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Influence of varieties, dates of planting, spacing and nitrogen levles on growth, yield and quality of turmeric (*Curcuma longa*)

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India is the largest producer and exporter of turmeric (*Curcuma longa* L.) in the world. Among spices grown in India it ranks fifth in area (6 161 300 hectares), second in production (6 53 600 tonnes) and third in export (both in quantity (35 556 tonnes) and value (Rs 1 217 million) during 1999–2000 (S B, 2000). In India, states like Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal contributes 90° of the total production. Tamil Nadu stands third in area (32 511 ha) and second in production (1 67 380 tonnes) and Erode district in the state alone contributes 10% of the national production with high relative spread index (101.81) and very high relative yield index (874.5) (Kandiannan *et al.* 2001) and it is delineated as Turmeric Export Zone. However, its low productivity is a chronic problem. In the present study, effect of dates of planting and nitrogen levels on growth, yield and quality of turmeric varieties under different spacing were conducted to select the best combinaiton.

The field experiments were conducted in well-drained sandy loam soil with irrigation at Agricultural Research Station, Bhavanisagar, (11° 29' N latitude and 77° 08' E longitude with an altitude of 256 m mean sea level) during 2000–01 and 2001–02. The major nutrients status of soil was low in available N and P and high in K with near neutral *p*H (6.9). The experiments were laid out in split plot design with 3 replictions. The combinations of 2 varieties ('BSR 1' and 'BSR 2') and 3 dates of planting (15 May, 15 June and 15 July) constituted the main plot treatments. The combinations of 3 spacing (30 cm × 15 cm × 15 cm and 60 cm × 15 cm) and 3 nitrogen levels (125, 150 and 175 kg/ha) formed the sub plot treatments. A common dose of P and K was applied at 60 kg and 108 kg/ha respectively. The entire P was applied as basal at planting. Nitrogen and potash were applied in 5 equal splits at 30, 60, 90, 120 and 150 days after planting.

'BSR 1' and 'BSR 2' did not differ in their growth but 'BSR 2' gave higher dry matter production in both the years than 'BSR 1' (Table 1) which was 5.24 and 5.95% higher than 'BSR 1' in the first and second years respectively. This was due to higher under ground rhizome mass. On an average 'BSR 2' recorded 17.3 and 11.7% higher fresh and dry yields respectively than the 'BSR 1' (Table 2). On an average 'BSR 1' produced 5.9 and 10.1% higher dry recovery and curcumin content respectively than 'BSR 2' had a low recovery per cent its higher fresh yield could compensate and produced more dry yield than 'BSR 1'. The differences among varieties were attributed to their genetic make up. Similar growth and yield differences among turmeric varieties were also recorded by

Table 1 Effect of spacing and nitrogen levels on growth attributes of turmeric varieties at different times of planting

Treatment	Plant height (cm)		Leaf area index		Dry matter production	
	2000 – 01	2001 – 02	2000 – 01	2001 – 02	2000 – 01	2001 – 02
Varieties						
V_1- 'BSR 1'	31.5	33.7	6.39	6.78	11.45	10.42
V_2- 'BSR 2'	32.7	31.5	6.71	7.02	12.05	11.04
SEm ±	1.2	1.2	0.27	0.30	0.26	3.30
CD (*P*=0.05)	NS	NS	NS	NS	0.58	0.67
Planting time						
D_1- 15 May	35.3	34.1	7.00	7.53	10.22	11.68
D_2- 15 June	32.1	32.2	6.30	6.67	9.53	10.87
D_3- 15 July	28.9	31.5	5.60	6.59	8.53	9.87
SEm ±	1.4	1.3	0.33	0.37	0.33	0.40
CD (*P*=0.05)	3.1	2.9	0.75	0.80	0.74	0.89
Spacing						
S_1-30 cm×15cm	34.2	33.4	7.20	9.19	11.47	14.70
S_2-45 cm×15cm	32.0	31.6	6.00	6.34	9.64	9.98
S_3-60 cm×15cm	30.1	32.8	5.60	5.17	7.30	7.53
SEm ±	1.3	1.3	0.23	0.25	0.25	0.26
CD (*P*=0.05)	2.6	2.6	0.46	0.50	0.50	0.52
Nitrogen						
N_1- 125 kg/ha	29.7	30.6	6.08	5.96	9.43	9.79
N_2- 150 kg/ha	32.9	32.8	6.50	6.97	10.45	10.62
N_3- 175 kg/ha	33.6	34.5	7.06	7.69	11.47	11.79
SEm ±	1.3	1.3	0.23	0.25	0.25	0.26
CD (*P*=0.05)	2.6	2.6	0.46	0.50	0.50	0.52

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Table 2 Influence of varieties, times of planting, spacing and nitrogen levels on yield and quality

Treatment	2000 – 2001				2001– 2002			
	Fresh yield (tonnes/ha)	Dry yield (tonnes/ha)	Dry recovery (%)	*Curcumin (%)	Fresh yield (tonnes/ha	Dry yield (tonnes/ha	Dry recovery (%)	*Curcumin (%)
Varieties								
V_1- 'BSR 1'	29.3	5.0	17.2	3.8	30.8	5.3	17.2	3.8
V_2- 'BSR 2'	34.3	5.6	16.2	3.4	36.2	5.9	16.3	3.5
SEm +	0.5	0.1	0.4		0.3	0.1	0.2	
CD (*P*=0.05)	1.1	0.2	0.9		0.7	0.2	0.4	
Planting time								
D_1- 15 May	35.4	6.4	18.4	4.0	36.8	6.9	18.7	4.0
D_2- 15 June	31.6	5.1	16.3	3.7	33.1	5.6	16.8	3.8
D_3- 15 July	28.4	4.4	15.3	3.1	30.6	4.5	14.7	3.2
SEm +	0.6	0.2	0.6		0.4	0.2	0.3	
CD (*P*=0.05)	1.3	0.4	1.3		0.9	0.4	0.7	
Spacing								
S_1-30 cm×15cm	35.8	6.0	16.7	3.6	37.7	6.3	16.8	3.7
S_2- 45 cm×15cm	32.8	5.5	16.6	3.6	33.8	5.6	16.7	3.6
S_3- 60 cm×15cm	26.8	4.5	16.6	3.5	29.0	4.8	16.7	3.7
SDm +	0.5	0.2	0.1	0.3	0.5	0.1		
CD (*P*=0.05)	0.9	0.4	NS	0.6	1.0	NS		
Nitrogen								
N_1-125 kg/ha	28.6	4.7	16.7	3.6	28.9	4.9	16.8	3.7
N_2-150 kg/ha	32.4	5.4	16.7	3.6	33.8	5.6	16.7	3.6
N_3-175 kg/ha	34.4	5.7	16.6	3.5	37.8	6.3	16.7	3.6
SEm +	0.5	0.2	0.1		0.3	0.5	0.1	
CD (*P*=0.05)	0.9	0.4	NS	0.6	1.0	NS		

Deeksha Dixit and Srivastava (2000).

Early planting of turmeric recorded significantly taller plants, leaf area index, dry matter production, higher yield and better quality than the delayed plantings during both the years (Table 1 and 2). The rhizome formation starts early and gets more time for developmet thus resulting in more accumulation of dry matter, yield and curcumin in early planted crop than late planted crops. The reduction in yield due to delayed planting for fresh and dry rhizome yields were 10.2 and 18.3% and 19.5 and 32.8% for 15 June and 15 July plantings respectively than 15 May planting. The dry recovery of 15 May planted crop was higher by 12.9 and 20.3% during the first year and 11.3 and 27.2% in the second year than 15 June and 15 July plantings respectively. Similarly, the curcumin content of 15 May planted crop was higher by 8.1 and 29.0% in the first year and 5.3 and 25.0% in the second year than 15 June and 15 July planted crops respectively. There was no reported evidence on the effect of times of planting on quality characters of turmeric crop.

The closer spacing produced taller plants, higher leaf area index during both the years than medium and wider spacing. On an average closer spacing produced 32.8 and 52.2% higher leaf area index than medium and wider spacing respectively at 180 days after planting. At closer spacing more plants / unit area resulting in more leaf area per unit area and dry matter production. The closer spacing on an average recorded 33.4 and 76.5% more dry matter production than medium and wider spacing respectively at harvest (Table 1). Closer spacing recorded 9.1 and 33.6% during first year and 11.5 and 30.0% higher fresh rhizome yield in the second year than medium and wider spacing respectively (Table 2). The spacing treatment did not influence the dry recovery and curcumin content of turmeric.

Higher nitrogen produced taller plants with more leaf area index and dry matter production (Table 1). Higher N level promoted the growth on an average and high rate of N recorded 21.0 and 10.4% higher dry matter production at harvest than 125 and 150 kg. N/ha respectively. The fresh and dry rhizome yields were higher under 175 kg N/ha compared to 125 and 150 kg N/ha (Table 2). The better growth and yield components recorded under higher N level are the reasons for higher yield. The N - levels, did not influence quality characters like dry recovery and curcumin as reprted earlier at Punjab by Gill *et al.* (2001).

SUMMARY

A study was conducted for 2 years indicated that variety 'BSR 2' out yielded 'BSR 1'. On an average 5.75 tonnes/ha of dry yield was recorded by 'BSR 2' which was 11.7% higher than 'BSR 1'. Early planting at 15 May gave more growth, yield and better quality. The dry recovery of 15 May planted crop was 18.4 and 18.7% that was higher by 12.9 and 20.3%

during first year and 11.3 and 27.2% in second year than 15 June and 15 July planted crops respectively. Similarly, the curcumin content of 15 May planted crop was 4.0% in both the years was higher by 8.1 and 29.0% in first year and 5.3 and 25.0% in second year than late plantings, i e 15 June and 15 July respectively. Closer planting gave more yield by 9.1 and 33.6% in first year and 11.5 and 30% higher in the second year than the medium and wider spacings respectively however, spacing did not influence the quality, i e dry recovery and curcumin content. Higher dose of N gave dry yield of 5.7 tonnes/ha and 6.3 tonnes/ha in first and second years respectively which was more than yield recorded in lower levels on N and N levels had no conspicuous effect on quality as that of spacing.

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