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Study on the Effect of Plant Spacing on the Production of Turmeric at Farmer's Field

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Abstract: The research work was conducted to find out the optimum plant spacing for maximizing the yield of turmeric. Four plant spacing i.e., 45 x 10, 45 x 20, 45 x 30 and 60 x 30 cm^2 were considered in the study. The highest average yield (17.87 t ha^{-1}) was obtained from 45 x 10 cm^2 plant spacing which was closely followed (16.77 t ha^{-1}) by 45 x 20 cm^2 plant spacing. While the lowest average yield (13.42 t ha^{-1}) was recorded from 60 x 30 cm^2 plant spacing in respective two years. So, in agronomic point of view, 45 x 10 cm^2 plant spacing is suitable but economically 45 x 20 cm^2 plant spacing is viable for turmeric production.

Key words: Turmeric, yield, spacing, economic return

Introduction

Turmeric (*Curcuma longa* L.) is one of the most important spices crop of Bangladesh and belongs to the family Zingiberaceae. It has diversified uses. The peoples of Bangladesh are usually used in all carry preparation for its typical color and flavor. Besides, it is used in medicine and cosmetics and as dye in textile industries (Pruthi, 1976). It contents about 69.43 carbohydrate, 6.30 protein, 5.10 oil and 3.50 % mineral and other important element in dry turmeric (Shakur, 2000). It is intensively grown in the highland with sandy loam soil. In Bangladesh turmeric is cultivated in 16000 hectare of land with production of 42000 tons (Anonymous, 1999). Turmeric is always propagated by finger or rhizomes and large quantities of seeds are required for planting one hectare of land. The quantity of seeds to be used depends on the spacing at which they are planted.

Farmers of Bangladesh are growing turmeric following indigenous methods with the yield 2.26 t ha^{-1} (Shakur, 2000). The reason behind such low yield due to lack of high yielding variety and method of production practices followed by the local growers. The yield of turmeric can be increased by adopting improve production technology like proper plant spacing. Spacing is one of the factor that greatly influences the yield contributing characters and eventually effects the yield of turmeric to great extent (Aiyadural, 1966; Purseglove *et al.*,1981). Ahmed and Rahman (1987) reported that although turmeric is a major spice crop of Bangladesh, but its production technologies has not been standardized from the scientific and economic point of view. Therefore, research needs to bring improvement in production technologies as well as considering economic return.

Bangladesh Agricultural Research Institute (BARI) has recently been developed improved variety of turmeric 'sinduri' (Shakur, 2000). On-farm Research Division of BARI carried out a number of varietal trial and the variety 'sinduri' was performed better in respect of yield and quality. Moreover, it was found that the variety 'sinduri' produced the highest yield in closer spacing (40x10 cm^2). The study was therefore, designed to determine the effect of spacing on the production of turmeric at farmer's field.

Materials and Methods

The experiment was conducted at Kashinathpur MLT site, Santhia, Pabna during 1997-98 and 1998-99 to find out the effective plant spacing of turmeric (Variety 'sinduri') production. Four spacing i.e. 45 x 10, 45 x 20, 45 x 30 and 60 x 30 cm^2 were distributed in randomized complete block (RCB) design with five dispersed replications. The unit plot size was 9 x 2.4 m^2. The finger of turmeric (25-30 g) was planted on 10-25 April, both the year. Fertilizers and manures were used at the rate of 90-72-96 kg N-P-K and CD 1 t ha^{-1} respectively (Anonymous, 1997). The entire quantity of cowdung, TSP and 50 percent of MP were applied as basal during final land preparation. Rest 50 percent MP and full urea were top dressed in two equal split at 50 and 90 days after planting followed by earthling up. All other intercultural practices such as irrigation, weeding, ridging were done as and when required. Ten plants were selected randomly from each unit plot for collection of necessary information of different yield contributing characters. But the marketable fresh yield was calculated from total harvest of each unit plot and converted to per hectare yield.

The crop was harvested from 12-26th January in respective years when the plants became completely yellow and the leaves including the base of the pseudo stem dried up completely. Yield and yield contributing data were analyzed by DMRT (Gomez and Gomez, 1984) and finally economic analysis was done.

Results and Discussion

Plant spacing had significant ($p < 0.05$) effect on number of leaves per plant, number of stems per hill, number of primary fingers per hill and yield per hectare except plant height at both years (Table 1), However, highest plant height (75.83 cm) was found from wider spacing (60 X 30 cm^2) while the lowest (71.41 cm) was in closer (45 X 10 cm^2) spacing. This result is in agreement with Ahmad and Rahman (1987) who reported that plants spacing had no significant effect on plant height. Highest number of leaves (10.43), number of stems (5.04) per hill and number of primary fingers (13.70) per hill were produced when plants were spaced at wider (60 X 30 cm^2) spacing which was similar and closely followed by (45 X 30 cm^2) plant spacing and the lowest was found in closer (45 X 10 cm^2) spacing.

The highest yield (16.98 t ha^{-1}) and (18.76 t ha^{-1}) average highest yield (17.87 t ha^{-1}) was obtained from closer plant spacing (45x10 cm^2), which was statistically identical (16.11 t ha^{-1}) with (45 X 20 cm^2) spacing in 1st year and closely followed (17.44 t ha^{-1}) by 2nd year and average yield of (16.77 t ha^{-1}) with (45x20 cm^2) plant spacing in both the years. Result are in agreement with the findings of Purseglove *et al.* (1981) and Rahman and Faruque (1974) who reported that closer spacing (15 cm) gave higher yield than when plants were spaced at 25 and 30 cm respectively. This results are in also agreement with the finding of Choudhury *et al.* (2000) who described that closer spacing (50 x 15 cm^2) gave the higher yield of turmeric when conducted an experiment with 3 spacing viz. 50 x 15, 50 x 20 and 50 x 25 cm^2. It was clearly indicated that the plant population in turmeric per unit area is one of the main factors that determines the total yield of the crop. These results are also supported by Anonymous (1982) and Randhawa and Mishra (1974) who obtained increase number of plants per unit area with increased total yield of turmeric crop. While the lowest yield (12.33 and 14. 52 t ha^{-1}) was recorded in both years respectively and average lowest yield (13.42 t ha^{-1}) was found from wider (60x30 cm^2) plant spacing.

From two year results, it was observed that closer spacing produced higher yield due to higher plant population and effective

Table 1: Effect of spacing on different parameters of turmeric

Spacing (cm^2)	Plant height (cm^2)	No. of leaves/ plant	No. of stems/hill	No. of primary fingers/hill	Yield (t ha^{-1}) 1997-98	1998-99	Average (t ha^{-1})
45x10	71.41	09.09b	4.30b	12.11b	16.98a	18.76a	17.87
45x20	73.10	09.83ab	4.62ab	12.69b	16.11a	17.44ab	16.77
45x30	74.97	10.23a	4.62ab	13.48a	12.74b	15.64bc	14.19
60x30	75.83	10.43a	5.04a	13.70a	12.33b	14.52c	13.42
CV%	3.6	04.9	6.60	02.8	05.40	07.00	

Means with different letters differ significantly at $P<0.05$

Table 2: Economic performance of turmeric production

Spacing (cm^2)	Gross return (Tk ha^{-1})	Total variable cost (Tk ha^{-1})	Gross margin (Tk ha^{-1})	BCR
45x10	107220	63194	44026	1.70
45x20	100620	55440	45180	1.81
45x30	85140	53009	32131	1.61
60x30	80520	51852	28668	1.55

BCR: Benefit cost ratio
Price of input:
Labor Tk 6.25/h, Bullock including man 16h/day Tk 16.66/h, Urea Tk 5.00/Kg, TSP Tk 6.00/Kg, MP Tk 5.00/Kg, Turmeric (seed) Tk 10.00/Kg
Price of output:
Turmeric Tk 6.00/Kg

nutrient use.

Total variable cost (TVC 63194 Tk ha^{-1}) was obtained where 45x10 cm^2 plant spacing was maintained due to higher seed cost corresponding the lowest TVC (51852 Tk ha^{-1}) was found from 60x30 cm^2 spacing due to use of small amount of fingerlings (Table 2). The gross return was highest (Tk. 107220 ha^{-1}) where 45x10 cm^2 spacing was used because of highest average yield (17.87 Tk ha^{-1}) (Table 1) and benefit cost ratio (1.70) of the same treatment was ranked the second position due to higher seed cost was involved. On the other hand, due to the lowest yield (13.42 t ha^{-1}) (Table 1), gross return, gross margin and benefit cost ratio were also the lowest where plants were spaced at 60 x 30 cm^2. Though the yield was slightly lower in 45x20 cm^2 spacing than (45 X 10 cm^2), but benefit cost ratio (BCR) was the highest (1.81) in the same treatment as because 50 percent lower seed cost was involved (Table 1). This result supported by Karim and Momin (1990) who stated that the highest yield was obtained in closer (40x10 cm^2) but highest seed cost was involved. Therefore, incase of yield 45x10 cm^2 spacing is technically suitable, but 45x20 cm^2 spacing is economically viable and profitable for turmeric production. From two years result, it was revealed that though the highest yield (17.87 t ha^{-1}) was obtained in 45x10 cm^2 spacing but economically it was inferior to the yield obtained in 45x20 cm^2 spacing (16.77 t ha^{-1}) where the highest benefit cost ratio (1.81) was obtained.

Therefore, it may be concluded from two years result that 45x10 cm^2 spacing was technically suitable but economically 45 x 20 cm^2 spacing is viable technology for commercial cultivation of turmeric.

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