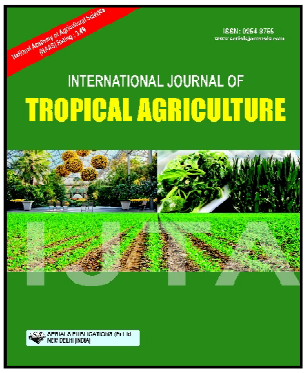

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Effect of Rhizome Size on Growth and Yield and of Turmeric

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Abstract: Turmeric is important rhizomatic spice crop of India. It is propagated by different types of rhizomes viz, mother rhizomes, primary rhizomes and fingers. The effect of seed rhizomes cuttings on growth and yield of turmeric was evaluated for three consecutive years. The mother rhizome as well as fingers were cut to different sizes and planted directly in to the field as well as plantlets were prepared in pro tray and transplanted one month after planting in portray. The pooled data shows that significantly highest leaf area, height of plant, maximum number of leaves per tiller and highest number of tillers were recorded by the turmeric planted by mother rhizomes which was at par with mother rhizomes cuttings (2 halves) directly planted in the field. The significantly maximum weight of mother rhizome (71.14 gm/plant), maximum number of primary rhizomes per plant (2.64), maximum weight of primary rhizomes (101.95 gm/plant), maximum number and weight of fingers per plant (15.00 and 534.74 gm/plant, respectively) and highest fresh as well as dry yield of rhizomes was recorded in the same treatment (346.25 qha^{-1} and 72.90 qha^{-1}, respectively) which was at par with mother rhizome pieces directly planted in the field (313.94 qha^{-1} and 65.58 qha^{-1}, respectively). Hence, the planting of Mother rhizome pieces (2 halves) directly in the field will saves the 50% seed rhizomes without affecting yield of the turmeric.

Key Words: Turmeric, Planting material, Rhizome, size

INTRODUCTION

Turmeric (*Curcuma longa* L) is one of the most important spice cash crop of India. It is cultivated throughout the India around 2.32 lakh ha area with annual production 11.90 lakh tonnes (Anonymous, 2015). It is sacred, auspicious dual purpose spice

valued for its food and colouring agent required by pharmaceutical, confectionary and cosmetic industry. Modern biomedical research also attests the medical value of turmeric in a variety of ailments. The major constituent present in turmeric is curcumin 0.3 -5.4 per cent (Leung, 1980) depending on the variety and climatic situations. The demand for the varieties having high curcumin content is increasing day by day. But the avability of quality planting material is the major limiting factor in turmeric cultivation.

Traditionally turmeric is propagated by through a small portion of the rhizomes known as seed rhizome or seed sets. (Ravindran *et al.* 2007). The seed rhizomes are mainly three types viz., mother rhizomes, side or primary rhizomes and secondary rhizomes and fingers. The yield of turmeric was maximum in the plants grown directly form mother rhizomes among the different types of rhizomes. The planting material used affects the growth and yield of turmeric. Therefore, selecting the right size of planting material is the most critical factor in the turmeric cultivation (Padmadevi *et al.*, 2012). Large sized seed rhizomes of ginger give significantly higher yield than planting of small pieces (Nybe and Raj, 2004). Hossain *et al* (2005) found high yield of turmeric from using 30-40 gm seed rhizomes compared to 10 and 20 g seed rhizomes.

Even though the rhizomes having large size, yields more but the seed requirement is too large about 2.5 tonnes ha^{-1}. These rhizomes have limitations as they are having less multiplication ratio. The cutting of seed rhizomes into pieces as well as preparation of plant lets in pro tray helps to reduce the seed rate of turmeric. Hence, the present experiment was conducted to study the effect of seed rhizome size as well as its cutting on growth and yield of turmeric with major objective of reduction in the quantity of seed.

MATERIAL AND METHODS

The field experiment was conducted to study effect of seed rhizome cuttings on growth and yield of turmeric on vertisols at Agricultural Research Station Kasbe Digraj, Dist. Sangli (Maharashtra) during 2014-2016 for three consecutive years to record the consistency in results. The experiment was laid out in randomized block design with three replications and a spacing of 37.5 x 30 cm. All the cultural practices were followed as per the recommended package of practices. The treatment comprises Single node cuttings directly planted in field (T_1), Two node cuttings directly planted in field (T_2), Mother rhizome cuttings (2 halves) directly planted in the field (T_3), Single node cutting planted in pro tray (T_4), Two node cutting planted in pro tray (T_5), Mother rhizome cuttings (2 halves) planted in pro ray (T_6), Secondary rhizomes/fingers planted directly in the field (T_7), primary rhizomes directly planted in the field (T_8) and Mother rhizomes directly planted in the field (T_9). The single node cuttings and two node cuttings were prepared from fingers. The plantlets prepared in pro tray by using planting mixture (Coco peat, farm yard manure and soil 1:1:1 proportion) were transplanted in the field after one month of its planting in pro tray. The observations of growth and yield attributes were recorded. The data were analyzed as per the method suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The pooled effect of different size of rhizomes on growth and yield attributing characters of turmeric are presented in Table 1.

Growth attributing characters

In the present study the growth attributing characters like leaf area, height of plant, number of tillers per plant and number of leaves per tiller were studied. The significantly highest leaf area (502.32 cm^2) was recorded in turmeric planted by using mother rhizomes which was followed by mother rhizome cuttings directly planted in the field (423.08 cm^2). The maximum height of plant (116.62 cm) after 150

days after planting was recorded in the treatment turmeric planted by using mother rhizomes which was at par with mother rhizome cuttings directly planted in the field (106.34 cm). The maximum number of leaves per tiller was recorded in the treatment turmeric planted by using mother rhizomes (13.27) which was at par with mother rhizome cuttings directly planted in the field (13.00). The highest number of tillers per plant was recorded in the treatment turmeric planted by using mother rhizomes (3.16) which was at par with mother rhizome cuttings directly planted in the field (3.00).

This might be due to the mother rhizomes contain more reserved food material which is utilized by the plant for initial establishment and vigorous growth. The more is the rhizome size maximum is the growth attributes. But the turmeric plantlets prepared in pro tray after transplanting recorded slow growth as it contains less stored food material in the rhizome cuttings. Padmadevi *et al.* (2012) reported that larger seed rhizomes contain larger amount of reserves that enhanced seedling growth which ultimately result in to taller plant. These results are in conformity with the observations recorded in tropical soda apple (Akanda *et al.*, 1996) and spring wheat (Stougaard and Xue, 2004). They reported that larger seed produce longer coleoptiles and had higher reserves which improves seedling establishment.

YIELD ATTRIBUTING CHARACTERS

The significantly maximum weight of mother rhizome (71.14 gm/plant) was recorded in turmeric planted by using mother rhizomes which was followed by mother rhizome cuttings directly planted in the field (67.92 gm/plant) and turmeric planted by using primary rhizomes (61.33 gm/plant). The maximum number of primary rhizomes per plant (2.64) was observed in mother rhizome cuttings directly planted in the field which was at par with turmeric planted by using mother rhizomes (2.42). The significantly maximum weight of primary rhizomes (101.95 gm/plant) was recorded in turmeric planted by using mother rhizomes which was followed by mother rhizome cuttings directly planted in the field (86.34 gm/plant). The maximum number and weight of fingers per plant (15.00 and 534.74 gm/plant, respectively) was observed in turmeric planted by using mother rhizomes which was at par with mother rhizome cuttings directly planted in the field (13.96 and 486.70 gm/plant, respectively). The highest fresh as well as dry yield of rhizomes was recorded by turmeric planted by using mother rhizomes (346.25 qha^{-1} and 72.90 qha^{-1}, respectively) which was at par with mother rhizome cuttings directly planted in the field (313.94 qha^{-1} and 65.58 qha^{-1}, respectively) which shows that 10.04 % reduction of the dry yield of turmeric as compared to turmeric planted by using mother rhizomes (Table 2).

The vigorous initial growth of the plant yields more may be due to better establishment of the plants. The maximum leaf area, number of leaves and tillers traps maximum sunlight results into increase in photosynthesis and yields maximum shoot biomass as compared to the transplanted plantlets. The Hossain *et. al* (2005) reported that maximum will be the yield of turmeric because of larger shoot biomass production. The similar results were observed by Sarker *et. al* (2001) in rice plant.

ECONOMICS

There is 50% saving in the seed cost by the turmeric planted by making two halves of the mother rhizomes (Table 2). The maximum net returns per hectare was observed in turmeric planted by using mother rhizomes (Rs. 312619) which was at par with mother rhizome cuttings directly planted in the field (Rs.310008.33). The maximum B: C ratio (1:2.02) was noticed in mother rhizome halves of turmeric directly planted in the field.

Table 1

Effect of rhizome size and cuttings on growth and yield attributing characters of turmeric (Pooled mean 2014-2016)

Treatments	*Leaf area (cm^2)*	*Height of plant (cm)*	*No. of leaves / tiller*	*No. of tillers / plant*	*Wt. of mother rhizome/ Plant (gm)*	*No. of primary rhizomes/ plant*	*Wt. of primary rhizomes/ Plant (gm)*	*No. of Secondary rhizomes/Plant*	*Wt. of fingers/ Plant (gm)*
T_1	242.31	81.85	9.81	1.60	39.04	1.11	37.36	10.18	271.35
T_2	296.90	94.84	11.11	2.13	57.70	1.89	62.60	11.33	388.42
T_3	423.08	106.34	11.67	3.00	67.92	2.42	86.34	13.96	486.70
T_4	160.67	68.66	8.82	0.93	33.85	0.82	24.62	9.38	225.98
T_5	246.59	75.60	9.67	1.31	36.95	1.00	28.51	11.09	306.28
T_6	285.89	85.96	9.90	1.53	43.23	1.38	48.80	11.56	371.79
T_7	295.91	97.10	10.86	2.07	52.38	1.69	64.29	11.85	380.23
T_8	386.44	106.88	11.51	2.47	61.33	2.05	78.62	13.25	414.53
T_9	502.32	116.62	13.00	3.16	71.14	2.64	101.95	15.00	534.74
S. E.±	7.68	5.20	0.45	0.06	1.08	0.11	5.21	0.35	17.67
C. D. 5%	23.03	15.65	1.36	0.19	3.26	0.33	15.66	1.06	53.07

Table 2

Effect of rhizome size and cuttings on yield and economics of turmeric (Pooled mean 2014-2016)

Treatments	*Fresh Yield of rhizomes (qha^{-1})*	*Dry Yield (qha^{-1})*	*% reduction yield over control*	*Seed Cost (Rs)*	*% reduction of cost over control*	*Gross returns (Rs ha^{-1})*	*Cost of cultivation (Rs ha^{-1})*	*Net returns (Rs ha^{-1})*	*B:C ratio*
T_1	161.24	32.99	54.75	11250	88.75	307233.33	225590.67	81642.67	1.36
T_2	254.45	52.29	28.27	18750	81.25	487998.33	262962.33	225036.00	1.86
T_3	313.94	65.58	10.04	50000	50.00	612398.33	302390.00	310008.33	2.02
T_4	126.93	25.78	64.64	11250	88.75	240928.33	236047.67	4880.67	1.02
T_5	200.80	41.23	43.44	18750	81.25	385005.00	268667.67	116337.33	1.43
T_6	232.65	48.39	33.62	50000	50.00	452030.00	297063.33	154966.67	1.52
T_7	261.72	53.62	26.45	75000	25.00	501126.67	325184.67	175942.00	1.54
T_8	282.85	58.74	19.42	100000	0.00	548486.67	346323.00	202163.67	1.58
T_9	346.25	72.90	0.00	100000	0.00	681033.33	368414.33	312619.00	1.85
S. E.±	13.10	2.52				7115.84	2360.39	5147.45	
C. D. 5%	40.00	7.61				21334.22	7076.75	15432.75	

CONCLUSION

The planting of Mother rhizome pieces (2 halves) directly in the field will saves the 50 % seed rhizomes without affecting yield of the turmeric. The growing of the plant lets in pro tray yields less due to its initial slow growth after transplanting. But it needs further investigation to provide the solution for maximum yield of the turmeric form the transplants as it requires less seed.

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