➔DOI : 10.15740/HAS/AJBS/10.2/133-137
e ISSN-0976-8343 | ■ Visit us : *www.researchjournal.co.in*
ASIAN JOURNAL OF BIO SCIENCE
Volume **10** | Issue 2 | October, 2015 | 133-137

RESEARCH **P**APER

Effect of organic manure, vermicompost and neemcake on growth, yield and profitability of turmeric (*Curcuma longa* L.) variety- Megha Turmeric-1

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Article Info : Received : 29.07.2015; Revised : 19.08.2015; Accepted : 05.09.2015

A field experiment was conducted during 2012-2013 at farmer's field of Jorhat district to investigate the effect of different organic nutrients on growth, yield and economics of turmeric cultivation. The experiment was laid out in Randomized Block Design with four treatments and five replications. Application of different combinations of organic manure, vermicompost and neemcake influenced the growth and yield of turmeric variety Megha Turmeric-1. The results revealed that the combined applications of FYM + vermicompost + neemcake *i.e.* T_4 increased plant height, number of fingers, girth of rhizome, weight of rhizome and rhizome yield. While minimum of these were observed in the absolute control *i.e.* T_1. Highest rhizome yield (20.48 t ha^{-1}) with maximum benefit- cost ratio (3.6) was obtained in the treatment combination T_4 and the lowest yield (12.50 t ha^{-1}) was obtained in the treatment T_1 with minimum benefit- cost ratio (3.1).

Key words : Organic, Turmeric, Vermicompost, FYM, Neemcake

How to cite this paper : Sarma, I., Phukon, M. and Borgohain, Roopa (2015). Effect of organic manure, vermicompost and neemcake on growth, yield and profitability of turmeric (*Curcuma longa* L.) variety- Megha Turmeric-1. *Asian J. Bio. Sci.*, **10** (2) : 133-137.

INTRODUCTION

Turmeric (*Curcuma longa* L.) is an important spice crop of India and many other Asian countries. Turmeric grows well in Andhra Pradesh, Maharashtra, Orissa, Tamil Nadu, Karnataka, Kerala and some parts of North East India including Assam. Turmeric is widely cultivated mainly for its rhizomes. It is used both as spice and as raw material for dye making and cosmetic industries. It is also used in religious ceremonies and for culinary purposes. Curcumin, the primary pigment of turmeric, is generally used in various food industries as a food colourant. It is one of the basic components of curry powder which is available in the market. The use of turmeric for colouring and flavouring food items and its medicinal properties has been reported from the time of ancient Vedic culture of India. It is rich in dietary fibre, iron, potassium, magnesium and vitamin B_6. In Assam, turmeric cultivation is done by the farmers traditionally in kitchen garden or in hillock areas. The farmers usually don't use any fertilizers and chemicals and purpose of cultivation is mostly for consumption. But to maintain the soil health and sustainability for longer period, organic manures and other organic fertilizers are important. Combined application of different organic sources such as the farm yard manure, vermicompost and neemcake results in to high yield and quality rhizomes. It will not only be helpful for sustainable agricultural development but will also avoid chemical- based farming.

Consistent and indiscriminate use of inorganic fertilizers has caused serious damage to the soil and

ecology. In recent years, organic agriculture has been gaining considerable importance and many farmers are switching over to this traditional method of cultivation as a means to produce safe foodstuff and conserve the environment. Application of organic manures has various advantages like improving soil physical properties, water holding capacity and organic carbon content apart from supplying good quality of nutrients (Singh *et al*., 2009).

Considering the world demand for organic food, the improvement of soil health and productivity and the availability of local resources, the organic farming practice can be encouraged. The present research was conducted to evaluate the significant and combined effect of organic manure, vermicompost, microbial inoculants and neemcake on the growth, yield and profitability of turmeric variety Megha Turmeric-1.

RESEARCH METHODOLOGY

A field experiment was conducted at farmers' field in Mariani of Jorhat district of Assam during 2012-13 using turmeric variety Megha Turmeric-1. The experiment was laid out in Randomized Block Design with four treatments and five replications. The treatment consisted of different combinations of FYM, vermicompost, neemcake and *Trichoderma harzianum*. The selected plot of land was previously lying virgin.

T_1 : Absolute control

T_2 : Vermicompost + Neemcake + *Trichoderma harzianum*

T_3 : FYM+ Neemcake + *Trichoderma harzianum*

T_4 : FYM + Vermicompost + Neemcake + *Trichoderma harzianum*

Organic sources of nutrients were applied as vermicompost @ 1 t/ha, FYM @ 5 t/ha and neemcake 250 kg/ha. The gross plot size for each treatment was 12 m^2. All organic manures were incorporated in the soil before planting of rhizomes. In case of *Trichoderma*, slurry was prepared by dissolving 20g in one litre of water and the rhizomes were dipped in it and then dried for 30 minutes under shade before planting. The crop was harvested when the above ground portion were completely dried up. Five observational plants from each treatment per replication were taken. All the cultural operations were done as per normal package of practices of horticultural crops (Anonymous, 2005). Observations on plant height (cm) and girth of rhizome were recorded at monthly interval and weight of rhizome, number of finger per plant and total yield were recorded at the time of harvest. The data on different parameters were recorded from a sample of five randomly chosen plants. Girth of rhizome per plant was recorded by uprooting the plants at monthly interval. Plot means were computed and were subjected to analysis of variance (ANOVA).

RESEARCH FINDINGS AND ANALYSIS

The study revealed that different combinations of organic treatments showed variation in growth and yield characters of turmeric. Significant differences were observed among the four different treatments for growth and yield characters *viz*., plant height, girth of rhizome, weight of rhizome, numbers of fingers and total yield. Among different organic manures and their combinations tried, combined application of vermicompost and FYM (T_4) was found to be the most effective followed by application of vemicompost (T_2). Maximum plant height (75.02cm) was obtained in T_4 while minimum was in T_1. Similarly maximum girth of rhizome (15.76cm), weight of rhizome (500g) were observed in T_4.The highest yield (20.48t/ha) was obtained in the treatment T_4 and minimum (12.5 t/ha) was obtained in T_1 (Table 1 and 2).

The improvement in growth and yield parameters in the treatment combination (T_4) might be due to combined application of vermicompost and FYM that influenced the physical, chemical and biological properties of soil through supplying macro and micro nutrients leading to better plant growth and development which supports the findings of Meelu (1996), Patidar and Mali (2004), Singh *et al*. (2009) and Sarma *et al*. (2011). Compared to the availability of nutrients from most of the bulky organic manures, the release of nutrients from vermicompost is more and could be the reason for higher plant heights (Bhende *et al*., 2013). These results showed that the improvement in plant growth parameters could probably be due to increase in enzymatic activity, increase in microbial population and activity, increase in soil moisture holding capacity, accelerating the population and activity of earthworm and easy availability of macro and micro nutrients by application of vermicompost (Mascolo *et al*., 1999; Albiach *et al*., 2000; Arancon *et al*., 2006; Prabha *et al*., 2007; Azarmi *et al*., 2008 and Ekinci and Dursun, 2009). The higher and easily available nutrient content in vermicompost and their uptake by the plants might be one of the reasons for the highest rhizome yield in T_4.Besides influencing the physico chemical properties

of soil, vermicompost is also known to contain growth promoting substances, enhance microbial activity and prevent nitrogen loss by leaching (Sultan, 1995 and Shinde *et al*., 1992).

Vermicompost improves the overall soil health, nutrient retention and their availability (Sreenivas *et al.*, 2000). Vermicompost is known to contain all essential plant nutrients and gives steady supply of these nutrients during entire crop period (Jat and Ahlawat, 2004). Favourable influence of vermicompost on the availability of all the essential plant nutrients during the crop period was also reported by Sharma *et al*. (2004). The higher nutrient content in neemcake coupled with their easy and extended availability and better uptake brought about by the microbial action might have resulted in higher yield in treatment T_4. Neemcake reduces leaching loss and extends the period of availability of N (Sathianathan, 1982). Increase in the yield by the application of neemcake has been reported by Sadanandan and Hamza (1997) in ginger and Rao *et al*. (2005) in turmeric.

Perusal of the data (Table 3) revealed that the cost of cultivation of turmeric varied from Rs. 45000.00 to Rs.86000.00. The maximum gross return Rs. 400000.00 was found in the treatment combination T_4 due to maximum yield of rhizome and minimum Rs. 187500.00 in the treatment T_1. The highest benefit-cost ratio (3.6) was obtained in the treatment combination T_4 and the lowest was found in the treatment T_1 (3.1).

Conclusion :

The growth, yield and profitability of turmeric variety Megha Turmeric-1 were influenced by the application of different combinations of organic manure, vermicompost, and neemcake. From the results it was found that the combined application of FYM + Vermicompost + Neemcake + *Trichoderma harzianum i.e.* T_4 increased all the plant growth parameters, yield attributing characters and total yield. While minimum of these were produced by T_1 *i.e.* absolute control. Highest rhizome yield (20.48 t/ha) with maximum benefit- cost ratio (3.6) was obtained in the treatment combination T_4 and the lowest yield (12.50 t ha^{-1}) was obtained in the treatment T_1 with minimum benefit- cost ratio (3.1).

Acknowledgement :

The authors are grateful to the Department of Biotechnology, Government of India for providing financial assistance to conduct the experiment under

Table 1 : Influence of organic manure, vermicompost and neemcake on plant height and girth of turmeric rhizome at monthly interval

Treatments	Plant height(cm)							Girth of rhizome(cm)					
	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	180 DAP	210 DAP	90 DAP	120 DAP	150 DAP	180 DAP	210 DAP	240 DAP
T_1	19.53	24.54	25.49	26.08	40.04	50.54	52.50	1.75	4.50	6.09	7.50	9.50	10.25
T_2	19.64	24.66	28.62	33.24	47.47	55.78	65.58	1.94	5.29	7.54	9.54	11.51	13.85
T_3	19.71	24.51	26.56	30.50	45.36	52.87	60.39	1.86	4.94	7.29	8.84	10.65	12.80
T_4	20.02	25.00	30.00	35.51	55.46	65.00	75.02	1.94	5.54	8.51	11.70	13.50	15.76
C.D. (P=0.05)	0.07	0.24	0.19	0.14	0.19	1.82	0.27	0.04	0.04	0.20	0.09	0.05	0.06

Table 2 : Influence of organic manure, vermicompost and neemcake on yield and yield attributing characters of turmeric

Treatments	Weight of rhizome/plant(g)	Number of fingers per plant	Yield (t/ha)
T_1	450.22	4.48	12.50
T_2	484.71	7.44	18.23
T_3	470.99	7.56	16.56
T_4	500.00	7.24	20.48
C.D. (P=0.05)	0.98	0.23	0.28

Table 3 : Economics of cultivation of turmeric under different treatments

Treatments	Total cost of cultivation(Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	Benefit : Cost ratio
T_1	45000.00	187500.00	142500.00	3.1:1
T_2	81000.00	364600.00	283600.00	3.5:1
T_3	78000.00	331200.00	253200.00	3.24:1
T_4	86000.00	400000.00	314000.00	3.6:1

the project on “Biotechnology Led organic farming in North Eastern Region”.

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