Agriways 1 (2) : 113-117 (2013)

ISSN: 2321-8614

RESEARCH ARTICLE

GROWTH, YIELD AND QUALITY OF TURMERIC (*Curcuma longa* L.) AS INFLUENCED BY ORGANIC MANURES

Rajeev Kumar, Sandeep Kumar, Ram Jeet, Sanjeev Kumar and Harnam Singh

Janta Mahavidyalaya Ajeetmal, Auraiya (Uttar Pradesh) - 206 121
E-mail : rajeevkumard699@gmail.com

ABSTRACT

A field experiment was carried out during 2008-09 in the Department of Agri. Botany Janta P.G. College Ajeetmal, Auraiya (C.S.J.M. University, Kanpur, U.P.), to evaluate the effect of different organic manures on growth, yield and its attributes of turmeric.Significant enhancements were notedby the application of different organic manures. Application of neem cake producedmaximum plant height, maximum number of tillers per plant, leaf number, leaf area,leaf area index, fresh weight of haulm, fresh weight of root, fresh weight of rhizome, dry weight of haulm, dry weight of root, dry weight of rhizome and total dry matter than from those receiving other types of manure. Yield attributes such as number of mother rhizomes plant^{-1}, number of primary rhizomes per plant^{-1}, secondary rhizomes per plant^{-1} and tertiary rhizomes per were also highly accelerated by neem cake application. Similarly, the same treatment expressed best in terms of size of mother rhizome, primary and secondary rhizomes. All these parameters cumulatively contributed to produce the highest estimated fresh rhizomes yield and cured rhizomes yield respectively. However, highest curing percentage (20.28) was observed in T_3 treatment having mustard cake@ 2.0 tones ha^{-1}. Thus neem cake was best suited natural fertilizer for turmeric cultivation.

Key Words **:** Turmeric, organic manures, growth, yield **.**

Chemical fertilizer, herbicide and pesticide used in agriculture for increasing yield and controlling weeds and crop pests can contaminate the water, air and food, decrease soil fertility, inhibit growth of soil microorganisms and cause hazard to human health (Parr *et al.*, 1991). This negative effect of agricultural practices could be reversed by the correct utilization of manures and/ or crop residues within cropping system either alone or in combination with organic fertilizer (Mandal*et al*, 2007). Beside these, utilization of organic manure in agriculture is recommended for retaining productivity of problem soils, reducing the usages of chemical fertilizer, improving economy in agriculture and minimizing environmental problems. Organic farming assumes significance globally towards sustainable production and quality up gradation of turmeric (Sadaanadan, 1998). The adverse effects of continuous use of high dose of chemical fertilizers on soil health and environment are long realized; hence, the farmers are also showing considerable inclination towards traditional farming with least usage of fertilizers. The role of organic manures in improving soil structure and fertility

is well understood. Organic manures have positive influence on soil texture and structure, better water holding capacity and drainage which in turn help for better growth and development of rhizomatous crop like turmeric (Kale *et al.*, 1991). Considering the economic importance of turmeric and environmental problems caused by chemicals application, it is important to cultivate turmeric using organic fertilizer. Different organic manures influence differently in terms of yield and quality of turmeric.

Turmeric (*Curcuma longa* L.) is aherbaceous perennial plant belonging to the family, Zingiberaceae. It is an ancient, most valuable, sacred spice of India that contains appreciable quantities of proteins (6.3%), lipids (5.1%), carbohydrates (69.4%) and fiber (2.6%). Turmeric is rich in minerals like phosphorus, calcium, iron and vitamin A. Turmeric is widely consumed, especially in Middle Eastern diets, and has a broader range of pharmacological application. It acts as anti-inflammatory agent. Turmeric has demonstrated anti-mutagenic and anti-carcinogenic properties. Curcumin has also been shown to potentiate the beneficial effects of drugs and vitamins.

Turmeric originated in South-East Asia. It is grown in India in about 195.1 thousand hectare with an annual production of 992.9 thousand tonneswith a productivity5.1 mt. ha^{-1}(Anonymous, 2011). India produces nearly 20 per cent of its total demand and the rest is imported. So, cultivation of turmeric should be emphasized. Turmeric being a long duration (8-9 months) exhaustive crop responds well to nutrition. Hence, optimum dose of nutrients is essential to get good yield. So keeping this in view the present study was under taken in order to evaluate the effect of different organic manures on yield and quality ofturmeric.

MATERIALS AND METHODS

A field experiment was carried out in the Department of Agri. Botany Janta P.G. College Ajeetmal, Auraiya(C.S.J.M. University, Kanpur, U.P.), during 2008-09. Seeds of Turmeric genotypes (BARI Halud-3) were collectedfrom National Research Center for Spices,Ajmer (Rajasthan). The experiment was laid out in a randomized block design with three replications having four treatments in addition to control were as follows

T_0: Control (No organic and inorganic fertilizer).
T_1: Cow dung @12tonnes ha^{-1}
T_2: Poultry manure @ 6.0 tonnes ha^{-1}
T_3: Mustard cake @ 1.75tonnesha^{-1}
T_4: Neem cake @ 1.75tonnesha^{-1}.

All of the manures were applied one week before sowing. Manure pH was determined with the help of pH meter. Nitrogen was determined by Kjeldahl method (Black, 1965). For determination of P and K, plant samples were digested with nitric-perchloric acid solution and absorption of color was measured with spectrophotometer at 660 nm wavelength and flame photometer, respectively. A recommended dose of fertilizers 100 kg N ha^{-1}, 100 kg P ha^{-1}, 87.5 kg K ha^{-1} 13 kg S ha^{-1} and 2.5 kg Zn ha^{-1}were applied in the form of single super phosphate (SSP), muriate of potash (MOP), zinc sulphate and gypsum, respectively. Half dose of nitrogen and full dose of phosphorus, potassium, sulphur, zinc were applied before sowing and the remaining nitrogen was applied at 80 and 110 DAP followed by irrigation. Rhizomes of BARI Halud-3 were planted in 01 April, 2008. Crop management practiceswere done as per recommendation.The crop was harvested at 01 February, 2009 after complete maturity, as indicated by the leaf drying and falling down of plants. For recording observationrandomly five plants were selected in each of the plot. Growth parameters such as plant height, tiller number, leaf number, leaf area, leaf area index, leaf biomass, shoot biomass; total dry matter and yield parameters*viz.*rhizomes number, weight, size, and rhizome dry matter were recorded. Harvest index and curcumin content was calculatedby the procedure suggested by Donald (1962) and Manjunath e*t al.*, (1991), respectively. Curing percentage was computed by deducting dry weight of rhizomes after curing from fresh weight of rhizomes and the same divided by fresh weight then multiplied by 100.The collected data of different observations were statistically analyzed by the procedure described by Panse and Sukhatme (1976).

RESULTS AND DISCUSSION

A significantenhancementwas noted in growth and development of turmeric withthe application of organic manure Table 1. Plant height, number of tillers/plant, leaf area, leaf area index, fresh weight of haulm, root, rhizome, per plant, dry weight of (haulm, root, rhizome, per plant) and total dry matter was maximum recorded with organic matter treated plants as compared to control. The plants with the organic manure remained green longer and had higher plant height, number of tiller, larger leaf area and greater leaf biomass and total dry matter which ultimately provided longer and faster photosynthesis process and ultimately resulted in a higher rhizome yield of turmeric. Similar results were obtained in previous studies (Hossain*et al.*, 2005). Among the treatments, the taller plant (79.30 cm) and maximum number of tillers per plant (5.40), leaf number (5.40), leaf area (44.09) leaf area index (0.429), fresh weight of halum (190.05g), fresh weight of root (49.13 g), fresh weight of rhizome per plant (256.21 g) and dry weight of halum (15.21g), dry weight of root (7.32 g), dry weight of rhizome per plant (40.35 g), total dry matter yield (6.85 t ha^{-1}) were obtained from the treatment T_4, with neem cake @ 2.0 tones ha^{-1}.Although the vegetative growth and biomass production of T_4 treatment apperedidentical to that of other organic manure treatments and being statistically similar with another treatment T_2 having poultry manure@ 7.0 tones ha^{-1} except in plant height and number of leaves. However, leaf number and plant height increased slightly with the cow manure application than those with poultry manure. The better performance of plants with neem cake was probably because it acted as natural fertilizer along with possessing pesticidal properties which protects plant roots from nematodes, soil grubs and white ants and also performs as a nitrification inhibitor and prolongs the availability of nitrogen to long duration crops like turmeric. Beside these, it improves the soil condition considerably and benefits the soil during the droughts. The manure provided nutrients to the plants and may improve edaphic factors, which resulted in higher vegetative growth. These results are also confirmed with finding of Roy *et al.*, 2010.

Table 1 : Effect of organic manures on vegetative growth and biomass production of turmeric

Treatments	Plant height (cm)	No. of leaves /plant	No. of tillers/ plant	Leaf area (dm2)	Leaf area Index	Fresh weight of halum (g/plant)	Fresh weight of roots (g/plant)	Fresh weight of rhizome (g/plant)	Dry weight of halum (g/plant)	Dry weight of roots (g/plant)	Dry weight of rhizome (g/plant)	Total dry Matter (t/ha)
T_0(Control)	59.37	5.13	3.47	22.17	0.219	98.94	18.50	87.26	9.81	3.16	13.91	2.54
T1(Cowdung @15 t/ha)	73.73	8.13	4.83	37.61	0.363	141.50	43.47	217.80	11.43	5.75	31.16	5.33
T_2 (Poultry manure @ 7.0 t/ha)	72.80	7.14	5.13	42.12	0.416	178.28	48.04	246.97	14.70	6.97	38.02	6.45
T_3 (Mustard cake @ 2.0 t/ha)	74.33	6.37	5.13	35.62	0.352	161.00	47.12	242.52	13.50	6.52	33.90	5.85
T_4 (Neem cake @ 2.0 t/ha)	79.30	8.67	5.40	44.09	0.429	190.05	49.13	256.21	15.21	7.32	40.35	6.85
CV (%)	4.38	4.77	0.31	2.66	0.025	9.29	2.41	26.60	1.59	0.54	3.80	0.40
LSD(0.05)	7.474	0.644	0.767	1.020	0.059	1.360	1.347	1.701	0.509	0.362	1.017	0.238

Significant differences were noticed for yield, yield attributes and quality of turmeric due to the application of various organic manures. Among the organic manures, neem cake followed by poultry manure was superior to cow dung with regard to yield and quality parameters (Table 2). The application of neem cake manure produced superior yield attributes like more number of mother rhizomes per plant^{-1} (1.75), more number of primary rhizomes per plant^{-1} (5.19), secondary rhizomes per plant^{-1} (18.03) and tertiary rhizomes per plant (7.69). This treatment was found the best in terms of size of mother rhizome (7.69 cm), primary rhizome (21.86 cm) and secondary rhizomes (7.05 cm). All these parameters in cumulative produced thehighest estimated fresh rhizomes yield andcured rhizomes yield (29.48 t ha^{-1}, 5.59 t ha^{-1} respectively). The highest curing percentage (20.28) was excelled by the T_3 treatment having mustard cake@ 2.0 t/ha followed by T_1 treatment. Harvest index in all the organic manure treatment was almost similar except control which performed least. With regard to curcumin recovery percentage on turmeric, among the treatments, neem cake gave highest (3.73%) followed by T_3 treatment with mustard cake @2.0 t ha^{-1}(3.67%). Curcumincontenthowever was not statistically significant among the treatments. The lowest yield, yield attributes and quality was observed in control treatment. Although the yield and quality of turmeric was evidently the superior in the T_4 treatment having neem cake @ 2.0 tones ha^{-1} comparing with other organic manure impact, it was however, statistically similar to another treatment T_2 having poultry manure@ 7.0 tones ha^{-1} except curcumin content percentage. Neem cake provided the best option for production of turmeric being an exhaustive crop because neem cake acts as usual fertilizer with pesticidal properties and enhances the organic carbon content of soil. Beside these, neem cake as an effective nitrogen inhibitor helps longer availability of nitrogen for such high exhaustive crop probably increasing thereby the productivity of turmeric. Similar finding were also reported by Roy *et al.*, 2010. Manhasand Gill (2010) noted that application of FYM increased the growth, dry matter accumulation, yield and quality of turmeric.

It is concluded that application of organic manures

Table 2 : Effect of different organic manures on yield, yield attributes and quality of turmeric

Treatments	No. of Mother Rhizomes/plant	No. of Primary rhizomes /plant	No. of Secondary rhizomes/ plant	No. of tertiary rhizomes/plant	Size of Mother Rhizomes (cm2)	Size of Primary rhizomes (cm2)	Size of Secondary rhizomes (cm2)	Fresh rhizome yield (t/ha),	Curing (%),	Cured rhizome yield (t/ha),	Harvest Index	Curcumin content (%)
T_0(Control)	0.43	2.27	4.82	1.33	3.36	9.82	2.13	14.84	16.54	2.38	0.56	3.23
T1(Cowdung @15 t/ha)	1.46	3.87	16.15	4.65	6.28	15.73	4.62	21.17	19.21	4.36	0.63	3.31
T_2 (Poultry manure @ 7.0 t/ha)	1.81	4.80	15.33	6.17	7.35	19.80	6.12	27.30	19.01	5.18	0.63	3.50
T_3 (Mustard cake @ 2.0 t/ha)	1.55	4.03	16.12	5.48	6.71	16.73	6.52	22.80	20.28	4.59	0.64	3.67
T_4 (Neem cake @ 2.0 t/ha)	1.75	5.19	18.03	6.08	7.69	21.86	7.05	29.48	19.03	5.59	0.63	3.73
CV (%)	0.24	0.62	2.17	0.52	0.51	3.09	0.97	3.13	2.00	0.62	0.063	NS
LSD(0.05)	0.198	0.179	0.589	0.381	0.206	0.639	0.429	0.473	0.309	0.206	0.060	0.061

like cow dung, poultry manure, mustard cake and neem cake have significant influence on growth, yield, yield parameters and quality of turmeric. However, plants with neem cake performed better in term of growth, yield and yield attributes than that of other organic manures although not statistically always. Therefore, a fertilization strategy that involves organic manure in supplementation of chemical fertilizers is crucial for nutrient exhaustive crops like turmeric for commercial cultivation. The data taken for these results confine to one crop season only and hence need repetition for confirmation.

REFERENCES

Anonymous (2011). Crop wise area production and productivity of major spices crops in India.*Indian horticulture database,* 6.

Donald C M (1962).In search of yield. *Journal of Australian Institute of Agriculture*, **28:**171-178.

Hermann P T A and Martin A W (1991). Pharmacology of Curcuma longa.*Planta Medica,* **57:**1-7**.**

Hossain M A, Ishimine Y, Akamine H and Motomura K (2005). Effects of Seed Rhizome Size on Growth and Yield of Turmeric (Curcuma longa L.). *Plant Production Science*, **8 :**86-94.

Kale R N, Bano K and Satyavati G P (1991). Influence of vermicompost application on growth and yield of cereals, vegetables and ornamental plants. Final report of KSCSI Project, N67004/Vermi (34B (3478): 27-29.

Manhas S S and Gill B S (2010). Effect of planting materials, mulch levels and farmyard manure on growth, yield and quality of turmeric (Curcuma longa). *The Indian Journal of Agricultural Science*, **80(6):** 227-233.

Manjunath M N, Sattigeri V D and Nagaraj K V (1991). Curcumin in turmeric. *Spice India*, **12:** 7-9.

Mandal A, Patra A K, Singh D, Swarup F and Masto R E (2007). Effect of long term application of manure and fertilizer on biological and biochemical properties in a silty loam soil under conventional and organic management. *Soil Tillage Research*, **90:**162-170.

Panse G V and Sukhatme V P (1976). Statistical Methods for Agric. Worker, Indian Council of Agriculture Research, New Delhi.

Parr J F, Hornick S B and Whitman C E (1991).First International Conference on Kyusei Nature Farming. Proceedings of the Conference held October 17-21, 1989, at KhonKaen, Thailand. 175.

Roy S S and Hore J K (2010).Vermiculture can be practised in all plantation crops. A report of Department of Spices and Plantation Crops, Faculty of Horticulture,Bidhan Chandra KrishiViswavidyalaya, Mohanpur, Nadia, West Bengal. 20-39.

Sadanandan A K, Peter K V and Hamza S (1998). Soil nutrient and water management for sustainable spices production.Proc. National seminar on water and nutrient management for sustainable production and quality of spices. ISS, IISR, Calicut, 5-6 Oct **1997.** 12-20.

Kamal M Z U and Yousuf M N (2012).Effect of Organic Manures on Growth, Rhizome Yield and Quality Attributes of Turmeric. *The Agriculturists,**10 (1):** 16-22.*

****