Biological Forum – An International Journal **14(3): 1218-1221(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Influence of Organic and Inorganic Fertilizers on Growth, Yield and Quality of Turmeric (*Curcuma longa* L.) cv. Salem

U.B. Anuradha[1*], S.S. Patil[1], A.R. Kurubar[1], G. Ramesh[1] and S. Hiregoudar[2]
[1]M.Sc. Student, Department of Horticulture, College of Agriculture,
University of Agricultural Sciences, Raichur (Karnataka), India.
[2]Department of Processing and Food Engineering,
College of Agriculture Engineering, University of Agricultural Sciences, Raichur (Karnataka), India.

(Corresponding author: U.B. Anuradha)*
(Received 08 July 2022, Accepted 13 August, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The persistent application of inorganic nutrients is not only a costly affair bid also detrimental to soil and plant health. Integrated nutrient management which is the combined application of organic and inorganic matters as the nutrient sources is effective combination to supply the recommended dose of nitrogen. The present investigation was conducted to study the integrated nutrient approaches in turmeric cv. Salem. The significant differences were observed among the various treatments. Soil application of 50 per cent of RDN through inorganic sources remaining 50 per cent of RDN through organic sources as pongamia cake (T_7) effected in significantly vigorous growth of the plants which resulted in higher rhizome yield (43.94 t ha^{-1}) dry rhizome yield (1.85 t ha^{-1}) as well as turmeric powder yield (1.67 t ha^{-1}). However, application of RDN through inorganic sources (T_1) as per the RDF resulted in lower fresh rhizome yield, dry rhizome yield and turmeric powder which coupled with lower plant growth and lower yield parameters. The highest quality of curcumin was resulted in T_1 of 100 per cent recommended dose of fertilizer and FYM has found with maximum curcumin content (2129.32 ppm) and minimum curcumin content of 1805.39 ppm was noticed in application of 50 per cent of recommended dose of nitrogen through inorganic sources and 25 per cent of recommended dose of nitrogen with pongamia cake (T_4) where as highest oleoresin content (12.80%) was observed in T_4 (50 % of recommended dose of nitrogen through inorganic sources and 25 per cent of recommended dose of nitrogen with pongamia cake) where as lowest oleoresin content (8.90%) was observed in treatment T_1 (100 % recommended dose of fertilizer and FYM).

Keywords: RDN, FYM, Vermicompost and turmeric.

INTRODUCTION

Turmeric (*Curcuma longa* L.) is an ancient, most valuable and sacred spice of India. It is an herbaceous, perennial belonging to the family of Zingiberaceae. India is the largest producer and exporter of this crop. It is extensively used in culinary application, cosmetic, pharmaceutical and dyeing industries. It is also used in religious ceremonies. Curcumin, the primary pigment of turmeric, is generally used in various food industries as a food colourant. Its having antimicrobial, anti-inflammatory, antioxidant property and have a potential application in clinical research (Heath *et al*., 2004). Across the world, strong demand for Indian spices such as turmeric, ginger and saffron and increased the 192% of export value. India is the world's largest producer of turmeric and produces 70-75% of world's total production (Anon., 2022). In order to meet the export and internal demands of turmeric, production has to be increased. Turmeric being a heavy feeder and exhaustive crop responds very well to nutrients application. The continuous use of high dose of chemical fertilizers has an adverse effect not only on soil health and but also on environment. The combined use of organic and inorganic fertilizers not only increases the yield but also improves the physical, chemical and biological property of soil which further improves fertility, productivity and water holding capacity of soil. The organic source will help to maintain nutrient equilibrium in soils whereas, the inorganic fertilizers readily furnish nutrient which would enhance the initial growth in the crop and finally results in better growth, development and yield (Singh *et al*., 2009) with this background the present experiment was conducted to study the effect of integrated nitrogen management on yield and quality of turmeric.

MATERIALS AND METHODS

The experiment was carried out at Horticulture Farm, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India, during 2016-17. The experiment was laid out in a randomized complete block design with eight treatments replicated thrice.

The following treatments were included in the study to impose on turmeric cv. Salem.
(RDF = 150:125:250 NPK kg/ha)
T_1 – 100% RDF + FYM
T_2 - 75 % RDN + 25 % nitrogen through Neemcake
T_3 – 75% RDN + 25% nitrogen through Vermicompost
T_4 – 75% RDN + 25 %nitrogen through Pongamia cake
T_5 – 50% RDN + 50 % nitrogen through Neemcake
T_6 – 50% RDN + 50% nitrogen through Vermicompost
T_7 – 50% RDN + 50% nitrogen through Pongamia cake
T_8 – 50% RDN + 2% Urea as foliar spay
The rhizomes were with the spacing of 45 cm × 22.5cm. The required quantity of FYM, neemcake, pongamia cake and vermicompost for gross plot area were computed as per their N contents and applied in respective plots as per the treatments. Observations were recorded for growth parameters at 150 days after planting, yield and quality parameters after the harvest of the crop.

RESULTS AND DISCUSSION

Growth. The data on presented in the Table 1 revealed that significant differences at all stages of growth. Plant height (122.23cm), Number of leaves per plant (34.40), Number of tillers per clump (5.03) and Leaf area index (3.75) exhibited significantly higher values at 150 DAP respectively effected through the consortia of application of 50 per cent RDN through inorganic and 50 per cent RDN through organic sources as pongamia cake (T_7). However, the application of 100 per cent RDF along with FYM resulted in significantly lower per cent of emergence, plant height, number of leaves per plant, number of tillers per clump and leaf area index 87.50 (at 45DAP), 107.43cm, 26.30, 4.07 and 3.37 at 150 DAP respectively through T_1. The observations were made at vigorous growth stages of crop at 50, 100 and 150 DAP.(Table 1.)
At 150 days the vegetative growth slowed down and lower values were recorded for plant height and number of leaves per plant. The plant exhibited the vigorous growth between 50 to100 DAP. This trend was in good agreement with the observations of Manohar Rao *et al.* (2005) in turmeric. The slow growth after 150 days might be attributed to rhizomes development due to source and sink relationship. Transportation of more photosynthates from source (leaves) to sink (rhizomes). The number of leaves per tiller was significantly promoted with all the organic, inorganic and recommended dose of INM treatments (Singh, 2015; Sarma *et al*., 2015; Datta *et al*., 2017).
Yield. The data presented in the Table 2 revealed that application of RDN through T_7 produced significantly superior yield attributes like more number of mother rhizomes (3.67), more number of primary rhizomes (14.13), secondary rhizomes (4.40). Similarly, the same treatment T_7 has shown the maximum weight of mother rhizome (177.00g), primary rhizome (253.33g) and secondary rhizomes (40.63g) per clump. However, significantly lower number of mother rhizomes (3.00), primary rhizomes (8.40), secondary rhizomes (2.80), weight of mother rhizomes (125.67g), weight of primary and secondary rhizomes per clump (161.67g and 22.27g respectively) through T_1.
The fresh rhizome yield and dry rhizome yield per hectare was significantly high with 43.94 tonnes and 4.17 tonnes respectively in T_7. On the contrary T_1 resulted in significantly lower fresh rhizome yield and dry rhizome yield (25.55 t ha^{-1} and 1.85 t ha^{-1} respectively). The highest dry recovery was notices in same treatment T_7. Highest turmeric powder yield (3.68 t ha^{-1}) might be due to the increased dry rhizome yield through the imposition of treatment T_7. Higher yield of dry rhizomes (4.17 t ha^{-1}) might be attributed due to higher fresh rhizome yield which ultimately results in highest turmeric powder yield (3.68 t ha^{-1}) through the imposition of treatment T_7. Significantly higher rhizome yield obtained from T_7 might be due to the effect of maximum number of mother rhizomes, primary rhizomes, secondary rhizomes, weight of mother rhizomes per clump, weight of primary and secondary rhizomes per clump also the higher nutrient status of pongamia cake preferably high N and K content compared to other organic sources such as neemcake and vermicompost. Especially N and K are two important nutrients for boosting the growth and yield of turmeric. Nitrogen is involved in chlorophyll synthesis and it influences stomatal conductance and photosynthetic efficiency. N is responsible for 26 to 41 per cent of crop yields. K plays catalytic roles in the plant rather than becoming an integral part of plant components. It regulates the permeability of cell walls and activities of various mineral elements as well as neutralizing physiologically important organic acids. Banafor *et al*., (1995); Sugtto *et al*. (1995); Padmapriya *et al*. (2007); Srinivasan *et al*. (2016); Amala *et al.* (2019) reported that with the increase in K levels growth, leaves number, tillers number and rhizome yield increased.
Quality. The intensity of yellow colour of the rhizome directly depends upon the quantity of curcumin content (Singh, 2014). The data presented in the Table 3 revealed that, quality parameters *viz.*, curcumin and oleoresin content of turmeric was significantly influenced by combined application of organic manures with inorganic fertilizers. The maximum curcumin content (2129.32 ppm) was noticed in treatment T_1 whereas, minimum curcumin content (1858.16 ppm) was noticed in the treatment T_7. The high curcumin content observed through treatment T_1 which indicated that, low yielding treatments were exhibited higher curcumin content where as high yielding treatment T_7 recorded less curcumin content. The maximum oleoresin content (12.80%) was observed in treatment T_4 and minimum oleoresin content (8.90%) was noticed in treatment T_1. Potassium is often described as a quality element for crop production. It increased the yield, size of fingers in ginger and turmeric. It also increases oleoresin in ginger and curcumin recovery in turmeric (Sadanandan and Hamza 1998; Isaac *et al*., 2016; Tripathi *et al*., 2021). Based on the present findings, it concluded that integrated application of 50% inorganic and 50% organic sources through pongamia cake has resulted best treatment for yield of rhizome. For curcumin content T_1 has shown the best result.

Table 1: Effect of integrated nutrient management on growth of turmeric cv. Salem.

Treatments	Plant height(cm)	Number of leaves/plant	Number of tillers/clump	Leaf Area Index
T_1	**107.43**	**26.30**	**4.07**	**3.37**
T_2	115.57	32.07	5.03	3.19
T_3	111.43	28.00	4.93	3.09
T_4	113.47	30.80	5.03	3.25
T_5	111.67	28.80	4.97	3.13
T_6	107.90	26.47	4.40	3.29
T_7	**122.23**	**34.40**	**5.03**	**3.75**
T_8	108.90	27.90	4.63	3.29
Mean	**112.33**	**29.34**	**4.76**	**3.3**
S.Em ±	**3.27**	**1.68**	**0.16**	**0.28**
CD @ 5%	**NS**	**5.09**	**0.47**	**0.65**

Table 2: Influence of organic and inorganic fertilizers on yield and quality of turmeric var. Salem.

Treatments	Number of Rhizomes per clump			Weight of Rhizomes per clump (g)			Fresh Rhizome Yield (t ha^{-1})	Dry rhizome yield (t ha^{-1})	Dry rhizome recovery (%)	Turmeric powder yield (t ha^{-1})
	Mother rhizomes	Primary rhizomes	Secondary rhizomes	Mother rhizomes	Primary rhizomes	Secondary rhizomes				
T_1	**3.00**	**8.40**	**2.80**	**125.67**	**161.67**	**22.27**	**25.55**	**1.85**	**13.15**	**1.67**
T_2	3.33	11.94	4.20	170.00	209.67	37.50	41.41	3.04	21.40	2.97
T_3	3.20	10.23	3.13	138.67	192.00	25.53	32.87	3.59	15.93	3.21
T_4	3.27	10.93	4.03	151.00	204.00	27.33	40.76	4.00	17.32	3.50
T_5	3.27	10.63	3.77	142.00	199.00	25.93	37.44	3.67	17.63	3.39
T_6	3.13	9.37	3.00	135.00	167.67	23.07	27.73	3.77	21.69	3.30
T_7	**3.67**	**14.13**	**4.40**	**177.00**	**253.33**	**40.63**	**43.94**	**4.17**	**23.16**	**3.68**
T_8	3.13	9.90	3.13	138.00	180.33	23.93	27.80	2.76	13.91	2.51
Mean	**3.25**	**10.62**	**3.55**	**147.17**	**195.21**	**28.28**	**34.70**	**3.35**	**18.02**	**3.03**
S.Em ±	**0.10**	**0.33**	**0.31**	**4.67**	**7.15**	**2.82**	**2.47**	**0.23**	**1.39**	**0.15**
CD @ 5%	**0.29**	**1.00**	**0.93**	**14.18**	**21.69**	**8.54**	**7.50**	**0.70**	**4.21**	**0.45**

Table 3: Effect of integrated nutrient management on quality of turmeric cv. Salem.

Treatments	Curcumin (ppm)	Oleoresin (%)
T_1	**2129.32**	**8.90**
T_2	1861.44	9.98
T_3	1886.13	11.24
T_4	1805.39	**12.80**
T_5	1907.28	12.25
T_6	1938.65	10.75
T_7	**1858.16**	11.55
T_8	2051.42	9.12
Mean	**1929.72**	**10.82**
S.Em ±	**57.36**	**0.62**
CD @ 5%	**173.99**	**1.88**

CONCLUSION

Integrated approach of inorganic and organic manures resulted in the higher yield compare to others. As turmeric is heavy feeder, it provides the nutrients continuously throughout the growing period which ultimately helps in higher accumulation nutrients in the rhizome. Influence of integrated application of 50% RDN through inorganic sources with 50 % RDN through organic sources as pongamia cake was found to be superior with respect to growth and yield of turmeric and application of 100% recommended dose of fertilizer and FYM treatment resulted in higher curcumin content.

FUTURE SCOPE

The finding established will helps in sustainable production practices of turmeric and also keeps the soil alive with organic matter, improves the soil health and quality of the produce.

Acknowledgement. To the University of Agricultural Sciences, College of Agriculture Raichur for providing research facilities is gratefully acknowledged.
Conflict of Interest. None.

REFERENCES

Amala, D., Prabhakar, B. N., Padma, M. and Triveni, S. (2019). Effect of integrated nutrient management on yield, quality and economics of turmeric (*Curcuma longa* L.) var. IISR Pragathi. *Journal of Pharmacognosy and Phytochemistry*, *8*(4): 3112-3114.

Anon. (2022). https://newsonair.com

Banafar, R. B. S. and Tiwari, R. J. (1995). Response of Turmeric to Potassium Application in Medium Black Soils of Madhya Pradesh. *Crop Research*, *10*(1): 93-95.

Datta, S., Jana, J. C., Bhaisare, P. T. and Nimbalkar, K. H. (2017). Effect of organic source of nutrients and biofertilizers on growth, yield and quality of turmeric (*Curcuma longa* L.). *Journal of Applied and Natural Science*, *9*(4): 1981-1986.

Heath, D. D., Khwaja, F. and Rock, C. L. (2004). Curcumin content of turmeric and curry powders. *Federation of American Societies for Experimental Biology*, *18*(4): 125-128.

Isaac, S. R. and Varghese, J. (2016). Nutrient management in turmeric (*Curcuma longa* L.) in an integrated farming system in southern Kerala. *Journal of spices and Aromatic Crops*, *25*(2): 206-209.

Manohar, R, A., Venkata, R. P., Narayana, R. Y. and Reddy, M. S. N. (2005). Effect of Organic and Inorganic Manorial Combination on Growth, Yield and Quality of Turmeric (*Curcuma longa* L.). *Journal of plantation crops*, *33*(3): 198-205.

Padmapriya, S., Chezhiyan, N. and Sathiyamurthy, V. A. (2007). Effect of shade and integrated nutrient management on biochemical constituents of turmeric (*Curcuma longa* L.). *Journal of Horticultural Sciences*, *2*(2): 123-129.

Sadanandan, A. K. and Hamza (1998). Organic Farming on Yield and Quality of Spices in India (Abs.) 16th World Congress on Soil Science; Montpellier, France during 20-26 August, pp 738.

Sarma, I., Phukon, M., and Borgohain, R. (2015). Effect of Organic Manure, Vermicompost and Neemcake on Growth, Yield and Profitability of Turmeric (*Curcuma longa* L.) Variety-Megha Turmeric-1. *Asian journal of biological sciences*, *10*(2): 133-137.

Singh, A. (2014). Effect of Rhizome Size and Growth Regulators on Growth, Yield and Quality of turmeric (*Curcuma longa* L.). *M.Sc. Thesis. Punjab Agriculture*. *Uni*versity Ludhiana (India).

Singh, S. P. (2015). Nutrient Supplementation through Organic Manures for Growth and Yield of Ginger (*Zingiber officinale* Rose.). *Journal of Eco-friendly Agriculture*, *10*(1): 28-31.

Singh, S. P., Choudhary, R. and Mishra, A. K. (2009). Effect of Different Combinations of Organic Manure on Growth and Yield of Ginger (*Zinziber officinale*. Rose.). *Journal of Eco-friendly Agriculture*, *4*(1): 22-24.

Srinivasan, V., Thankamani, C. K., Dinesh, R., Kandiannan, K., Zachariah, T. J., Leela, N. K., Hamza, S., Shajina, O. and Ansha, O., (2016). Nutrient management systems in turmeric: Effects on soil quality, rhizome yield and quality. *Industrial crops and Products*, *85*: 241-250.

Sugtto, Y. and Ma fluchah (1995). Influence of Rates of Farmyard Manure and KCI on Growth, Yield and Quality of Young Ginger Rhizome. *Agrivita*, *18*(2): 67-73.

Tripathi, S. K., Sharma, B., Kumari, P., Deb, P., Ray, R. and Denis, A. F. (2021). Evaluation of Productivity, Quality and Economics of Turmeric under different Moisture Regime and Integrated Nutrient Management at Eastern Indo-Gangetic Plains, India. *Agricultural Research*, *10*(4): 601-612.

How to cite this article: U.B. Anuradha, S.S. Patil, A.R. Kurubar, G. Ramesh and S. Hiregoudar (2022). Influence of Organic and Inorganic Fertilizers on Growth, Yield and Quality of Turmeric (*Curcuma longa* L.) cv. Salem. *Biological Forum – An International Journal*, *14*(3): 1218-1221.