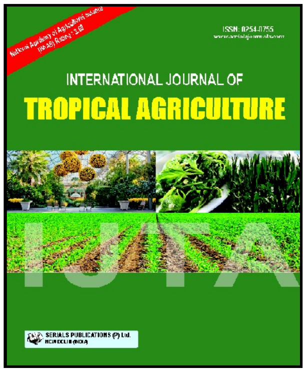

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Response of Different Planting Material to Major Nutrients on Yield and Economics of Turmeric (*Curcuma longa* L.)

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Abstract: At college farm of Horticultural College and Research Institute, Venkataramannagudem, Andhra Pradesh during 2014-15 an experiment was conducted to determine the effect of different types of planting material and fertilizer levels on yield and economics in turmeric. A total of six types of planting material raised in portrays *viz.*, single node cuttings, double node cuttings, mother rhizome pieces, primary, secondary and mother rhizomes were evaluated with five fertilizer doses in factorial randomized block design. The results indicated that use of mother rhizome as planting material along with 360:120:160 kg NPK ha^{-1} as fertilizer dose can obtain maximum yield (30.94 t ha^{-1}) as well as mother rhizome pieces with 360:120:160 kg NPK ha^{-1} can obtain optimum yield (18.63 t ha^{-1}) and primary rhizome as planting material along with 360:120:160 kg NPK ha^{-1} as fertilizer dose obtained maximum B:C ratio (4.67) as well as mother rhizome pieces as planting material with 360:120:160 kg NPK ha^{-1} B:C ratio was optimum (3.87) in the margin of Rs. 0.80.

Key words: Planting material, fertilizer levels, turmeric, yield and benefit cost ratio.

INTRODUCTION

The indigenous Indian spice, turmeric, is now catching the fancy of people around the world. The botanical name of turmeric is *Curcuma longa*. In fact, the dried root of this plant is turmeric. Popularly known to the western world throughout history as the Indian saffron due to its color and inimitable smell, it is widely used as a cheaper substitute of saffron. Turmeric, incidentally, is part of the ginger family Zingiberaceae. Turmeric is widely cultivated in India, China, Japan, Indonesia, Burma, and Taiwan and throughout Africa. Distinguished by its bright yellow color, turmeric is an integral part of various Indian dishes. It is used preparation of pulses, vegetarian dishes, non-vegetarian dishes, fish, baked products, ice-cream, dairy products, cereals, sweets, sauces etc. Turmeric is easily one of the most valuable spices in the world. It is cultivated commercially in India, which actually caters to 94 per cent of the world demand, and is sold in the market in the form of dried hormones. Apart from India, the other turmeric producing countries include Pakistan, Indonesia and Bangladesh and the major importing countries of this versatile spice includes Middle East Countries, Sri Lanka and Iran which consume 75 per cent of India's produce. Curcumin is the main biologically active phytochemical compound present in turmeric. The compound is extracted for research purposes and has proven disease preventing medicinal properties.

Turmeric, being a sterile triploid, is propagated vegetatively. Since rhizome multiplication is slow and maintenance of planting material is expensive. A rapid multiplication method of low cost through protrays, pathogen free transplants which produce the planting material more effectively than standard seed rhizome is necessary. As seed material cost is very high, there is a need to reduce the cost of seed material by adopting alternative planting material and selecting optimum size rhizome or rhizome cuttings. As a crop, turmeric has a high demand for plant mineral nutrients and yield production generally responds to increased soil fertility. Keeping in view of these facts, the present investigation was proposed to find out the response of different types of planting material raised in protrays and different levels of fertilizer to ensure better growth and yield along with quality of turmeric and to reduce cost of cultivation by reduction of seed rate.

MATERIAL AND METHODS

This experiment was followed during 2014-2015 at the Horticultural College and Research Institute, Venkataramannagudem, West Godavari District, Andhra Pradesh. A total of six types of planting materials were taken *viz.* Single node cuttings of primary rhizome (5-6 g), Two node cuttings of primary rhizome (8-9 g), Mother rhizome pieces (10-12 g), Primary rhizomes (20-25 g), Secondary rhizomes (8-10 g), Mother rhizomes (75-90 g) with five fertilizer levels *viz.* 120:40:100 kg NPK ha^{-1}, 180:60:115 kg NPK ha^{-1}, 240:80:130 kg NPK ha^{-1}, 300:100:145 kg NPK ha^{-1} and 360:120:160 kg NPK ha^{-1}. There were thirty treatment combinations replicated three times in Factorial Randomized Block Design.

Factor-1 Planting material (M)	*Factor -2 Fertilizer dose (D)*
M_1: Seedlings raised from single node cuttings of primary rhizome (5-6 g)	D_1: 120:40:100kg NPK ha^{-1}
M_2: Seedlings raised from two node cuttings of primary rhizomes (8-9 g)	D_2: 180:60:115kg NPK ha^{-1}
M_3: Seedlings raised from mother rhizome pieces (10-12 g)	D_3: 240:80:130 kg NPK ha^{-1}
M_4: Seedlings raised from primary rhizome (20-25 g)	D_4: 300:100:145 kg NPK ha^{-1}
M_5: Seedlings raised from secondary rhizomes (8-10 g)	D_5: 360:120:160 kg NPK ha^{-1}
M_6: Seedlings raised from mother rhizomes (75-90 g)	

Treatment Combinations

T_1: M_1D_1	T_6:M_2D_1	T_{11}: M_3D_1	T_{16}:M_4D_1	T_{21}: M_5D_1	T_{26}:M_6D_1
T_2:M_1D_2	T_7:M_2D_2	T_{12}:M_3D_2	T_{17}:M_4D_2	T_{22}:M_5D_2	T_{27}:M_6D_2
T_3:M_1D_3	T_8:M_2D_3	T_{13}:M_3D_3	T_{18}:M_4D_3	T_{23}:M_5D_3	T_{28}:M_6D_3
T_4:M_1D_4	T_9:M_2D_4	T_{14}:M_3D_4	T_{19}:M_4D_4	T_{24}:M_5D_4	T_{29}:M_6D_4
T_5:M_1D_5	T_{10}:M_2D_5	T_{15}:M_3D_5	T_{20}:M_4D_5	T_{25}:M_5D_5	T_{30}:M_6D_5

Available Nitrogen, Phosphorous and Potassium in the soil were determined by Modified Kjeldahl method (Jackson, 1973), Olsen's method (Olsen, 1954) and Flame Photometer method (Muhr, 1965) respectively. The selected Duggirala White variety was a typical medium duration variety with 7-8 months crop period. Initially seed rhizomes were laid in a nursery with shade net and 1month old seedlings were transplanted in the main field.The crop was fertilized with nitrogen, phosphorus and potassium according to the dosage scheduled in the experiment. The NPK fertilizers were applied in the form of Urea, Single Super Phosphate and Muriate of Potash respectively. The entire dose of P was applied as basal, while N and K were applied in three equal splits during the crop growth.

Entire crop protection measures and intercultural operations were followed as per the recommendation where ever the crop needed. The crop was harvested 8months after raising. Fresh rhizomes from each plot were weighed and recorded in kilograms per plot later gross plot yield was computed for one hectare.The prices of the inputs cost were recorded against each treatment and the labour cost prevailed at the time of their uses was taken into consideration.The gross income was worked out based on the prevailing market price (Rs 20/- per kg) for the rhizomes and the net income per hectare was calculated by subtracting the cost of cultivation from the gross income. The benefit-cost ratio was worked by dividing net returns and cost of cultivation per hectare.

RESULTS AND DISCUSSION

The data presented in table 1 revealed thatyield and economic characters showed significant differences due to different planting material, fertilizer doses and their interaction effects.The highest rhizome yield (30.94 t ha^{-1}) was recorded by treatment T_{30} (mother rhizomes with 360:120:160 kg NPK ha^{-1}) followed by (30.05 t ha^{-1}) T_{20} (primary rhizomes with 360:120:160 kg NPK ha^{-1}). The lowest rhizome yield (9.62 t ha^{-1}) was recorded by the treatment T_1 (single node cuttings with 120:40:100 kg NPK ha^{-1}). Studies made by Meenakshi *et al.,* 1999 and Reddy *et al.* 2015 also indicated similar trend in turmeric.

Regarding the economic parameters, the highest cost of cultivation (Rs. 243740 ha^{-1}) and gross returns (Rs. 618912 ha^{-1}) was recorded by T_{30} *i.e.*, mother

Table 1

Effect of type of planting material and fertilizer levels on yield and economics inturmeric (*Curcuma longa* L.)

Treatments	*Total yield (kg ha^{-1})*	*Cost of cultivation (Rs ha^{-1})*	*Gross returns (Rs ha^{-1})*	*Net returns (Rs ha^{-1})*	*B:C Ratio*
T_1	96204	56809	192408	135599	2.38
T_2	10223.2	58696	204464	145768	2.48
T_3	11922.7	60566	238454	177888	2.93
T_4	12272.9	62453	245457	183004	2.93
T_5	12950.2	64340	259003	194663	3.02
T_6	11008.0	64609	220159	155550	2.40
T_7	12774.2	66496	255484	188988	2.84
T_8	13779.6	68366	275591	207225	3.03
T_9	14462.5	70253	289250	218997	3.11
T_{10}	16316.1	72140	326322	254182	3.52
T_{11}	12829.5	69809	257850	188041	2.69
T_{12}	13824.6	71696	276472	204796	2.85
T_{13}	15596.5	73566	311930	238364	3.24
T_{14}	17774.0	75453	355480	280027	3.71
T_{15}	18636.4	77340	372727	295385	3.81
Treatments	*Total yield (kg ha^{-1})*	*Cost of cultivation (Rs ha^{-1})*	*Gross returns (Rs ha^{-1})*	*Net returns (Rs ha^{-1})*	*B:C Ratio*
T_{16}	24454.3	98409	489086	390677	3.96
T_{17}	25470.9	100296	509418	409122	4.07
T_{18}	26317.2	102166	526344	424178	4.15
T_{19}	28431.9	104053	568637	464584	4.46
T_{20}	30058.2	105940	601154	495224	4.67
T_{21}	12967.5	69809	259350	189541	2.71
T_{22}	14145.3	71696	282906	211210	2.94
T_{23}	14690.4	73566	293808	220242	2.99
T_{24}	17190.8	75453	343815	268362	3.55
T_{25}	19790.8	77340	395815	318475	4.11
T_{26}	24132.3	236209	482646	246437	1.04
T_{27}	26366.2	238096	527323	289227	1.21
T_{28}	28292.8	239966	565855	325889	1.35
T_{29}	29026.8	241853	580536	338683	1.40
T_{30}	30945.6	243740	618912	375172	1.53

Fertilizer cost: Urea-Rs. 5.5 kg^{-1}, SSP-Rs. 7.0 kg^{-1}, MOP-Rs. 16.5 kg^{-1}

rhizomes with 360:120:160 NPK kg ha^{-1}. The lowest cost of cultivation (Rs. 56809 ha^{-1}), gross returns (Rs. 192408 ha^{-1}) and net returns (Rs. 135599 ha^{-1}) was recorded by T_1 *i.e.*, single node cuttings with 120:40:100 NPK kg ha^{-1}. Based on these parameters analysis of benefit cost ratio revealed that it was highest (4.67) in T_{20} *i.e.*, primary rhizomes with 360:120:160 NPK kg ha^{-1} and the lowest benefit cost ratio (1.04) was recorded by T_{26} *i.e.*, mother rhizomes with 120:40:100 NPK kg ha^{-1}.

From the results obtained in the present investigation, it was clearly indicated that thee differences in the rhizome yield might be due to different planting materials can relate to the difference in the dry matter and biomass production of the plant. This may be due to translocation and mobilization of assimilates and nutrients from the source which is more in the mother rhizome, from where they are further translocated and accumulated in fingers making the mother rhizome quantitatively superior. Economic efficiency and the viability of crop cultivation are mainly the outcome of the yield of crops with higher management costs. Higher crop productivity with lesser cost of cultivation could result in better economic parameters like net returns and B:C ratio.

CONCLUSION

Even though there was increased yield in mother rhizomes with higher fertilizer doses one have to keep in mind that mother rhizomes were the another name for quality both for the purpose of curcumin extraction as well as for trade in case of turmeric. Hence for reducing the seed rate as well as cost, adaption of alternative methods like double node cuttings of primary rhizomes and pieces of mother rhizomes could be a foremost step towards better economy.

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