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Influence of plants spacing and nitrogen doses on yield and growth of turmeric

SP Khedkar, PC Mali, RG Khandekar, VG Salvi, BR Salvi and KV Malshe

Abstract
The present study entitled "Influence of plant spacing and nitrogen doses on yield and growth of turmeric" was undertaken at College of Horticulture, DBSKKV, Dapoli during the year 2021 to 2022 by considering the importance of turmeric under agro climatic condition of Konkan. In the interaction effect of treatment combination S_1N_1 (45 cm × 45 cm; 300 kgha^{-1} N) recorded the highest number of leaves (14.98) and tillers per plant (3.91) whereas the interaction effect of treatment combination S_3N_1 (45 cm × 15 cm; 300 kg ha^{-1} N) found the maximum plant height (110.19 cm). In post harvest parameters, treatment S_1N_1 (45 cm × 45 cm; 300 kg ha^{-1} N) observed the maximum number of primary fingers (15.51), the highest number of secondary fingers (19.42). The highest yield per hectare in tones (58.48 t) was recorded in treatment combination S_3N_1 (45 cm × 15 cm; 300 kg ha^{-1} N). The economic analysis of the yield data revealed that S_3N_1 *i.e.,* 45 cm × 15 cm and 300 kg ha^{-1} N recorded the more gross return (Rs. 1321800) and B:C ratio (1.91).

Keywords: Spacing, nitrogen, turmeric, tillers

Introduction
Important crops used to enhance flavor and aroma in food include spices. Essential oils, which give spices their aroma and taste but have little nutritional benefit, are present in spices. The majority of spices, especially the dry variety, lengthen the shelf life of food. Some are used to enhance texture, while others are added to create a flavorful colour or odour. Due to India's diverse environment, which includes tropical, subtropical, and temperate regions, there are around 63 species growing there (Malhotra *et al*., 2016) [2]. The seedlings developed on pro-trays made from finger rhizome buds should be employed to provide the highest yield with economic returns possible from turmeric agro climatic conditions of Konkan. Similar to how it will assist increase the area planted with turmeric in the Konkan region of Maharashtra, where there is a severe water constraint in the months of April and May when the crop is planted and grown from mother rhizomes (Mali *et al*, 2016) [3]. This spice crop needs nitrogen fertilization and its management methods since it needs a lot of N and takes a long time to reach physiological maturity. One of the key elements that actively affects the development, interplant competition, and final turmeric production is spacing (Manjunathgoud *et al*, 2002) [4]. The farmers' choice of a very large plant population is the cause of the low production. As a result, the amount of biomass produced per unit area increased, which led to the early stages of crop growth using up the majority of soil resources including moisture and nutrients.
Any crops performance is influenced by its genetic make-up and the environmental condition of the area in which it is grown. Due to different environmental conditions, a genotype that performs better in one area may not do well in another. PDKV Waigaon is high curcumin content with large growing variety in other part Maharashtra region. Therefore, it is crucial to research the PDKV Waigaon variety of turmeric's reaction to nitrogen doses and plants spacing for growth and production in the Konkan area.

Materials and Methods
The study, " Influence of plant spacing and nitrogen doses on yield and growth of turmeric" was conducted at Nursery Number Four, College of Horticulture, Dapoli; Dist. Ratnagiri (MS) from 2021 to 2022. The plots were chosen based on how well the soil and topography would cultivate turmeric.
The majority of the soil in the South Konkan is lateritic, permeable, varies in texture from sand to sandy loam, and has a pH between 5.5 and 6.5. Before laying out the experimental block, a

soil sample from layer of 0 to 30 cm deep was obtained. This sample was then utilized for examination to determine the nutritional condition of the experimental plot.

After previous crop harvested, land was ploughed neatly and left as such for weathering for 15 days. This was then followed by clod crushing and harrowing in order to bring the soil to a fine tithe. The layout according to the treatment details and design, the beds for the two trials were built in accordance with the plans and layouts. The pro tray raised uniformly growing seedlings was planted at 45 cm × 45 cm, 45 cm × 30 cm, and 45 cm × 15 cm spacing in split plot designs

For experiment, FYM was administered uniformly at 25 t ha^{-1} and completely mixed into the soil throughout the field preparation process. Three equal applications of nitrogen were made. The remaining doses of nitrogen were administered in the first and second months following transplantation. One third of the nitrogen was applied as a basal dose along with the full doses of phosphorus and potassium. Urea, Single Super Phosphate and Muriate of Potash, respectively, were used to apply nitrogen, phosphorous, and potassium.

Plate 1: Experimental Plot View

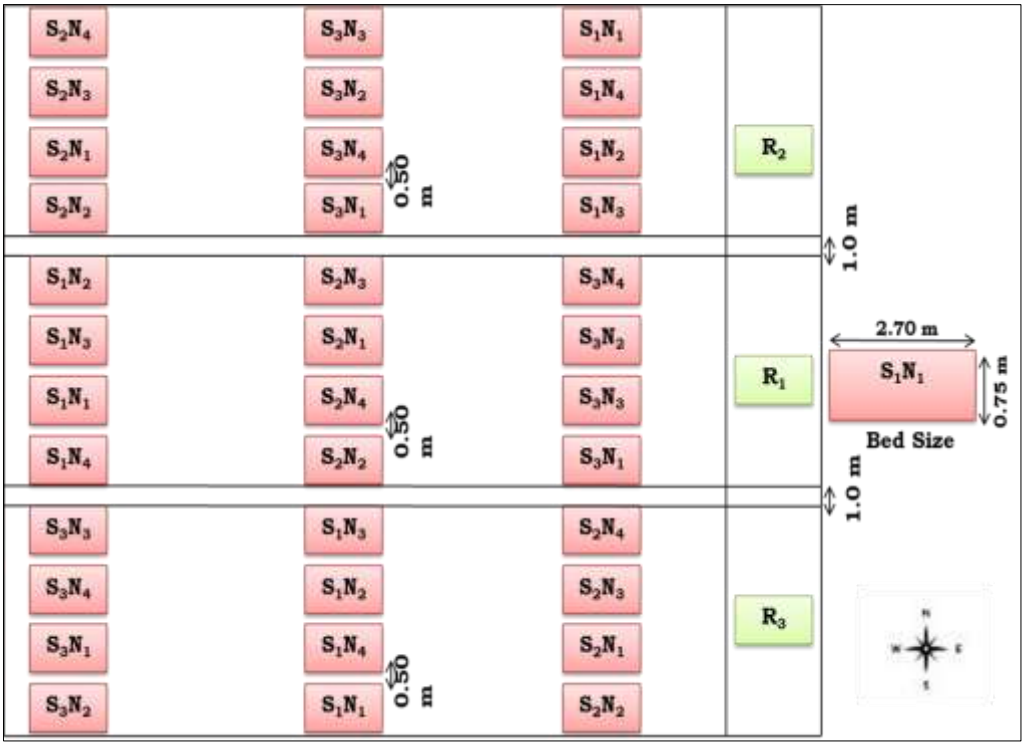

Plate 2: Experimental Plot Layout

Results and Discussion

The data in Table 1 indicated at 150 DAT, the highest number of leaves (18.57, 11.40 and 14.98) was recorded in S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}) and the lowest number of leaves (1077, 8.03 and 9.40) was noticed in S_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}) during 2021, 2022 including pooled analysis (Table 1). With respect to interaction, similar results were reported by leaves per plant was influenced due to different doses of spacing and nitrogen during both the years of experiment. Maximum number of leaves was recorded with 150 kg N ha^{-1} and 45 cm × 45 cm spacing. The similar findings of confirmed with the present study conducted by Nautiyal *et al.* (2016) [5], Pandey and Mishra (2009) [6] in turmeric.

With regards to interaction influence of spacing and nitrogen on plant height of turmeric; it was varied significantly at 150 DAT. The maximum plant height was found in S_3N_1 (45 cm ×15 cm and 300 kg ha^{-1}) (115.40 cm, 104.98 cm and 110.19 cm) and the lowest plant height (84.53 cm, 62.44 cm and 73.49 cm) was recorded in S_1N_4 (45 cm × 45 cm and 150 kg ha^{-1}) during 2021, 2022 and in pooled analysis (Table 2)

The height of the turmeric plant increased when the nitrogen level rose; however, it decreased as the spacing increased. Due to the intense competition for light, nutrients and space among the plants, some of them may have slterd their canopies to fit the vertical space. Present findings are in confirming action with Nautial *et al.* (2016) [5] who concluded that all the interaction was found to be significant during both the years in turmeric. The similarly Pandey and Mishra (2009) [6] also found significant results in turmeric with respect to interaction

Table 1: Influence of plant spacing and nitrogen doses on number of leaves

Number of leaves															
Treatment	2021					2022					Pooled				
	N_1	N_2	N_3	N_4	Mean	N_1	N_2	N_3	N_4	Mean		N_2	N_3	N_4	Mean
S_1	18.57	14.80	13.03	11.90	14.58	11.40	10.03	9.13	8.30	9.72	14.98	12.42	11.08	10.10	12.15
S_2	17.10	13.67	12.77	11.67	13.80	10.73	9.87	8.80	8.07	9.37	13.92	11.77	10.78	9.87	11.58
S_3	14.60	13.13	12.17	10.77	12.67	10.33	9.50	8.43	8.03	9.08	12.47	11.32	10.30	9.40	10.87
Mean	16.76	13.87	12.66	11.44	13.68	10.82	9.80	8.79	8.13	9.39	13.79	11.83	10.72	9.79	11.53
	S.Em±	CD at 5%	F- test				S.Em ±	CD at 5%	F- test			S.Em ±	CD at 5%	F- test	
S	0.14	0.48	S			S	0.03	0.12	S		S	0.08	0.27	S	
N	0.10	0.29	S			N	0.03	0.10	S		N	0.06	0.17	S	
S x N	0.19	0.58	S			S x N	0.07	0.20	S		S x N	0.11	0.34	S	
N_1 - 300:50:150 kg ha^{-1} NPK			N_2 - 250:50:150 kg ha^{-1} NPK					N_3 - 200:50:150 kg ha^{-1} NPK			N_4 - 150:50:150 kg ha^{-1} NPK				
S_1 - 45 cm x 45 cm			S_2 - 45 cm x 30 cm					S_3 - 45 cm x 15 cm							

Table 2: Influence of plant spacing and nitrogen doses on plant height (cm)

Plant height (cm)															
Treatment	2021					2022					Pooled				
	N_1	N_2	N_3	N_4	Mean	N_1	N_2	N_3	N_4	Mean	N_1	N_2	N_3	N_4	Mean
S_1	101.53	95.20	92.40	84.53	93.42	87.14	82.12	73.74	62.44	76.36	94.34	88.66	83.07	73.49	84.89
S_2	107.47	101.93	94.40	88.47	98.07	91.58	84.68	79.48	62.81	79.64	99.52	93.31	86.94	75.64	88.85
S_3	115.40	108.10	104.50	94.50	105.63	104.98	92.01	83.90	67.40	87.07	110.19	100.05	94.20	80.95	96.35
Mean	108.13	101.74	97.10	89.17	99.04	94.57	86.27	79.04	64.22	81.02	101.35	94.01	88.07	76.69	90.03
	S.Em±	CD at 5%	F- test				S.Em ±	CD at 5%	F- test			S.Em ±	CD at 5%	F- test	
S	0.59	2.02	S			S	0.71	2.45	S		S	0.43	1.50	S	
N	0.38	1.15	S			N	0.72	2.16	S		N	0.37	1.11	S	
S x N	0.77	2.29	S			S x N	1.44	4.33	S		S x N	0.74	2.21	S	
N_1 - 300:50:150 NPK kg ha^{-1}			N_2 - 250:50:150 NPK kg ha^{-1}					N_3 - 200:50:150 NPK kg ha^{-1}			N_4 - 150:50:150 NPK kg ha^{-1}				
S_1 - 45 cm x 45 cm			S_2 - 45 cm x 30 cm					• S_3 - 45 cm x 15 cm							

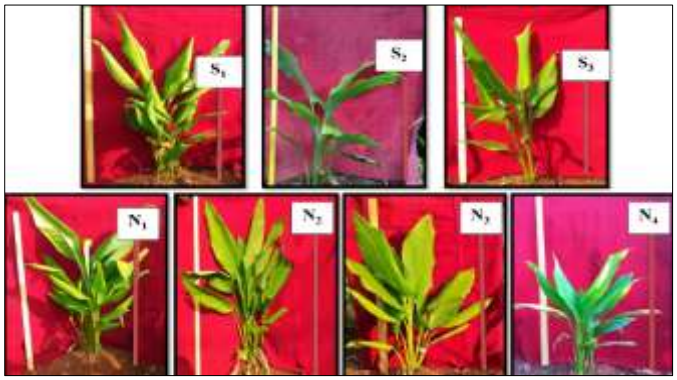

Plate 3: Influence of plant spacing and nitrogen doses on plant height

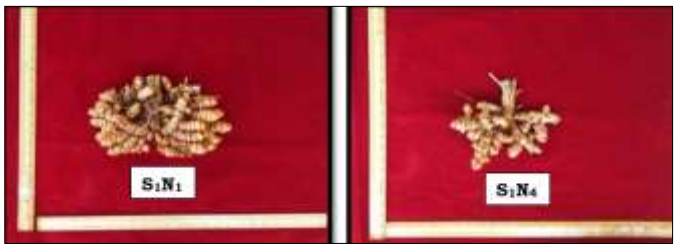

Plate 4: Influence of plant spacing and nitrogen doses on rhizome

The highest number of tillers per plant was recorded in S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}) (5.33, 2.48 and 3.91) and the lowest number of tillers per plant (2.47, 0.57 and 1.52) was recorded in S_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}) during 2021, 2022 and in pooled analysis (Table 3). The increase in tillers may be the result of its significant impact on plans; ability to absorb and utilize the ideal quantity of N and spacing for development of plant tissue and vegetative growth. Verma *et al.* (2019) [10] reported the increase the nitrogen levels increase the number of tillers (3.70) at 30 cm × 20 cm spacing.

The influence of plant spacing and nitrogen on primary fingers exhibited a significant trend in the years of experimentation (Table 4). During 2021, the maximum number of primary fingers (16.53) was recorded in S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}), while the lowest number of primary fingers (9.50) recorded in S_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}). During 2022, significant trend was observed in the number of primary fingers. The highest number of primary fingers (14.53) was recorded in S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}) which was superior over all interaction, while the lowest number of primary fingers (8.63) was observed in S_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}) (Table 4).

In pooled data, the highest number of primary fingers (15.53) was noted in S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}), while the lowest number of primary fingers (9.07) was noted in S_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}). High amount of nutrition and less plant population provided luxuriant growth which developed more number of primary rhizomes. Pandey and Mishra (2009) [6] reported the higher numbers of fingers under combination of 100 kg Nitrogen with 45 cm × 45 cm plant spacing. Similarly Rajput *et al.* (1982) [7]; Rao and Reddy (1977) [8] also reported.

Table 3: Influence of plant spacing and nitrogen doses on number of tillers

Number of tillers per plant															
Treatment	**2021**					**2022**					**Pooled**				
	N_1	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**
S_1	5.33	4.53	3.87	3.07	4.20	2.48	1.70	0.97	0.75	1.48	3.91	3.12	2.42	1.91	2.84
S_2	5.07	4.33	3.60	2.73	3.93	2.02	1.33	0.92	0.68	1.24	3.54	2.83	2.26	1.71	2.59
S_3	4.80	4.20	3.33	2.47	3.70	1.85	1.23	0.92	0.57	1.14	3.33	2.72	2.13	1.52	2.42
Mean	5.07	4.36	3.60	2.76	3.94	2.12	1.42	0.93	0.67	1.28	3.59	2.89	2.27	1.71	2.61
	S.Em±	CD at 5%	F- test				S.Em ±	CD at 5%	F- test			S.Em ±	CD at 5%	F- test	
S	0.02	0.07	S			S	0.02	0.07	S		S	0.02	0.06	S	
N	0.02	0.05	S			N	0.02	0.05	S		N	0.01	0.03	S	
S x N	0.03	0.10	S			S x N	0.03	0.09	S		S x N	0.02	0.07	S	
N_1 - 300:50:150 kg ha^{-1} NPK				N_2 - 250:50:150 kg ha^{-1} NPK				N_3 - 200:50:150 kg ha^{-1} NPK			N_4 - 150:50:150 kg ha^{-1} NPK				
S_1 - 45 cm x 45 cm				**S_2** - 45 cm x 30 cm				• **S_3** - 45 cm x 15 cm							

Table 4: Influence of plant spacing and nitrogen doses on primary fingers

Number of primary fingers															
Treatment	**2021**					**2022**					**Pooled**				
	N_1	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**
S_1	16.53	15.53	12.30	12.10	14.12	14.53	13.27	11.03	11.20	12.51	15.53	14.40	11.67	11.65	13.31
S_2	16.33	14.37	11.43	9.80	12.98	13.83	12.73	10.80	9.13	11.63	15.08	13.55	11.12	9.47	12.30
S_3	16.13	12.00	10.00	9.50	11.91	13.33	12.20	9.43	8.63	10.90	14.73	12.10	9.72	9.07	11.40
Mean	16.33	13.97	11.24	10.47	13.00	13.90	12.73	10.42	9.66	11.68	15.12	13.35	10.83	10.06	12.34
	S.Em±	CD at 5%	F- test				S.Em±	CD at 5%	F- test			S.Em±	CD at 5%	F- test	
S	0.34	1.16	S			S	0.09	0.32	S		S	0.14	0.50	S	
N	0.22	0.66	S			N	0.07	0.22	S		N	0.12	0.37	S	
S x N	0.44	1.32	S			S x N	0.14	0.43	S		S x N	0.25	0.74	S	
N_1 - 300:50:150 kg ha^{-1} NPK				N_2 - 250:50:150 kg ha^{-1} NPK				N_3 - 200:50:150 kg ha^{-1} NPK			N_4 - 150:50:150 kg ha^{-1} NPK				
S_1 - 45 cm x 45 cm				S_2 - 45 cm x 30 cm				• S_3 - 45 cm x 15 cm							

The effect interaction (S×N) on number of secondary fingers exhibited a significant trend (Table 5).

During 2021, the highest number of secondary fingers (21.13) was recorded in S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}) and superior whereas the lowest secondary fingers (14.43) was found in S_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}). In 2022, the same trend was observed. The treatment S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}) recorded the maximum number of secondary fingers (17.71) and lowest number of secondary fingers (9.62) was recorded in S_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}).

In pooled data, the maximum number of secondary fingers (19.42) was noted in S_1N_1 (45 cm × 45 cm and 300 kg ha^{-1}) and treatment combinationS_3N_4 (45 cm × 15 cm and 150 kg ha^{-1}) recorded the lowest number of secondary fingers (13.34). High amount of nutrition and less plant population provided luxuriant growth which developed more number of secondary rhizomes. Similarly, Pandey and Mishra (2009) [6] reported the higher numbers of fingers under treatment of 45 cm × 45 cm plant spacing and 100 kg N ha^{-1}. The influence of spacing and nitrogen on turmeric yield per hectare for both successive years (Table 5).

During 2021, the highest turmeric yield per hectare (61.99 t) was obtained in S_3N_1 (45 cm × 15 cm and 300 kg ha^{-1}). Lowest turmeric yield in hectare (13.52 t) was recorded in S_1N_4 (45 cm × 45 cm and 150 kg ha^{-1}). During 2022, the highest turmeric yield per hectare (54.98 t) was obtained in S_3N_1 (45 cm × 15 cm and 300 kg ha^{-1}). Lowest turmeric yield per hectare (11.94 t) was recorded in S_1N_4 (45 cm × 45 cm and 150 kg ha^{-1}).

Table 5: Influence of plant spacing and nitrogen doses on number of secondary fingers

Number of secondary fingers															
Treatment	**2021**					**2022**					**Pooled**				
	N_1	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**
S_1	21.13	18.20	17.60	15.83	18.19	17.71	16.07	15.80	13.45	15.76	19.42	17.14	16.70	14.64	16.97
S_2	19.17	17.33	16.20	14.97	16.92	16.37	15.77	14.78	11.74	14.66	17.77	16.55	15.49	13.35	15.79
S_3	17.43	16.90	15.90	14.43	16.17	15.74	15.14	13.96	9.62	13.61	16.59	16.02	14.93	12.03	14.89
Mean	19.24	17.48	16.57	15.08	17.09	16.61	15.66	14.84	11.60	14.68	17.93	16.57	15.71	13.34	15.88
	S.Em±	CD at 5%	F- test				S.Em±	CD at 5%	F- test			S.Em±	CD at 5%	F- test	
S	0.11	0.37	S			S	0.18	0.61	S		S	0.13	0.46	S	
N	0.10	0.30	S			N	0.14	0.42	S		N	0.10	0.29	S	
S x N	0.20	0.60	S			S x N	0.28	0.84	S		S x N	0.19	0.58	S	
N_1 - 300:50:150 NPK kg ha^{-1}				N_2 - 250:50:150 NPK kg ha^{-1}				N_3 - 200:50:150 NPK kg ha^{-1}			N_4 - 150:50:150 NPK kg ha^{-1}				
S_1 - 45 cm x 45 cm				S_2 - 45 cm x 30 cm				S_3 - 45 cm x 15 cm							

Table 6: Influence of plant spacing and nitrogen doses on yield per hectare

Yield per hectare (t)															
Treatment	**2021**					**2022**					**Pooled**				
	N_1	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**	**N_1**	**N_2**	**N_3**	**N_4**	**Mean**
S_1	28.52	23.28	18.33	13.52	20.91	25.55	19.65	14.85	11.94	18.00	27.04	21.47	16.59	12.73	19.46
S_2	35.71	28.12	21.65	18.96	26.11	32.98	24.40	19.64	14.97	22.99	34.34	26.26	20.64	16.97	24.55
S_3	61.99	44.71	37.74	34.50	44.74	54.98	41.31	32.78	27.41	39.12	58.48	43.01	35.26	30.95	41.93
Mean	42.07	32.04	25.91	22.33		37.84	28.45	22.42	18.11		39.96	30.24	24.16	20.22	
	S.Em±	CD at 5%	F- test				S.Em ±	CD at 5%	F- test			S.Em ±	CD at 5%	F- test	
S	0.85	2.94	S			S	0.32	1.10	S		S	0.47	1.62	S	
N	0.50	1.49	S			N	0.51	1.52	S		N	0.37	1.10	S	
S x N	0.99	2.98	S			S x N	1.01	3.03	S		S x N	0.73	2.20	S	
N_1 - 300:50:150 NPK kg ha^{-1}			N_2 - 250:50:150 NPK kg ha^{-1}			N_3 - 200:50:150 NPK kg ha^{-1}			N_4 - 150:50:150 NPK kg ha^{-1}						
S_1 - 45 cm x 45 cm			S_2 - 45 cm x 30 cm			S_3 - 45 cm x 15 cm									

Pooled data also reported that turmeric hectare yield varied. The higher turmeric yield per hectare (58.48 t) was recorded in S_3N_1 (45 cm × 15 cm and 300 kg ha^{-1}), whereas the treatment interaction S_1N_4 (45 cm × 45 cm and 150 kg ha^{-1}) recorded lowest turmeric yield per hectare (12.73 t) (Table 6). This increase in turmeric yield per hectare may be attributable to the application of higher nitrogen dose, closer spacing, which provided nutrients to plants for a longer period of time and greater number of plants in a unit area of land. These factors led to the development of a higher yield per hectare and the production of the greatest number of mother rhizome, primary, secondary rhizomes and tillers. These results are in close agreement with Shashidhar and Sulekeri (1996) [9] recorded the highest turmeric yield with spacing 45 cm × 22.5 cm and nitrogen levels 200 kg ha^{-1}. Nautial *et al.* (2016) [5] recorded the highest turmeric yield with spacing of 40 cm ×10 cm and nitrogen level of 150 kg ha^{-1}. Pandey and Mishra (2009) [6] also reported the highest turmeric yield with spacing 30 cm ×15 cm and nitrogen levels of 100 kg ha^{-1}. Kandiannan and Chandaragiri (2004) [1] recorded the similar result also (Table 6).

The influence of different plant spacing and nitrogen doses on economics of turmeric was analyzed and data are presented in Table 7. The highest gross return (Rs.1321800) and B: C ratio (1.91) was noted in S_3N_1 (45 cm × 15 cm and 300 kg ha^{-1}) whereas treatment combination S_1N_4 (45 cm × 45 cm and 150 kg ha^{-1}) recorded the lowest gross return (Rs. 287880) and lowest B:C ratio (0.87) (Table 7). The results summarized above, it remains no more obscure that nitrogen doses 300 kg ha^{-1} along with recommended dose of P, K fertilizer is the most suitable and profitable (Rs.158043 ha^{-1} net return). Plant spacing with 45cm × 15 cm is economical for use, because of higher benefit: cost ratio (1.91) is obtained with the same plant spacing. Nautiyal *et al.* (2016) [5] reported the highest gross return, net return and B: C ratio was obtained under 150 kg nitrogen ha^{-1}. Plant spacing with 40 cm × 10 cm recorded maximum gross return and net return but maximum benefit: cost ratio observed in plant spacing of 40 cm × 20 cm.

Table 7: Economics of the turmeric cultivation (B: C Ratio)

No	Treatments	Yield (t ha^{-1})	Total Cost	Gross Return	Net Return	B:C Ratio
1.	S_1N_1 (300 kg ha^{-1} and 45 x 45 cm)	27.04	387903.7	614640	226736.3	1.58
2.	S_2N_1 (300 kg $ha^{-1}$and 45 x 30 cm)	34.34	461399.08	777240	315840.92	1.68
3.	S_3N_1 (300 kg ha^{-1} and 45 x 15 cm)	58.48	691345.16	1321800	630454.84	1.91
4.	S_1N_2 (250 kg $ha^{-1}$and 45 x 45 cm)	21.47	366375.7	487560	121184.3	1.33
5.	S_2N_2(250 kg ha^{-1} and 45 x 30 cm)	26.26	431391.08	599280	167888.92	1.39
6.	S_3N_2 (250 kg ha^{-1} and 45 x 15 cm)	43.01	633117.16	974520	341402.84	1.54
7.	S_1N_3 (200 kg ha^{-1} and 45 x 45 cm)	16.59	347547.7	376680	29132.28	1.08
8.	S_2N_3 (200 kg ha^{-1} and 45 x 30 cm)	20.64	408923.08	466560	57636.92	1.14
9.	S_3N_3 (200 kg ha^{-1} and 45 x 15 cm)	35.26	601389.16	766240	184850.84	1.31
10.	S_1N_4 (150 kg ha^{-1} and 45 x 45 cm)	12.73	332399.7	287880	-44519.72	0.87
11.	S_2N_4(150 kg ha^{-1} and 45 x 30 cm)	16.97	395155.08	386040	-9115.08	0.98
12.	S_3N_4 (150 kg ha^{-1} and 45 x 15 cm)	30.95	587341.16	704040	116698.84	1.20

Conclusion

In the experiment most of the pre harvest and post harvest parameters of turmeric significantly maximum under 300 kg ha^{-1} nitrogen application and 45 cm x 45 cm spacing. In turns of per unit area, the highest yield and maximum B:C ratio was obtain with 300 kg ha^{-1} nitrogen and 45 cm x 15 cm plant spacing.

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