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Original Research Article

Response of Turmeric Varieties to Different Spacings in Relation to Growth and Development under Konkan Agro-Climatic Condition

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A B S T R A C T

An investigation was carried out at the college of horticulture, Dapoli during the period from August, 2019 to April, 2020 to determine the growth and development of turmeric as influenced by different varieties and spacing. The study was conducted with two varieties *viz.* Salem (V_1) and Waigaon (V_2) and three spacing *viz.* 60 cm X 45 cm (S_1), 40 cm X 45 cm (S_2) and 40 cm X 30 cm (S_3). consequences showed that among two turmeric varieties, variety Salem was performed better and found significantly superior over variety Waigaon (V_2) in respect of all growth parameters *viz.* plant height (80.26 cm), number of leaves (18.00), number of tillers (4.90), leaf length (44.51 cm), leaf width (16.76 cm) and leaf area (519.88 cm^2). The wider spacing of 60 cm X 45 cm (S_1) was found significantly superior in respect of all growth parameters except plant height. Significantly highest leaf length, leaf width, number of tillers and leaf area were found in V_1S_1 (Salem with 60 X 45 cm) whereas, the maximum plant height was found in V_1S_3 (Salem with 40 X 30 cm).

Keywords

Thin rather flaccid, Light green in colour, Lanceolate acuminate

Introduction

Turmeric (*Curcuma longa* L.) is an erect, herbaceous perennial plant belongs to the Zingiberaceae family with chromosome number 2n = 32. Turmeric is native to South East Asia along with the other spices *i.e.* ginger, cardamom and galangal (Thai ginger). Turmeric produced an underground stem or rhizome which is thick and rounded with abort blunt fingers. The plant is about 1 meter in height with short pseudo stem and long leaves. The leaves are born in a tuft and are about 60 cm in length. They are thin rather flaccid, light green in colour, lanceolate acuminate, with long leaf stalk. Flower is a dense spike like ending with coloured bracts, calyx and corolla comprises of broad segments (Rao and Rao, 1994).

Turmeric prefers a warm humid climate with a rainfall of 1500 mm and temperature of 20-

30 ^{O}C. It thrives well up to 1200 m above mean sea level. Well-drained sandy or clayey loam to red loamy soils having acidic to slightly alkaline pH is ideal for its cultivation. Turmeric is either planted on raised bed on ridges and furrows or in flat system.

The demand of turmeric increased all over the world as new ingredients of therapeutic and lifesaving properties were discovered. In order to fulfill the increasing demand of people for the turmeric and improved quality, it is essential to increase the production of turmeric considerably. This can be achieved by bringing more area under cultivation and increasing productivity per unit area. Lack of suitable cultivar for particular agro-climatic condition is one of the constraints for low productivity. However, other factors like high yielding varieties, nutrition, spacing and time of planting which influence the productivity of turmeric (Ashokan and Radhakrishnan, 1979; Jadhao, 2003).

Performance of any crop depends upon its genetic makeup and climatic conditions of the region under which they are grown. Genotype which performs better in one region may not perform well in other regions due to varying climatic conditions. Plant distance is an important factor for higher production and gives equal opportunity to the plants for their survival and best use of other inputs. The yield of plant is depending on the growth of the plant. Hence, it is essential to study and evaluate the turmeric genotypes in order to select the best genotype particularly for Konkan region and also find out the suitable spacing for its better growth and development.

Materials and Methods

The experiment was conducted at College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri during *Kharif* season of the year 2019-20. The experiment was laid out in split plot design with two varieties of turmeric *viz.*, Salem (V_1) and Waigaon (V_2) and three plant spacings *viz.*, 60 cmX45 cm (S_1), 40 cm X 45 cm (S_2) and 40 cm X30 cm (S_3). Six treatment combinations were replicated seven times. The flat beds of 4.5 m X 1.2 m were prepared and seedlings of turmeric were transplanted at different spacings. The recommended cultural practices (Manuring, irrigation, weeding and plant protection, *etc.*) were followed uniformly to experimental plots. Five plants were selected randomly from each block for recording growth attributing characters. Average of five observations recorded at appropriate times throughout the experimental periods from five randomly selected plants. The data obtained during investigation was statistically analyzed as per the procedure and design given by Panse and Sukhatme (1985).

Results and Discussion

Plant height

A perusal of data presented in Table 1 shows significant variations among the varieties. The maximum plant height (80.26 cm) was recorded in Salem (V_1) while the minimum (74.12 cm) was recorded in Waigaon (V_2). This might be due to genetic makeup of different varieties and response of varieties to the particular agroclimatic condition. Similar results also reported by Sinkar (2004) he reported that the variety Salem produced the maximum plant height (35.27 cm) followed by Krishna (35.23 cm). The plant height was varied significant due to the effect of different spacings (Table 1). The closer spacing of 40 cm X 30 cm (S_1) recorded the highest plant height (80.23 cm) which was significantly superior over other spacings. This might be due to the fact that under closer spacing competition among the plants for

light, nutrient, fertilizer and space is high; plant might have adjusted its canopy in the vertical space by increasing inter-nodal length as there was suppression of lateral growth leading to more of vertical growth. While, in case of wider spacing there was less competition among the plants resulting in greater horizontal spread, less inter-node length and shorter plant. This is in agreement with the findings of Mogle (1999) in turmeric. The interaction effect of varieties and spacings differed significantly. The treatment combination V_1S_3 was found significantly superior over the rest of treatments and recorded the highest plant height (83.22 cm) whereas, the lowest plant height was recorded with treatment combination V_2S_1 (70.52 cm). Similar result was agreement with the findings of Mohamed *et al.,* (2014).

Number of leaves per plant

Varieties had significant influenced on number of leaves per plant (Table 1). Salem (V1) has recorded significantly the highest number of leaves per plant (18.00) whereas, the minimum number of leaves (17.60) was recorded in variety Waigaon. It might be due to the variation in genetic constitution of varieties. Similar variation in number of leaves per plant among different varieties was reported by Jalgaonkar *et al.,* (1988) in turmeric. The number of leaves per plant was found significant due to different spacings. The maximum number of leaves (19.03) was found at wider spacing of 60 cm X 45 cm (S1) and the minimum (15.82) was found at closer spacing of 40 cm X 30 cm (S3) because plants at wider spacing of 60 cm X 45 cm could gave an opportunity for more availability of nutrients, moisture and better interception of light for development of more number of leaves per plant than the other spacings. Similar result was reported by Rashid *et al.,* (1996) in turmeric. The interaction effect of varieties and spacings showed non-significant effect on leaves per plant (Table 1). The highest number of leaves (20.04) was recorded from the treatment V_1S_1 whereas, the minimum number of leaves per plant was recorded with treatment combination V_2S_3 (15.27).

Number of tillers

Number of tillers per plant was significantly differed by varieties (Table 3). The maximum number of tillers per plant was recorded in variety Salem (4.90) while, the minimum number of tillers per plant was recorded in variety Waigaon (4.01). This may be due to good growth and vigour of Salem variety; it is generally governed by the genetic constitution of varieties and environmental condition under which the crop raised. These results are close conformity with the results obtained by Hegde *et al.,* (1997) in turmeric. Different spacings showed significant influenced on number of tillers per plant. The maximum number of tillers (4.73) was recorded at wider spacing of 60 X 45 cm whereas, the minimum (4.17) was recorded at closer spacing of 40 X 30 cm. The plant density had marked influence on the capacity of plants to utilize environmental factors in building up the plant tissues through regulation of absorption capacity of plants due to better utilization of resources and lesser plant to plant competition. Hence, the widely spaced plant produced the greater number of tillers.

Similar result was reported by Kumar and Gill (2010) reported that the tiller per plants decreased in closer plant spacing. The interaction of varieties and different plant spacings showed significant effect on number of tillers per plant (Table 1). The treatment combination of Salem with wider spacing of 60 cm X 45 cm spacing (V_1S_1) produced the highest number of tillers per plant (5.14)

which was significantly superior over the rest of the treatment combinations.

Leaf length

The data from Table 2 revealed that the leaf length was significantly influenced by varieties. The highest leaf length (44.51 cm) was recorded in variety Salem (V_1) while the minimum (41.43 cm) was recorded in Waigaon (V_2). This might be due to the variation in the growth habit among different varieties and its genetic factor that expresses morphological differences among the cultivars in turmeric. Similar results obtained by Sinkar (2004) in turmeric. Regarding spacing, significantly the highest leaf length (45.75 cm) was recorded at wider spacing of 60 X 45 cm which was significantly superior over the other spacings. There is close relationship with planting density and growth of plant, under wider spacing there might be sufficient availability of nutrients, moisture, space and better interception of sunlight within the plant canopy than the closely spaced plant hence, wide spaced plants might have produced maximum leaf length as compared to other spacings. The combine effect of varieties and spacings significantly influenced the leaf length (Table 2).

The Treatment combination V_1S_1 was found significantly superior over rest of the treatment combinations and recorded the highest leaf length (47.07 cm) whereas, the minimum leaf length was recorded in V2S3 (38.37 cm). Similar results were obtained by Khan *et al.,* (2003) in onion.

Leaf width

Varieties had marked influenced on leaf width. The highest leaf width was recorded in variety Salem (16.76 cm) while the minimum was recorded in Waigaon (15.55 cm).The presents results are in accordance with the findings reported by Sinkar (2004). Different spacings showed significant effect on leaf width. The highest leaf width (17.33 cm) was recorded at wider spacing of 60 X 45 cm which was significantly superior over the rest of spacings. This is due to fact that there is close relationship with planting density and growth of plant; as there is more competition for nutrients, moisture, space and light in closely spaced plant than widely spaced plant. The present findings are in close conformity with results obtained by Mogle (1999) in turmeric. The interaction effect showed significant effect on leaf width. The planting of Salem variety along with wider spacing of 60 cm X 45 cm significantly recorded the highest leaf width (18.04 cm) whereas, the lowest leaf width (14.48 cm) was recorded in variety Waigaon along with closer plant spacing of 40 cm X 30 cm. The present findings are in accordance with results obtained by Mohamed *et al.,* (2014).

Leaf area

Leaf area was significant influenced by varieties (Table 2). Variety Salem recorded the highest leaf area (519.88 cm^2) while, the lowest leaf area was recorded in Waigaon (460.10 cm^2). Similar results obtained by Jalgaonkar *et al.,* (1988) reported the maximum leaf area was recorded in the variety Salem (433.23 cm^2) while, the minimum (256.23 cm^2) in Waigaon under Konkan condition of Maharashtra. The different spacing showed significant effect on leaf area. The highest leaf area (562.60 cm^2) was recorded at wider spacing of 60 cm X 45 cm (S_1) which was significantly superior over S_2 and S_3 spacings. Under wider spacing plants absorb the sufficient availability resources and increased their photosynthetic efficiency that further increased the vegetative growth and ultimately resulted in increased leaf area. The finding agreed with Manjunathgoud *et al.,* (2002).

Table.1 Influence of varieties, spacings and their interaction on plant height, number of leaves and number of tillers of turmeric

	Plant height (cm)			Number of leaves			Number of tillers		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
S_1	77.05	70.52	73.78	20.04	18.01	19.03	5.14	4.31	4.73
S_2	80.52	74.60	77.56	17.60	16.97	17.29	4.89	4.06	4.47
S_3	83.22	77.24	80.23	16.37	15.27	15.82	4.69	3.66	4.17
Mean	80.26	74.12	77.19	18.00	17.60	17.38	4.90	4.01	4.46
	S.E.m±	C.D at 5 %	F-test	S.E.m±	C.D at 5 %	F-test	S.E.m±	CD at 5%	F-test
V	0.08	0.25	SIG	0.06	0.19	SIG	0.03	0.09	SIG
S	0.09	0.29	SIG	0.20	0.60	SIG	0.04	0.11	SIG
V X S	0.12	0.36	SIG	0.29	-	NS	0.05	0.15	SIG

Table.2 Influence of varieties, spacings and their interaction on leaf length, leaf width and leaf area of turmeric.

	Leaf length (cm)			Leaf width (cm)			Leaf area (cm^2)		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
S_1	47.07	44.43	45.75	18.04	16.61	17.33	594.42	530.77	562.60
S_2	44.35	41.50	42.92	17.07	15.56	16.31	523.99	458.45	491.22
S_3	42.10	38.37	40.23	15.19	14.48	14.83	441.24	391.08	416.16
Mean	44.51	41.43	42.97	16.76	15.55	16.16	519.88	460.10	489.99
	S.E.m±	CD at 5%	F-test	S.E.m±	CD at 5%	F-test	S.E.m±	CD at 5%	F-test
V	0.04	0.13	SIG	0.05	0.17	SIG	2.41	7.33	SIG
S	0.11	0.32	SIG	0.07	0.22	SIG	2.04	6.08	SIG
V X S	0.15	0.45	SIG	0.08	0.24	SIG	2.89	8.45	SIG

The interaction between varieties and spacings showed significant effect on leaf area. The treatment combination of Salem with wider spacing of 60 cm X 45 cm (V_1S_1) was found significantly superior over the rest of treatment combination and recorded the highest leaf area (594.42 cm^2).

From the present investigation it may be concluded that varieties and different spacing showed significant effect on growth and development of turmeric. It is concluded that variety Salem (V_1) was performed better than variety Waigaon (V_2) in all growth parameters i.e. plant height, number of leaves, leaf length, leaf width, leaf area and number of tillers per plant. Spacing 60 X 45 cm (S_1) was found significantly superior in respect of all growth parameters except plant height i.e. number of leaves, leaf length, leaf width, leaf area and number of tillers per plant while, spacing 40 X 30 cm (S_3) was found significantly superior in respect of plant height. With regards to interaction effect, variety Salem (V_1) planted with wider spacing of 60 X 45 cm (S_1) found significantly superior and recorded the highest number of leaves, leaf length, leaf width, leaf area and number of tillers per plant. However, Salem (V_1) planted with closer spacing of 40 X30 cm (S_3) recorded highest plant height.

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