



ISSN:0976-4933
Journal of Progressive Science
A Peer-reviewed Research Journal
Vol.16, No.02, pp 112-116 (2025)
<https://doi.org/10.21590/jps.16.02.05>

Effect of different combinations of organic and chemical fertilizers on yield of turmeric (*Curcuma longa* L.) and soil fertility status of alluvial soil

Ajeet Kumar Verma, Ashok Kumar Singh, Mandhata Singh and Naveen Kumar Shukla

Department of Soil Science and Agricultural Chemistry,

Shri Murli Manohar Town P. G. College (Jananayak Chandrashekhar University) Ballia, U. P.

Corresponding author email- aksinghtdc@rediffmail.com

Abstract

A field experiment was conducted during 2024-25 in kharif season to evaluate the effect of integrated use of chemical fertilizers and organic manure on yield of turmeric (*Curcuma longa* L.) and soil properties. Experiment was comprised in ten treatments and three replications with RBD design. The chemical nutrient source included RDF (N: P: K) with sulphur and organic nutrients sources were included FYM, poultry manure and compost applied in different rates per plot. Organic sources of nutrients and RDF applications revealed that FYM @40 t ha⁻¹ + 100% RDF (T₃) recorded maximum fresh rhizome yield (t ha⁻¹) as compared to T₁₀ (poultry manure @ 20 t ha⁻¹ + 75% RDF). Integrated use of organic and 100% RDF sources found to maintained soil pH in considerable range and EC. At 90 DAP have considerable response and in post-harvest soil samples were found to be increased available N (283.29 kg ha⁻¹), available P (17.47 kg ha⁻¹), available K (299.04 kg ha⁻¹) and available S (5.51 mg kg⁻¹) in soil by application of FYM @40 t ha⁻¹ (T₂), compost 75% + 100% RDF (T₇), 100% RDF + compost @ 20 t ha⁻¹ (T₅) and FYM @40 t ha⁻¹ + 100% RDF (T₃) significantly.

Keywords: Turmeric, organic sources of nutrients, soil fertility, yield, soil pH, soil EC, organic carbon.

Introduction

Turmeric (*Curcuma longa* L.) is a spice crop of great value, which is grown extensively in India for its rhizomes, which have immense value in terms of culinary, medicinal and industrial uses. India is the largest producer and exporter of turmeric, but in some parts of the country, their yield is low due to poor soil fertility and improper management of nutrients Tandon (2004) and Yadav et al. (2013). For the targeted yield of turmeric the continuous use of chemical fertilizers without addition of organic materials often leads to deterioration of physical and chemical properties of soil, reduction in organic carbon content in soil and imbalance of nutrients. On the other hands organic manures like FYM and compost help in improving soil structure, water-holding capacity and availability of nutrients through a process of gradual mineralization Gaur (1979). Organic matters also help in maintaining soil reaction and electrical conductivity within favorable limits Bhigurvanshi (1988). Many experiments showed that INM practices increased curcumin content by 12-15% over control or alone fertilizer treatments. Integrated use of

organic and inorganic sources of nutrients, have been identified as a sustainable means of maintaining soil fertility and increasing crop productivity. Various researchers have found the beneficial effect of INM on turmeric yield and soil properties Majumdar et al. (2002); Venkatesh et al. (2003); Sharma et al. (2003) and Kanaujia et al. (2016). Therefore, in view of the above facts the experiment was carried out.

Materials and methods

The experimental site was approximately 25°33'-26°15' N latitude and 83°38'-84°39' E longitude, with an average elevation of 59 m above mean sea level. The area receives an average annual rainfall of 950-1150 mm which occurs mostly during the monsoon season. The soil type of the experimental field was sandy loam and slightly alkaline in nature. The initial analysis of soil showed pH 7.05, EC 1.1 dSm⁻¹, organic carbon 0.46%, available nitrogen 301.04 kg ha⁻¹, available P 9.79 kg ha⁻¹, available K 196.24 kg ha⁻¹ and available sulphur 1.97 mg kg⁻¹ soil. The experiment was laid out in randomized block design with three replications and ten treatments. T₁ (RDF + sulphur @ 40 kg ha⁻¹), T₂ (FYM @ 40 t ha⁻¹), T₃ (FYM @ 40 t ha⁻¹ + 100% RDF), T₄ (75% RDF + FYM @ 40 t ha⁻¹), T₅ (100% RDF + compost 40 t ha⁻¹), T₆ (compost @ 40 t ha⁻¹), T₇ (compost 75% + 100% RDF), T₈ (Poultry manure @ 20 t ha⁻¹), T₉ (poultry manure @ 20 t ha⁻¹ + 100% RDF) and T₁₀ (Poultry manure @ 20 t ha⁻¹ + 75% RDF). The RDF was given @ 120:50:80 kg N: P: K per ha along with sulphur @ 40 kg ha⁻¹ as per treatment need. The size of each bed was 3 × 3 m and the total area was 330 m². Turmeric was used as test crop variety 'Narendra haldi-1'. Healthy and disease-free rhizomes were treated with Bavistin (1g L⁻¹) and chlorpyrifos (1mL L⁻¹) before planting. Planting was carried out on 23rd May 2024 with spacing of 60 × 30 cm. Irrigation was done as per crop requirement. Weeding and earthing-up activities were also performed at the right stages of growth to facilitate proper establishment and rhizome development. Harvesting of the crop was carried out on 10th February 2025. Soil samples were collected from each plot at 90 DAP and at harvest at depth of 0-15 cm and analyzed for physico-chemical characteristics. Soil pH and EC were measured by the method described by Jackson (1973). Available nitrogen, phosphorus, potassium and sulphur were estimated by standard methods Subbiah and Asija (1956); Olsen *et al.* (1954); Muhr *et al.* (1965) and Williams and Steinbergs (1959). All the data collected during the experiment were analyzed for critical difference of statistically used RBD tools for the test of significance method cited by Gomez and Gomez (1989).

Results and discussion

Fresh rhizome yield

The fresh rhizome yield (table 1) of turmeric was significantly affected by the different treatments. The maximum yield was obtained in treatment T₃ (FYM @ 40 t ha⁻¹ + 100% RDF) as compared to T₄ (FYM @ 40 t ha⁻¹ + 75 % RDF) alone organic source of nutrient as FYM T₂, while T₁ (RDF + Sulphur @ 40 kg ha⁻¹) also responding in better way of fresh rhizome yield, it might be due to better nutrient supply and improved soil physical properties. The minimum fresh rhizome yield was obtained in T₁₀ (poultry manure @ 20 t ha⁻¹ + 75% RDF), which might be due to relatively some biochemicals interaction with turmeric rhizome and buildup negative behaviors in nutrient supply and physical condition while poultry manure could be better organic source. Similar results have been obtained by Majumdar et al. (2002) and Venkatesh et al. (2003).

Soil pH

Soil pH at 90 DAP and at harvest (Table-1) showed only slight variation between treatments and was in neutral zone. The lowest value of soil pH at both stages were obtained in T₁ (RDF + sulphur @ 40kg^{ha}⁻¹) due to the acidic behaviour of sulphur that release acidic compound in soil. The highest and most uniform soil pH was observed in T₃ (FYM @ 40 tha⁻¹ + 100% RDF) and T₂ (FYM @ 40tha⁻¹) which have released the organic acids showed the pH buffering capacity of organic manure. These results were agreement with Singh and Yadav (1994) and Sharma et al. (2003).

Electrical conductivity

Soil electrical conductivity at 90 DAP and at harvest (Table-1) was in the safe range for all treatments. The highest values of EC at 90 DAP were measured in T₁ and T₅ due to soluble salts of fertilizers. The lowest values of EC were measured in T₂ and T₆ at both stages. A slight reduction in EC was noticed in all treatments after harvest, indicating the uptake of nutrients by the crop. These results were in agreement with Venkatesh et al. (2003) and Sharma et al. (2003).

Available nitrogen

The maximum available nitrogen (table-2) was found in T₂ (FYM @ 40tha⁻¹), followed by T₃, due to mineralization of organic nitrogen. Minimum available nitrogen was found in T₁₀ (poultry manure @ 20 tha⁻¹ + 75% RDF). These findings are in agreement with Bhrigurvanshi (1988) and Ghosh et al. (2010).

Available phosphorus

Available phosphorus content (table- 2) was significantly affected by the treatments. The maximum available phosphorus was found in T₇ (compost 75% + 100% RDF), which could be due to less fixation of phosphorus and production of organic acids during compost decomposition. Minimum phosphorus availability due to similar increase in phosphorus availability due to integrated nutrient management has been found by Venkatesh et al. (2003).

Available potassium

The maximum available potassium (Table- 2) was found in treatment T₅ (100% RDF + compost @ 40tha⁻¹), which might due to enhanced potassium retention and decreased fixation in the presence of compost. The minimum available potassium was observed in treatment T₈ (poultry manure @20tha⁻¹). The result was similar with Sharma et al. (2003).

Available sulphur

Available sulphur content (Table-2) in soil differed considerably among the treatments. Maximum available sulphur was found in T₃ ((FYM @ 40 tha⁻¹ + 100% RDF), which could be attributed to the combined effect of fertilizer sulphur and mineralization of organic sulphur from FYM. Minimum available sulphur was found in T₂ (FYM @ 40tha⁻¹). Similar findings regarding increased availability of sulphur due to integrated nutrient management have also been reported by Tandon (2004) and Sharma et al. (2003).

Table 1. Effect of organic, inorganic and integrated plant nutrient supply on pH and EC in turmeric grown soil

Treatment combination	pH		EC		Fresh weight of rhizome (t ha ⁻¹)
	90 (DAP)	Post-harvest	90 DAP	Post-harvest	
T ₁ - RDF + Sulphur @40 kg ha ⁻¹	7.23	7.03	1.013	1.00	21.80
T ₂ - FYM @ 40 t ha ⁻¹	7.47	7.77	1.009	0.97	22.46
T ₃ - FYM @ 40 t ha ⁻¹ + 100% RDF	7.33	7.73	1.017	0.99	29.24
T ₄ - RDF 75% + FYM @ 40 t ha ⁻¹	7.97	7.93	1.020	0.97	24.82
T ₅ - RDF 100% + Compost @ 40 t ha ⁻¹	7.87	7.87	1.040	1.00	17.85
T ₆ - Compost @ 40 t ha ⁻¹	7.47	7.63	1.023	0.98	17.30
T ₇ - Compost 75% + RDF 100%	7.53	7.83	1.020	0.99	19.50
T ₈ - Poultry manure @ 20 t ha ⁻¹	8.03	7.73	1.030	1.01	19.76
T ₉ - Poultry manure @ 20 t ha ⁻¹ + RDF 100%	7.57	7.93	1.011	1.02	19.67
T ₁₀ - Poultry manure @ 20 t ha ⁻¹ + RDF 75%	8.00	7.97	1.007	1.00	16.15
CD (P=0.05)	0.231	0.274	0.028	0.020	03.134

Table-2 Effect of organic and inorganic sources of plant nutrients on available N, P K (kg ha⁻¹) and S (mg kg⁻¹) in turmeric grown soil

Treatment	Treatment combination	Available Nitrogen (kg ha ⁻¹)	Available Phosphorus (kg ha ⁻¹)	Available Potassium (kg ha ⁻¹)	Available Sulphur (mg kg ⁻¹)
T ₁	RDF + sulphur @ 40 kg ha ⁻¹	281.19	9.80	274.03	4.71
T ₂	FYM @ 40 t ha ⁻¹	283.29	7.97	227.73	4.34
T ₃	FYM @ 40 t ha ⁻¹ + RDF 100%	275.97	11.0	298.67	5.51
T ₄	RDF 75% + FYM @ 40 t ha ⁻¹	263.42	7.97	286.35	5.13
T ₅	RDF 100% + compost@ 40 t ha ⁻¹	239.38	10.13	299.04	5.43
T ₆	Compost@40 t ha ⁻¹	261.33	9.70	251.63	4.34
T ₇	Compost75% + RDF 100%	239.38	17.47	287.09	5.13
T ₈	Poultry manure @ 20 t ha ⁻¹	236.25	9.27	240.80	4.51
T ₉	Poultry manure @ 20 t ha ⁻¹ + RDF 100%	259.24	13.10	252.37	5.01
T ₁₀	Poultry manure @ 20 t ha ⁻¹ + RDF 75%	254.02	10.0	253.87	5.47
	CD (P=0.05)	10.494	0.494	5.919	0.256

Conclusion

Integrated use of chemical fertilizers and organic manure has a significant effect on the yield of turmeric and physico-chemical properties of soil. The highest fresh rhizome yield was obtained by the application of FYM @ 40 t ha⁻¹ along with 100% RDF (T₃). The integrated treatments helped in maintaining a desirable soil pH and EC at both 90 DAP and at harvest. The availability of nitrogen, phosphorus, potassium and sulphur was also increased by the combined application of organic manures and fertilizers. Hence, the integrated source of nutrients practice can be recommended for turmeric farming on sandy loam soils of eastern U. P.

Acknowledgement

Authors are thankful to Principal of the College to provide the facility during the research work and analysis.

References

1. Bhrigurvanshi, S. R. (1988). Effect of FYM on organic carbon status of soil, *Journal of Indian Soil Science*, 36(3): 251–254.
2. Gaur, A. C. (1979). Role of organic manures in soil fertility, *Indian Farming*, 29(7): 9–12.
3. Ghosh, P. K., Ramesh, P., Bandyopadhyay, K. K. and Hati, K. M. (2010). Integrated nutrient management for improving soil and crop productivity, *Indian Journal of Agronomy*, 55(3): 186–190.
4. Gomez, K. A., and Gomez, A. A. (1984). *Statistical procedures for agricultural research*, John Wiley and sons.
5. ICAR–Indian Institute of Spices Research. Annual Report on Turmeric Research. Kozhikode, India.
6. Jackson, M. L. (1973). *Soil Chemical Analysis (Edition Second)* Published by Prentice Hall of India Pvt. Ltd., New Delhi.
7. Kanaujia, S. P., Singh, B. P. and Singh, D. (2016). Effect of INM on growth and yield of turmeric. *Vegetable Science*, 43(1): 104–107.
8. Manjunathgoud, P., Patil, H. Y. and Patil, V. S. (2002). Spacing and NPK effect on turmeric, *Journal of Maharashtra Agricultural Universities*, 27(3): 299–301.
9. Muhr, G. R., Datta, N. P., Shankara, D. (1965). *Soil Testing in India*. ICAR, New Delhi.
10. Olsens, S.R.; Cole, C.V.; Watanable, F.S. and Dean, L.A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate, *United States Department of Agriculture Circular*, 939.
11. Sharma, D. P., Sharma, T. R., Agrawal, S. B. and Rawat, A. (2003). Differential response of turmeric to organic and inorganic fertilizers, *JNKVW Research Journal* 37:17-19.
12. Singh, B. P. and Yadav, D. S. (1994). FYM and NPK impact on soil acidity, *Indian Journal of Agronomy*, 39(1): 102–104.
13. Subbiah, B. V. and Asija, G. L. (1956). A rapid procedure for the estimation of available nitrogen in soil, *Current Science*, 25: 259–260.
14. Tandon, H. L. S. (2004). *Fertilizer, Organic Manure and Biofertilizer Use in India*. Fertilizer Development and Consultation Organization, New Delhi.
15. Venkatesh, J. and Padmaja, G. (2003). Rock phosphate and FYM in turmeric nutrition, *Indian Journal of Soil Science*, 51(2): 134–138.
16. William, C. H. and Steinbergs, A. (1959). Soil sulphur determination, *Australian Journal of Agricultural Research*, 10(2): 340–352.

Received on 09.06.2025, Revised on 12.10.2025 and accepted on 27.12.2025