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Effect of manures on growth and yield of Turmeric in the agency areas of East Godavari district

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Abstract

Unscientific use of chemicals leads to several health hazards and environmental problems to protect our crops and the environment we have to follow the scientific and eco-friendly horticulture which minimises the use of harmful and energy intensive inputs and adopts the use of organic manures. A study on turmeric was conducted at Horticultural Research station, pandirimamidi, Dr. YSR Horticultural University, Andhra Pradesh, to find out the growth and yield response of turmeric to organic manures (general recommended dose, farmyard manure, vermicompost, sheep manure and their combinations) on nitrogen basis, in turmeric variety Tekuripeta-2. The experiment was laid out in randomized Block design with eight treatments and three replications. The trial was conducted on the fixed site of soil for the continuous of three years (2016-18) and the pooled data revealed that the maximum plant height (99cm) number of leaves (8.4) number of tillers per plant (2.6) fresh rhizome yield per plant (432g) per plot (26.3kg) and curing per cent 21.4 was recorded in application of vermicompost plus sheep manure followed the application of combination of farmyard manure alone.

Keywords: Farmyard manure, vermicompost, sheep manure

Introduction

India is the largest producer of turmeric, supplying 94% of the world's demand. India dominates the world production scenario contributing to approximately 75% of world's total production producing 6,00,000 tonnes of turmeric annually. The area under turmeric cultivation is about 183 thousand hectares annually. India produces about 792 thousand tonnes of turmeric in 2010. Turmeric occupies 6% of the total area under spices and condiments in India. Andhra Pradesh is the leading turmeric producing state in India contributing about approx. 47% of total production followed by Tamil Nadu and Kerala. India has been a traditional producer, consumer and exporter of turmeric, but the productivity of turmeric in India is lowest in the world. Chemical fertilizer, and pesticide used in agriculture for increasing yield and controlling weeds and pests can contaminate the water, air and food, decrease soil fertility, inhibit growth of soil microorganisms and hazard human health (Sharifuddin and Zaharah, 1991; Li *et al.*, 1999; Neera *et al.*, 1999; Erisman *et al.*, 2001) [11, 14, 21]. In addition, chemicals may destroy many species of plants, insects, fishes and soil microorganisms (Fantroussi *et al.*, 1999) [3]. Therefore, utilization of farmyard manure in agriculture is recommended for retaining productivity of problematic soils, reducing the usages of chemical fertilizer, improving economy in agriculture and minimizing environmental problems (Sharifuddin and Zaharah, 1991; Neera *et al.*, 1999; Whalen *et al.*, 2003; Xiao *et al.*, 2006) [14, 25, 27]. Turmeric is a horticultural root-crop that is important not only as a spice and cosmetic, but also as a medicinal plant worldwide (Hermann and Martin, 1991; Sugiyama *et al.*, 1996; Nakamura *et al.*, 1998; Ishimine *et al.*, 2003; Hossain *et al.*, 2005a, b) [5, 22, 13, 9, 6-7]. Considering the medicinal values of turmeric and environmental problems caused by chemicals application, it is important to cultivate turmeric using organic fertilizer (e.g. farmyard manure). farmyard manure is regularly applied to many root crops for higher yield (Vaneck *et al.*, 2003) [23].

Turmeric being a long duration (8-9 month) exhaustive crop responds well to nutrition, so optimum dose of nutrients is very much essential to produce good yield. The organic manure gives better quality produce as compared to those grown with inorganic sources of fertilizer. (Abusaleha and Shanmugavelu, 1985) [1]. They are superior with respect to desirable ingredients such as minerals, vitamin (B1, B2 and C), carbohydrate, protein and free amino acid as well as organic acids (Woese *et al.*, 1997) [26]. Organic manure improves soil physical texture; structure and decreased soil bulk density and retained more moisture, consequences

paved the way for greater weight of primary rhizomes per plant (Gill. *et al* 2004)^[4]. Gradual deficiency in soil organic matter and reduced yield of crops are alarming factors and burning issues for the farmers and agriculturists. All efforts should be made to develop consciousness of the farmers about the importance of soil organic matter and sustainable soil productivity for getting higher yield of crops. Integrated use of organic manures are necessary for sustaining soil fertility and productivity. Hence, keeping the above aspects and importance in view the present study was taken up to evaluate the effect of different forms of organic manures and their combination on growth, yield and quality of turmeric.

Farmyard manure, sheep manure and vermicompost are locally available on commercial scale in agency areas where tribals are major population with a habit of rearing of cattle, sheeps etc. This provides huge availability of manures for organic cultivation. A field experiment was conducted for three consecutive years (2016 to 2018) at the Horticultural Research station, pandirimamidi, Dr.YSR horticultural university, with an objective to find out the optimum organic manure and its combination in turmeric var. Tekuripeta-2, to get higher growth and economic yields.

Materials and methods

The study was carried out at Horticultural Research Station, Pandirimamidi, Rampachodavaram, Andhra Pradesh. Trumric var Tekuripet -2 seed rhizomes collected from germplasm availability of the same station and used for this study. Since the temperatures and climatic conditions higher altitude zones were preferable for the cultivation of this crop. This experiment is laid out in Randomized Block design and plots are laid after thorough ploughing of the field and also after application of the recommended manure treatments and their combinations. The experimental site was well prepared and all the necessary cultural practices like ploughing, weeding, irrigation, manural application measures were followed for healthy growth of the experimental material. Data on growth, yield and yield attributing characters were collected at appropriate stage.

Eight treatments i.e T1- Farm yard manure(100 Percent), T2- Vermicompost(100 Percent), T3-Sheep manure(100 Percent), T4- Farm yard manure (50 per cent) + Vermicompost(50 per cent), T5- Farm yard (manure 50 per cent) + Sheep manure (50 per cent), T6- Vermicompost(50 per cent)+ Sheep manure (50 per cent), T7- Farm yard manure (33 per cent) + Vermicompost(33 per cent) + Sheep manure (33 per cent), T8- is control with recommended dose of fertiliser and replicated thrice. Manures a completely dried farm yard manure (50 t/ha), goat manure (12.5 t/ha) and vermicomposting at 13 t/ha were applied as per the nitrogen equivalent basis. One turmeric plant requires around 0.20 x 0.8m space in field for better growth and higher yield, therefore the manure was applied this area (0.16 m²) as pit method and each plot considering as 7.7 m². Healthy seed rhizomes (30-35g of each) of turmeric were planted to a depth of 3-4 cm, in the last week of April. Three to four hand weedings were done. Irrigation was given as per requirement through drip with water discharge of 8 liters per hour.

The crop was harvested 9 months after planting, observations on different growth and yield attributing parameters were recorded from five randomly selected plants per replication. Rhizome yield was taken on net plot basis at harvest and projected yield was calculated on the basis of yield per plot, considering the 75 per cent area occupied by the crop (Anon., 1995). For determination of dry recovery the composite

sample were kept at 70 °C till constant weight. The oleoresin content were estimated using air condenser and chromatographic column respectively. (Sadasivam and Manickam, 1996)^[17].

Results and Discussion

Growth parameters and yield of turmeric increased with all types of manural applications. Among the growth parameters, highest plant height (99cm) recorded in vermicompost combination with Sheep manure T6, which are statistically significant and on par with the treatments T5 (96 cm), T4 (93cm) and T1 (93cm) and lowest plant height(80cm) were recorded in T7. This might be due to the soil treated with the manure were found to be loose and were also found to have more available soil moisture (hand feeling) and slow release of required nutrients which resulted in higher vegetative growth parameters of turmeric.

Among the treatments in table 1 indicated that highest number of leaves (8.4) were recorded in vermicompost plus sheep manure(T6) whereas lowest number of leaves(7.2) were recorded in control (T8). Highest number of tillers (2.6) were recorded in vermicompost plus sheep manure(T6) which is on par with both the farm yard manure (T1)(2.4) and farm yard manure plus vermicompost(T4) (2.0) lowest number of tillers(1.5) recorded in (T7) farm yard manure plus Vermicompost plus sheep manure which are significantly different. Highest leaf length and leaf width are not showing much variation and which are statistically non-significant.

Among the parameters the pooled data depicted in Table 2, the highest yield per plant (438g) were recorded in farm yard manure (T1) which were at par with vermicompost plus sheep manure(T6) (432g) and Control (T8) (432g) followed by vermicompost (422g) and lowest (357g) were recorded in farm yard manure plus vermicompost plus sheep manure (T7) and (T3) Sheep manure alone which are significantly different to other treatments. (Poinkar.MS *et al.* 2006, Yanthan TS *et al.* 2012)^[15, 28]. Similarly, other studies reported that organic fertilizer improved soil productivity and fertility, which improved yield and quality of crops (Whalen *et al.*, 2000; Maerere *et al.*, 2001; Vanek *et al.*, 2003)^[24, 12, 23] The higher yield might be due to increase in plant height, number of leaves, number of tillers per plant. This might be due to the availability of the nutrients in readily available form during organic manuring and the C: N was high over control (Roy S.S &Hore J.K 2010)^[16]. The soil treated with manure was found to be loose, which probably provided adequate aeration into the soil and improved soil microbial activities (Xiao *et al.*, 2006)^[27]. The highest yield per plot recorded (26.3kg) (T6) vermicompost plus sheep manure which is on par with (T5) (23.9kg) farmyard manure plus sheep manure and farm yard manure alone(T1) (23.8kg). These findings are in agreement with the findings of Sarma I *et al.* 2015^[19]. Highest curing percent 21.6 were recorded T6 vermicompost plus sheep manure followed by T1 farmyard manure 20.6 whereas lowest was recorded Control T8. Higher soil microbial activities may release nutrients from the farmyard manure as well as soil for better plant growth. The soil without manure showed a water logging condition for some time and dried earlier as compared with the soil treated with manure, indicating that the soil without manure has lower porosity and farmyard manure improves water holding capacity of soil. Several studies (Whalen *et al.*, 2000, 2003; Seobi *et al.*, 2005)^[24-25, 20] revealed that organic manure increases pH and water-holding capacity, and decreases bulk density in soil. The loose soil was probably favorable for root

growth and rhizome-stub expansion, which ultimately promoted vegetative growth, rhizome size and yield of turmeric. The plants with the manure remained green longer and had higher plant height, larger leaf area and greater leaf biomass, which ultimately provided longer and higher

photosynthesis process and resulted in a higher yield of turmeric. Similar results were obtained in previous studies (Sarker *et al.*, 2001; Ishimine *et al.*, 2003, 2004; Hossain *et al.*, 2005a, b; Hossain and Ishimine, 2003) ^[18, 9-10, 6-7,9].

Table 1: Effect of manures and there combination on growth of turmeric cv. Tekurpet-2

	Plant height(cm)				No. of leaves				No. of Tillers				Leaf Length (cm)			
	2016	2017	2018	Pooled	2016	2017	2018	Pooled	2016	2017	2018	Pooled	2016	2017	2018	pooled
T ₁ -FYM	106	81	93	93	7.6	8.0	7.3	7.6	2.8	2.5	2.0	2.4	49.7	46	43.6	46.4
T ₂ -VM	93	84	96	91	8.2	7.7	7.2	7.7	1.8	1.9	1.7	1.8	46.2	44	42.6	44.3
T ₃ -SM	94	86	96	92	8.3	8.3	7.4	8.0	1.8	1.7	1.5	1.7	46.4	43	41.6	43.7
T ₄ -F + VM	105	81	92	93	8.2	8.1	7.7	8.0	2.0	2.1	1.8	2.0	49.6	45	44.3	46.3
T ₅ -F + S	101	90	96	96	8.2	8.2	7.4	7.9	2.1	2.0	1.7	1.9	49.0	49	46.3	48.1
T ₆ -V + S	99	94	105	99	8.0	8.7	8.5	8.4	2.3	2.5	2.9	2.6	45.7	48	46.3	46.7
T ₇ -F+V+S	94	61	84	80	8.8	7.7	6.9	7.8	1.4	1.5	1.5	1.5	48.3	47	44.3	46.5
T ₈ -Control	106	78	91	92	8.4	6.7	6.5	7.2	2.1	1.4	1.3	143.6	43.9	41	40.3	41.7
CD	8.4	6.7	6.7	7.3	NS	0.9	1.02	1.0	0.65	0.49	0.6	0.6	NS	NS	2.5	2.5
SEm	3.9	2.2	2.2	2.8	0.3	0.3	0.33	0.3	0.21	0.16	0.2	0.2	1.7	2.3	0.8	1.6
CV	2.8	4.6	4.1	3.8	6	6.4	7.8	7.1	18	14.1	19.4	17.2	6.1	9.1	3.2	6.1

Table 2: Effect of manures and there combinations on growth and yield of turmeric cv. Tekurpet-2

	Leaf width (cm)				Yield per plant (g)				Yield per plot (kg)				Curing per cent			
	2016	2017	2018	Pooled	2016	2017	2018	Pooled	2016	2017	2018	Pooled	2016	2017	2018	pooled
T ₁ -FYM	14.7	13.6	12.0	13.4	653	347	313	438	26.8	21.3	23.3	23.8	19.3	20.3	22.3	20.6
T ₂ -VM	14.1	13.8	11.0	13.0	583	362	320	422	24.5	20.3	21.6	22.1	19.6	19.8	20.3	19.9
T ₃ -SM	14.6	13.7	13.0	13.8	433	297	340	357	23.7	22.0	24.0	23.2	18.5	18.8	19.3	18.9
T ₄ -F + VM	15.2	14.5	11.6	13.8	513	313	320	382	26.2	21.3	23.0	23.5	19.1	19.3	19.7	19.4
T ₅ -F + S	13.4	12.9	12.0	12.8	493	377	310	393	25.0	22.6	24.0	23.9	19.6	19.4	20.0	19.7
T ₆ -V + S	14.5	14.5	14.6	14.5	533	417	345	432	29.3	23.3	26.3	26.3	21.2	20.9	22.0	21.4
T ₇ -F+V+S	14.7	13.8	12.0	13.5	500	337	235	357	23.0	20.3	20.6	21.3	18.3	18.8	19.0	18.7
T ₈ -Control	14.1	13.4	11.0	12.8	650	370	275	432	15.0	12.1	13.3	13.5	18.1	18.9	18.0	18.3
CD	0.82	NS	1.7	1.3	118	51	46	72	6.2	1.7	2.9	3.6	1.37	1.25	1.9	1.5
SEm	0.26	0.78	0.58	0.5	38	17	15	23	2.1	0.55	0.9	1.2	0.44	0.4	0.64	0.5
CV	3.2	9.8	8.2	7.1	12	8.3	8.5	10	14.5	4.7	7.6	8.9	4	3.6	5.5	4.4

Conclusions

Based on the results of the experiment, it may be concluded that treatment T₆ vermicompost and sheep manure combination and farmyard manure alone was found most suitable in relation to growth, yield and quality of turmeric (*Curcuma longa* L.) variety Tekuripet-2, cultivation under the agro-climatic conditions of tribal areas of East Godavari district Andhra Pradesh.

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