International Journal of Science, Environment and Technology, Vol. 14, No 2, 2025, 225 – 230
ISSN 2278-3687 (O)
2277-663X (P)

PERFORMANCE OF TURMERIC (*Curcuma longa* L.) VARIETIES UNDER ORGANIC AND INORGANIC PRODUCTION PRACTICES AT EASTERN GHATS REGION OF ANDHRA PRADESH

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Abstract: The agro-ecological conditions of the Eastern Ghats region of Andhra Pradesh with moderate temperatures, high rainfall and rich in soil organic carbon provide immense opportunity for the organic cultivation of turmeric. Turmeric is one of the essential crops being cultivated by tribal farmers of the Eastern Ghats region for their livelihood. At present nearly 8,000 ha area is under turmeric cultivation without adding inorganic fertilizers and plant protection chemicals. Since farmers do not follow any package of practices, farmers get less yields when compared to the state average yield. By observing this, ICAR-AICRP on Spices Centre, Horticultural Research Station, Chintapalli conducted an experiment to validated organic package in turmeric developed by ICAR- Indian Institute of Spices Research, Kozhikode along with inorganic package in three varieties of turmeric namely Roma, NDH-98 and Chintapalli Local in factorial RBD for three years from 2018-19 to 2020-21. The results revealed that irrespective of the variety, the inorganic package recommended by Dr. YSRHU recorded the highest plant height, fresh rhizome yield per hectare, dry recovery and dry rhizome yield per hectare when compared to the organic package. Among the varieties, NDH-98 recorded the highest fresh rhizome yield (42.80 t/ha) and dry yield (10.77 t/ha) when compared to other varieties.
Keywords: Turmeric, Organic package, Tribal Zone.

INTRODUCTION

Turmeric (*Curcuma longa* L.) is one of the most extensively cultivated spice crops grown in India because of agro-climatic suitability and rich genetic diversity. Turmeric is also known as the golden spice as reported by Ravindran *et al*., 2007. In India, turmeric is being cultivated in more than 20 states in an area of 1.93 lakh hectares with a yearly production of 10.52 MT. Turmeric occupies 5.47 per cent of the spices area and shares 14.87 per cent of spice production. In India, turmeric is extensively cultivated in Telangana, Andhra Pradesh, Odisha, West Bengal, Tamil Nadu, Assam, Maharashtra, Karnataka, Bihar and Kerala. In Andhra Pradesh, it is being cultivated in an area of 16800 hectares with 134100 MT of annual production (Anonymous, 2017).

Turmeric has a strong relation with the socio-cultural of the people of the Indian subcontinent. The turmeric rhizome was considered the “herb of the Sun” by the people of

*Received March 24, 2025 * Published April 2, 2025 * www.ijset.net*

the Vedic period (Ravindran *et al*., 2007). Turmeric has attracted much attention everywhere on the planet because of its significant medicinal properties (Cousins *et al*., 2007). Turmeric has anti-inflammatory, hepatoprotective, antitumor, antiviral, wound healing and anti-cancerous properties and is also beneficial in treating gastrointestinal and respiratory disorders (Polasa *et al*., 1994; Joe *et al*., 2004).

The agro-ecological situations of the Eastern Ghats region of Andhra Pradesh with moderate temperatures, high rainfall and rich in soil organic carbon provide immense opportunity for the organic cultivation of turmeric. Turmeric is one among the important crops being cultivated by tribal farmers of the Eastern Ghats region for their livelihood. At the movement, nearly 8,000 ha area is under turmeric cultivation within the Eastern Ghats region of Andhra Pradesh. The average productivity of this crop in the Eastern Ghats region of Visakhapatnam is extremely low (3 t/ha) as against the state average productivity (8.0 t/ha) since tribal farmers cultivate local cultivar by following the traditional method of cultivation without following package of practices and without adding inorganic fertilizers and plant protection chemicals. By observing this, ICAR-AICRP on Spices Centre, Horticultural Research Station, Chintapalli experimented assuming to have a comparative study on the effect of organic nutrient management package developed by ICAR- Indian Institute of Spices Research (IISR), Kozhikode and inorganic management practices on crop performance concerning crop growth and yield.

MATERIAL AND METHODS

An experiment was carried out at Horticultural Research Station, Dr. YSR Horticultural University, Chintapalli during *Kharif* 2018-19, 2019-20 and 2020-21 to enhance the productivity of turmeric under the Eastern Ghats region of Andhra Pradesh through the organic package of practices. The experimental site is found at the Agro-climatic zone of High Altitude and Tribal Zone with an annual rainfall of over 1300 mm, a maximum temperature range of 17 to 35ºC, a minimum temperature varies from 3 to 24ºC and is situated at an altitude of 933 m MSL. The geographical condition of the experimental site is 17^0.13′N latitude and 84^0.33′E longitude (Sivakumar *et al*., 2021). The soil of the experimental field was alluvial and it had been provided with good drainage. The experiment was conducted with two factorial randomized block design with four replications, where organic and inorganic plots had similar soil properties and were 5m aside from one another and were separated from polyethylene film up to a depth of 60 cm to eliminate any possible contamination. The experiment constitutes three varieties *Viz*., Roma, NDH-98 and

Chintapalli Local and two treatments *i.e*. organic package developed by ICAR- Indian Institute of Spices Research, Kozhikode (Table 1) and other treatment was an inorganic package of practices recommended by Dr. YSR Horticultural University *i.e.* incorporation of FYM @25 t/ha, neem cake @500 kg/ha, NPK @ 175:60:115 kg/ha and Zinc Sulphate @ 25 kg/ha. The standard of FYM required was calculated on a dry weight basis and therefore the total nitrogen content of manure used ranged from 0.99 to 1.10%. The recommended dose of nitrogen and potassium was given within the kind of inorganic fertilizers in three split doses *i.e*. at 40th 80th and 120th day after planting and the entire amount of phosphorus was applied during the last ploughing in the inorganic package of practices. Observations were recorded from 5 plants of every treatment in each replication on different growth and yield characters. The pooled replicated data was analyzed statistically.

Table 1. Organic production package in turmeric crop developed by ICAR-Indian Institute of Spices Research, Kozhikode Kerala and validated at HRS, Chintapalli

Pre sowing rhizome treatment	PGPR strain GRB-35 1 capsule/100 l of water	Seed rhizome dipping in PGPR solution
Basal application of organic manures	FYM 20 t/ha Neem cake 2 t/ha	To be applied before last ploughing
Top dressing of organic manures	Vermicompost 2 t/ha Ash 0.5 t/ha Soil low in K – Sulphate of potash supplementation 50-100 kg	45th & 90th Days after planting
Micronutrient	IISR turmeric booster @ 5 g/l (3-5 kg/ha)	Foliar spray at 60th and 90th Days after planting
Pest and disease management		
1. Shoot borer	Neem oil	5ml/l foliar spray
2. Rhizome rot	Bordeaux mixture 1%	Spray and drenching

RESULTS AND DISCUSSION

Analysis of pooled mean data over 3 years (2018-19, 2019-20 and 2020-21) for the different growth and yield traits are furnished in Table 2. Among the varieties, NDH-98 recorded more plant height (141.63cm). The plant height was more under the inorganic package of practice (134.88 cm) in comparison with the organic package of practices. Regardless of the variety, more plant height was noticed in the inorganic package of practices in comparison to the organic package of practices. Significantly more tillers per plant (1.57) were observed in Chintapalli Local under the inorganic package of practices. Among three varieties, NDH-98 recorded the highest fresh rhizome yield per hectare (40.95 t/ha). Irrespective of the variety, the highest fresh rhizome yield was recorded in the inorganic package (33.84 t/ha). The

interaction between varietal performance and production system for fresh rhizome yield per hectare was the highest in NDH-98 (42.80 t/ha) cultivated under the inorganic package of practice. From table 2 it has been found that a notable difference was noticed among the varieties. The very best dry recovery percentage was recorded in the variety NDH-98 (24.86 %) whereas in the inorganic package production system, it was 22.67 %. The recorded data also showed that the interaction between varietal performance and production system for dry rhizome yield per hectare was highest in variety NDH-98 (10.19 t/ha) cultivated under the inorganic package of practice. Irrespective of the variety, the dry recovery percentage was highest in the inorganic production system. The benefit-cost ratio indicated that no matter the variety, the crop grown with the inorganic package production system recorded the best benefit-cost ratio.

Growth and yield traits showed a significant difference among the varieties in different production systems. A significant increase in plant height in the present study could be because of the differential response of nutrient combinations ensured readily availability of nutrients for initial requirement through inorganic source and slow pace as long run availability through the organic source which includes a role in cellular division, other physiological processes and resulted in higher plant height. Similar results were reported by Gayathri and Reddy (2013) in okra, Pramod *et al*. (2020) in sweet basil and Basak and Jana (2016) in turmeric, where the beneficial result of the application of organic manures besides inorganic fertilizers increased the vegetative and rhizome growth of turmeric could be attributed to the readily available nutrients through inorganic fertilizers and effect of organic manures that improves physical, chemical, and biological properties of soil *i.e.* increasing soil organic matter, cation exchange capacity, water holding capacity and availability of mineral nutrients. The varieties, NDH-98 and Roma were found promising for growth and yield characters. That could be due to the environmental effect which could have triggered the phenotypic expressions.

CONCLUSIONS

Based on findings from this investigation, it could be concluded that regardless of the cultivar, inorganic treatments recorded more plant height, fresh weight of the rhizome, fresh yield and dry yield per hectare along with dry recovery in comparison to organic treatment but the organic package could be recommended to the organic growers to boost the productivity and net returns in turmeric crop under the high altitude tribal zone of Eastern Ghats region of Andhra Pradesh.

Acknowledgement

The authors are indebted to the Project Coordinator, ICAR-AICRP on Spices and Dr.YSR Horticultural University the facilities provided to carry out the study.

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Table 2. Performance of turmeric varieties under different nutrient management practices for growth and yield traits

Treatments	Plant height (cm)			No. of tillers			Fresh weight of rhizome/ ha (t)			Dry recovery (%)			Dry weight of rhizome/ ha (t)			B:C Ratio	
	P1	P2	Mean	P1	P2	Mean	P1	P2	Mean	P1	P2	Mean	P1	P2	Mean	P1	P2
Roma	129.11	134.63	131.87	1.47	1.47	1.47	29.89	32.56	31.22	22.68	24.03	23.35	6.78	7.82	7.30	2.37:1	2.73:1
NDH-98	137.73	145.54	141.63	0.92	0.95	0.94	39.11	42.80	40.95	24.55	25.17	24.86	9.60	10.77	10.19	2.79:1	3.13:1
Chintapalli Local	114.46	124.47	119.46	1.55	1.57	1.56	25.40	26.17	25.78	17.62	18.81	18.22	4.48	4.92	4.70	1.56:1	1.72:1
Mean	127.10	134.88	--	1.31	1.33	--	31.47	33.84	--	21.62	22.67	--	6.95	7.84	--		
	V	**P**	**V x P**	**V**	**P**	**V x P**	**V**	**P**	**V x P**	**V**	**P**	**V x P**	**V**	**P**	**V x P**		
S.E(m)	2.45	1.99	3.46	0.06	0.05	0.08	0.89	0.73	1.26	0.22	0.18	0.31	0.21	0.17	0.29		
CD (5%)	7.44	6.07	10.53	0.17	NS	0.23	2.71	2.21	3.84	0.66	0.54	0.93	0.64	0.52	0.90		

P1= Organic package of practices
P2= Inorganic Package of Practices recommended by Dr. YSRHU

V= Variety
P= Package of practice