each plot, were recorded at 120 days after sowing (DAS). The crop was harvested in the first week of March 2001. Data on plant height,,number of leaves, leaf area, number of tillers, length and girth of mother rhizome, number of primary and secondary fingers, fresh

Table 1. Effect of different levels of nitrogen and potassium on growth of turmeric

Treatment (NPK kg ha^{-1})	Plant ht. (cm)	Leaves plant^{-1}	Tillers clump^{-1}	Leaf area (cm^2)
T1(45:60:90)	77.26	7.66	2.26	416.06
T2(45:60:120)	83.06	7.90	2.66	447.50
T3(45:60:150)	85.10	8.13	3.00	487.16
T4(60:60:90)	84.00	8.53	2.80	464.10
T5(60:60:120)	86.76	8.13	2.80	473.66
T6(60:60:150)	87.40	8.56	2.86	498.66
T7(75:60:90)	86.93	8.70	2.93	501.83
T8(75:60:120)	97.03	8.96	3.66	556.16
T9(75:60150)	102.13	9.50	4.06	571.50
C.D. (5%)	5.35	0.55	0.25	25.44

weight, rhizome yield ha^{-1} and curing percentage, were recorded and statistically analyzed. Leaf area was computed by multiplying the product of length and breath of leaf with a conversion factor 0.72 (Rao & Swamy 1984).

Nitrogen and potassium levels have significantly influenced growth characteristics. As the level of nutrients increased there was significant increase in plant height, number of leaves, leaf area and number of tillers of the plants (Table 1). Maximum plant height (95.36 cm), number of leaves (9.05) and leaf area (543.16 cm^2) were obtained when nitrogen was supplied with 75 kg ha^{-1} (Table 3). Similarly, maximum plant height (91.73 cm), number of leaves (8.73), leaf area (519.11cm^2) and number of tillers (3.31) were obtained when potassium was supplied with 150 kg ha^{-1} (Table 4). This showed that with 25% increase of the recommended dose, there is an increase in uptake of nitrogen and potassium. There was significant decrease in growth when the fertilizer level was reduced by 25% from the recommended dose. Hence 75 : 60 : 120 kg ha^{-1} of NPK was found optimum for attaining higher growth ultimately contributing to the final yield.

In turmeric, increased vegetative growth results in increased production and storage of photosynthates in rhizomes, which accounts for higher yield. In the present study also, a significant increase in rhizome yield was observed with increase in nitrogen and potassium levels (Tables 2 & 4). Statistical analysis of data showed that maximum length of mother rhizome (8.21 cm), girth of mother rhizome (5.51 cm), nodes per mother rhizome (9.31), number of primary fingers (10.91) and number of secondary fingers (14.26) were found in plants supplied with 75 kg N ha^{-1}. Similarly maximum yield characteristics were found in plants supplied with 150 kg K_2O ha^{-1}. The highest fresh weight (458.9 g) of the rhizome was found when plants were supplied with 75 kg N ha^{-1}and 150 kg K_2O ha^{-1}. Maximum curing percentage of 29.17% was found with 75 kg N ha^{-1} and 150 kg K_2O ha^{-1}. This may be due to increase in uptake of nitrogen and potassium

Table2. Effect of different levels of nitrogen and potassium on yield of turmeric

Treatment (NPK kg ha^{-1})	Length of mother rhizome (cm)	Girth (cm)	Nodes rhizome^{-1}	Primary fingers rhizome^{-1}	Fresh weight rhizome^{-1} (g)	Curing percentage of rhizome	Rhizome yield (t ha^{-1})
T1(45:60:90)	5.66	4.06	8.03	6.8o	437.93	25.78	24.40
T2(45:60:120)	5.86	4.17	8.36	7.06	441.70	26.41	24.56
T3(45:60:150)	6.26	4.26	8.56	8.06	445.50	27.04	24.73
T4(60:60:90)	6.46	4.40	8.66	8.43	448.30	27.50	24.93
T5(60:60:120)	6.60	4.53	8.77	9.06	450.00	27.77	25.03
T6(60:60:150)	7.56	4.83	8.90	9.36	452.03	28.09	25.33
T7(75:60:90)	7.90	5.20	9.20	9.99	454.16	28.43	25.60
T8(75:60:120)	8.23	5.46	9.30	11.03	456.76	28.99	25.70
T9(75:60:150)	8.90	5.86	9.43	11.76	458.90	29.17	26.30
C.D. (5%)	0.22	0.16	0.12	0.36	1.21	0.24	0.10

Table 3. Effect of different levels of nitrogen on growth (120 DAS) and yield of turmeric

Parameter	Different levels of Nitrogen			
	N1 (45 kg ha^{-1})	N2 (60 kg ha^{-1})	N3 (75 kg ha^{-1})	C. D. (5 %)
Plant height (cm)	81.18	86.05	95.36	5.35
No. of leaves plant^{-1}	7.80	8.40	9.05	0.55
Leaf area (cm^2)	450.24	478.81	543.16	25.44
Tillers clump^{-1}	2.64	2.82	3.55	0.25
Length of mother rhizome (cm)	5.93	6.87	8.21	0.12
Girth (cm)	4.16	4.58	5.51	0.09
Nodes rhizome^{-1}	8.32	8.78	9.31	0.07
Primary fingers rhizome^{-1}	7.31	8.95	10.91	0.20
Secondary fingers rhizome^{-1}	11.71	12.90	14.26	0.12
Fresh wt. rhizome^{-1} (g)	441.71	450.12	456.61	0.70
Rhizome yield (t ha^{-1})	24.56	25.11	25.80	0.05
Curing (%)	26.41	27.71	28.86	0.14

Table 4. Effect of different levels of potassium on growth (120 DAS) and yield of turmeric

Parameter	Different levels of Potassium.			
	K1 (90 kg ha^{-1})	K2 (120 kg ha^{-1})	K3 (150 kg ha^{-1})	C.D. (5 %)
Plant height (cm)	82.73	86.05	91.73	5.35
No. of leaves plant^{-1}	8.29	8.33	8.73	0.55
Leaf area (sq cm)	460.66	492.44	519.11	25.44
Tillers clump^{-1}	2.66	3.04	3.31	0.25
Length of mother rhizome (cm)	6.67	6.90	7.44	0.12
Girth (cm)	4.55	4.72	4.98	0.09
Nodes rhizome^{-1}	8.63	8.81	8.96	0.07
Primary fingers rhizome^{-1}	8.38	9.05	9.73	0.20
Secondary fingers rhizome^{-1}	12.44	12.95	13.46	0.12
Fresh wt. rhizome^{-1} (g)	446.81	449.48	452.14	0.70
Rhizome yield (t ha^{-1})	24.96	25.11	25.4	0.05
Curing (%)	27.24	27.72	28.10	0.14

with 25 % increase in the recommended dose. The interaction between various levels of nitrogen and potassium was found to be significant during post harvest studies. Increased rhizome yield with increase in levels of nutrients in turmeric was observed by earlier workers (Muralidharan & Balakrishnan 1972; Rao & Reddy 1977; Rao & Swamy 1984; Shankariah & Reddy 1988). Shashidhar *et al.* (1997) found that there was a positive correlation between the uptake of nitrogen and potassium and dry matter accumulation. Tayde & Deshmukh (1986) reported that the growth and yield characteristics increased with increasing nitrogen level and the highest growth and yield were obtained at 100 kg ha^{-1}. Balashanmugam & Subramaniam (1991) and Banafar & Tiwari (1995) reported that the rhizome yield increased with increase in K level from 0 to 125 kg ha^{-1}.

The present study revealed that with increase in fertilizer level there is a linear influence on growth characteristics. Hence the best fertilizer combination which can increase the growth and yield potential of the crop is N P K at the rate of 75 : 60 : 150 kg ha^{-1}.

References

Balashanmgam P V & Subramanian K S 1991 Effect of split application of potassium on turmeric. South Indian Horticulture 39 (3) : 139-142.

Banafar R N S & Tiwari R J 1995 Response of turmeric (*Curcuma longa* L.) to potassium application in medium black soils of Madhya Pradesh. Crop Research Hisar 10(1) : 93-95.

Muralidharan A & Balakrishnan S 1972 Studies on some varieties of turmeric and its fertilizer requirement. Agric. Res. J. Kerala 10 : 112-115.

Muthuvel P, Rajkannan B, Selvaraj K V, Kulandaivelu R & Chamy A 1989 Irrigation, nitrogen and potash requirement of turmeric. South Indian Horticulture 37(1) : 61-63.

Rao M R & Reddy V R 1977 Effect of different levels of nitrogen, phosphorous and potassium on yield of turmeric. J. Plantation Crops 5 (1) : 60-63.

Rao D V R & Swamy G S 1984 Studies on the effect of N, P and K on growth, yield and quality of turmeric. South Indian Horticulture 32(5) : 288-291.

Shankariah V & Reddy I P 1988 Studies on effect of different manural and spacing levels with local and high yielding turmeric varieties. Indian Cocoa, Arecanut & Spices J. 11 (3) : 94-95.

Shashidhar T R, Sulekeri G S & Gaste V D 1997 Effect of different spacing and nitrogen levels on the growth attributes and the dry matter production of turmeric cv. Amalapuram. Mysore. J. Agri. Sci. 31 (3) : 225-229.

Tayde G S & Deshmukh V D 1986 Yield of turmeric as influenced by planting material and N levels. PKV Research J. 10 (1) : 63-65.