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Response of turmeric (*Curcuma longa* L.) to nitrogen in relation to application of farm yard manure and straw mulch

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Abstract

Experiments were conducted during *kharif* 1995 and 1996 at Ludhiana, India, to study the response of turmeric (*Curcuma longa*) to nitrogen in relation to application of farm yard manure and wheat straw mulch. The treatments consisted of two levels of mulch (0 and 6 t/ha), four levels of farm yard manure, (0, 20, 40 and 60 t/ha) and three levels of nitrogen (0, 60 and 120 kg/ha). The study revealed that application of wheat straw mulch improved growth and yield of turmeric significantly. Rhizome yield increased significantly with each increase in farm yard manure level during 1996 with a maximum yield of 365.4 q/ha with 60 t/ha of farm yard manure. Nitrogen levels did not affect growth and yield of turmeric significantly.

Key words : *Curcuma longa,* farm yard manure, mulch, nitrogen, turmeric, yield.

Turmeric (*Curcuma longa* L., Zingiberaceae) is grown for its rhizomes which are used as a condiment in curry powders and as an ingredient in cosmetic, pharmaceutical, confectionary and food industries. Since turmeric removes large amounts of nutrients from soil, sufficient quantities of nutrients have to be applied in order to meet its nutritional requirements and to obtain higher yields (Nagarajan & Pillai 1979). The response of turmeric to the application of nitrogenous fertilizers vary with change in soil and climatic conditions. Since farm yard manure releases nutrients slowly, its application may have favourable affects on turmeric yield. The application of wheat straw mulch not only reduces evaporation losses but also regulates soil temperature (Singh 1992) and smothers weeds. Keeping this in view, an experiment was carried out to study the response of nitrogen in relation to application of farm yard manure and wheat straw mulch.

The experiment was conducted at Students' Farm, Department of Agronomy, Punjab Agricultural University, Ludhiana (India) during *kharif* of 1995

and 1996. The soil of the experimental field was sandy loam, normal in respect to pH and EC, low in organic carbon and available nitrogen and medium in available phosphorus and potassium. The treatments consisted of two levels of wheat straw mulch (0 and 6 t/ha), four levels of farm yard manure (0, 20, 40 and 60 t/ha) and three levels of nitrogen (0, 60 and 120 kg/ha). The experiment was laid out in split plot design with three replications, keeping the combinations of mulch and farm yard manure in main plots and nitrogen levels in sub plots. The crop was planted in flat beds in the first week of May. Rhizomes (variety : PCT 8) of uniform size were planted in lines 30 cm apart, keeping a plant to plant spacing of 20 cm. A basal dose of 40 kg P_2O_5/ha was applied in the form of single superphosphate. Farm yard manure was applied as per treatments one day earlier to planting. Nitrogen in the form of urea was top dressed as per treatments in three equal splits i.e., at 50, 65 and 80 days after planting. Immediately after planting, wheat straw was applied. Irrigations were given as per the requirement of the crop. To control weeds, four hoeings were done in early growth stages. The crop was harvested at the end of December at maturity.

Effect of mulch

The application of straw mulch resulted in quick emergence of the crop, taller plants with more number of leaves, tillers and fingers per plant and reduced dry matter accumulation by weeds (Tables 1 and 2). The application of mulch conserves moisture and lowers

Table 1. Effect of mulch, farm yard manure and nitrogen levels on fresh rhizome yield and biometric characters of turmeric

Treatment	Fresh rhizome yield (kg/ha)		Plant height (cm)		Leaves/ plant		Tillers/ plant		Fingers/ plant	
	1995	1996	1995	1996	1995	1996	1995	1996	1995	1996
Mulch (t/ha)										
0	171.9	225.1	66.4	62.6	6.7	5.4	3.5	2.5	5.1	5.7
6	251.4	323.2	82.2	78.4	6.8	6.1	3.6	3.5	6.2	6.7
CD at 5%	50.0	17.0	12.2	2.7	NS	0.5	NS	0.3	0.8	0.1
FYM (t/ha)										
0	162.2	185.2	62.0	59.2	6.4	5.2	3.4	2.4	4.8	4.6
20	206.0	248.0	72.8	61.6	6.6	5.6	3.3	2.8	5.4	5.6
40	222.8	298.0	75.3	77.5	6.9	5.9	3.6	3.3	5.6	6.6
60	225.5	365.4	87.3	87.7	7.0	6.5	3.8	3.3	6.4	7.9
CD at 5%	NS	19.8	NS	3.8	NS	0.7	NS	NS	NS	0.1
N (kg/ha)										
0	204.7	272.5	73.5	66.3	6.7	5.7	3.5	3.0	5.6	6.1
60	208.3	274.3	73.4	71.7	6.7	5.8	3.6	2.9	5.7	6.2
120	221.9	275.7	76.0	73.5	6.7	5.9	3.5	3.1	5.6	6.2
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS = Not significant

Table 2. Effect of mulch, farm yard manure and nitrogen levels on emergence of the crop, dry matter of weeds and quality of turmeric (1996)

Treatment	Emergence count (%)	Dry matter of weeds at		Curcumin content	Nutrient content in rhizome (%)		
	at 40 DAP	60 DAP	120 DAP	(%)	N	P	K
Mulch (t/ha)							
0	57.3	36.2	44.9	1.12	2.44	0.22	2.44
6	75.4	24.3	38.9	1.14	2.52	0.23	2.53
CD at 5%	13.1	0.7	0.5	NS	NS	NS	NS
FYM (t/ha)							
0	58.2	24.8	37.7	1.09	2.47	0.22	2.48
20	66.2	28.7	42.3	1.10	2.48	0.22	2.49
40	67.5	32.0	43.0	1.16	2.46	0.22	2.47
60	73.4	35.5	44.5	1.17	2.51	0.23	2.48
CD at 5%	NS	1.10	0.7	0.05	NS	NS	NS
N(kg/ha)							
0	68.7	29.6	41.5	1.10	2.46	0.23	2.45
60	64.7	29.8	41.8	1.15	2.49	0.23	2.50
120	65.7	31.4	42.4	1.14	2.49	0.23	2.49
CD at 5%	NS	NS	0.5	NS	NS	NS	NS

DAP = Days after planting; NS = Not significant

soil temperature as compared to pure crop of turmeric (Singh 1992) and this might have resulted in quick and higher emergence of the crop and better establishment of the plants. The application of mulch delayed the emergence of weeds and would have also had a smothering effect on them. This quick and better establishment of the plants along with reduced competition by weeds had a favourable effect on all growth parameters of turmeric.

The application of mulch increased fresh rhizome yield of turmeric significantly as compared to no mulch (Table 1). An increase of 46 and 44% in yield was observed with application of 6 t/ha wheat straw mulch over no mulch during 1995 and 1996, respectively. The higher rhizome yield with straw mulch was due to the improved growth characters and reduced competition by weeds. Mohanty *et al.* (1991) have also reported higher yield of turmeric with mulching.

The contents of curcumin and N, P and K in rhizome was not affected with mulch application (Table 2).

Effect of farm yard manure

The application of farm yard manure improved the growth of the crop. Each increase in farm yard manure increased the emergence of the crop, plant height, number of leaves and fingers per plant (Tables 1 and 2) though the results were significant during the second year only. All these growth characters had contributed in increased rhizome yield with farm yard manure application. Fresh rhizome yield increased with each in-

crease in farm yard manure application significantly during 1996 and maximum yield of 365.4 q/ha was obtained with 60 t/ha farm yard manure (Table 1). However, during 1995, the differences were not significant. Balashanmugam *et al.* (1989) reported increase in turmeric yield with farm yard manure application.

Curcumin content of rhizomes improved significantly with application of 40 and 60t/ha farm yard manure as compared to lower levels of 0 and 20t/ha. N, P and K content in rhizome did not change with application of different levels of farm yard manure.

Effect of nitrogen

Various levels of nitrogen did not affect growth, yield and quality of turmeric during both the years of study (Tables 1 and 2). Turmeric is a long duration crop, therefore, its nutrient removal is spread over a long period of time which could be met easily from soil reserves. The light and frequent irrigations provided during the early crop growth stages might have caused leaching of applied inorganic nitrogen fertilizers. Randhawa *et al.* (1984) have also reported that turmeric did not respond to nitrogen application.

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