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Impact of integrated nutrient management on growth and yield of turmeric (Curcuma longa L.)

Bhoomika HR, Heena Kauser, Vaishnavi BA and Shivaprasad M

Abstract
Turmeric (*Curcuma longa* L.) a member of zingiberaceae family is one of the major medicinal plants cultivated in India. The rhizomes are of immense medicinal and culinary importance world over. It is an exhaustive crop and requires high soil fertility and applied nutrients for successful growth and yield. The present investigation on integrated nutrient management on turmeric involving organic, inorganic and bio-fertilizers was carried out at College of Horticulture, Mudigere, Karnataka, with Thirteen treatment combinations. Among the different combinations of inorganic and bio-fertilizers tried, application of 100 % RDF through inorganic sources along with seed treatment of rhizomes with *Azospirillum* and PSB @ 10g/kg and soil application of VAM @ 70 kg/ha has proven best to promote plant growth and yield of turmeric.

Keywords: Turmeric, *Curcuma longa*, Growth, Yield, Bio-fertilizers, *Azospirillum*

Introduction
Turmeric (*Curcuma longa* L. F: Zingiberaceae) is an underground, perennial rhizomatous crop valued for its bright orange rhizomes as source of natural colourant and as the reservoir of medicine. Native of Indo-China region it adapts very well to tropical climate. India- a leader in turmeric production has much of the area concentrated in states like Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Orissa. Turmeric is an exhaustive crop and demands application of higher levels of nutrients to soil for its optimum growth and development. It is a proven fact that the excessive application of chemical fertilizers for a long term, reduce the soil fertility status by adversely affecting the soil flora and fauna. Hence integrated approach towards nutrient management of crops becomes more relevant of which bio-fertilizers play a major role. Combined application of inorganic manures and organic sources of nutrients not only increase the yield but also improve fertility status of soil by improving physical, chemical biological properties of soil (Blane *et al.*, 1989) [1].

Materials and methods
The present investigation was undertaken at College of Horticulture, Mudigere for a period of three years from 2012-13 to 2014-15. The experiment was laid out in randomised block design with thirteen treatments and three replications. The details of the treatments are: T_1: NPK (100%) + *Azospirillum*: T_2: NPK (100%) + VAM: T_3: NPK (100%) + PSB: T_4: NPK (100%) + *Azos*.+ VAM+PSB: T_5: NPK (75%) + *Azospirillum:* T_6: NPK (75%) + VAM: T_7: NPK (75%) + PSB: T_8: NPK (75%) + Azos.+ VAM+PSB: T_9: NPK (50%) + *Azospirillum*: T_{10}: NPK (50%) + VAM: T_{11}: NPK (50%) + PSB: T_{12}: NPK (50%) +s Azos.+ VAM+PSB: T_{13}: CONTROL (100% RDF)
The land was ploughed to a fine tilth. Farm yard manure was incorporated to soil @ 25 t/ha along with VAM (*Glomus fasciculatum*) @ 70kg/ ha to the respective plots. Raised beds of 3mX1.2m size and 15 cm height were prepared. Healthy seed rhizomes of turmeric were selected and were treated with the bio-inoculants *viz. Azospirillum brasiliensis* and PSB (*Pseudomonas putida*) using jaggery solution as an adhesive. The rhizomes were shade dried for 30 minutes and planted on raised beds at a spacing of 30 cm X 30 cm. 50% of the nitrogen and full dose of recommended P and K were applied to the bed 15 days after planting. Remaining 50% of nitrogen was given 30 days after.

The beds were mulched and irrigated immediately after planting and subsequent intercultural operations like weeding and irrigation were carried out as and when required.

Observations on various growth parameters were recorded at monthly intervals after germination of rhizomes. Five plants were selected randomly from each bed and tagged for observation purpose. Plant height was measured from ground level to the tip of last fully opened leaf using linear scale and expressed in centimetres. Fully opened leaves were counted and expressed as number of leaves per plant. Once the above ground plant parts exhibited the symptoms of yellowing and drying the rhizomes were collected and the observations pertaining to various yield contributing parameters were recorded. Fresh weight of rhizomes per plant was recorded after removing the adhering soil and roots. The yield per plot was recorded and the yield per hectare was estimated and expressed in tonnes per hectare. The data was subjected to statistical analysis as per Panse and Sukhatme (1967) [2]. The pooled mean data of growth and yield parameters is presented in the paper.

Results and discussion

Analysis of pooled data of three years for various growth parameters revealed the presence of significant difference among the treatment combinations for the traits under study (table1). The treatment T1 recorded maximum plant height (63.97 cm) at 180 days after planting which was on par with T6 (63.27 cm), T10 (62.33 cm), T8 (61.16 cm) and T4 (60.90 cm). Number of tillers per plant was significantly higher in the treatment T2 (3.63) followed by T4 (3.34). Treatment T4 recorded higher number of leaves (17.79) per plant. Similar trends in increased growth parameters with the combined application of inorganic fertilizers and bio-fertilizers were also reported earlier by Singh (2012) [3], Padmapriya and Chezhiyan (2009) [4] in turmeric and by Rajeshwari and Shakila (2015) [5] in ambrette.

Similarly the yield parameters like number of primary rhizomes and secondary rhizomes, weight of rhizomes per clump, rhizome yield per plot and per hectare also varied with different treatments (table 2). Treatment T4 recorded maximum number of primary fingers and secondary fingers per plant (6.16 and 6.19 respectively) followed by T10 (5.88 and 6.03 respectively). Rhizome weight per clump was also recorded maximum in T4 (198.58 g fresh and 39.91g dry). The same treatment exhibited maximum rhizome yield per plot and estimated yield per hectare (6.85 kg and 21.75 t/ha respectively). Though the treatments did not differ significantly for curing percentage of rhizomes, the estimated cured yield was higher in T4 which is due to higher fresh rhizome yield realized in the treatment. The study clearly indicated the positive influence of bio-fertilizers on growth and yield of turmeric rhizomes when applied in combination with the inorganic fertilizers. The findings are in line with earlier reports by Tesfaye *et al*. (2007) [6], Velmurugan *et al*. (2007) [7] and Shamrao *et al*. (2013) [8] wherein the authors also reported the beneficial effects of integrated application of nutrients over chemical fertilizers alone.

Table 1: Plant growth parameters in turmeric as influenced by integrated application of nutrients

Treatments	Plant height (cm)	Number of tillers per clump	Number of leaves per clump
T_1: NPK (100%) + *Azospirillum*	83.72	3.72	15.05
T_2: NPK (100%) + VAM	83.31	3.56	14.92
T_3: NPK (100%) + PSB	76.65	3.13	13.49
T_4: NPK (100%) + *Azos*.+ VAM+PSB	90.96	4.34	17.79
T_5: NPK (75%) + *Azospirillum*	74.87	3.57	14.91
T_6: NPK (75%) + VAM	83.38	4.02	15.14
T_7: NPK (75%) + PSB	79.67	3.76	15.42
T_8: NPK (75%) + Azos.+ VAM+PSB	83.39	3.92	13.52
T_9: NPK (50%) + *Azospirillum*	80.00	3.66	15.74
T_{10}: NPK (50%) + VAM	85.04	3.53	14.50
T_{11}: NPK (50%) + PSB	75.38	3.67	12.36
T_{12}: NPK (50%) + Azos.+ VAM+PSB	75.99	4.08	12.17
T_{13}: CONTROL (100% RDF)	70.54	3.21	13.04
SEm ±	3.56	0.21	1.03
CD 5%	10.39	0.62	3.01
CV (%)	7.68	10.01	12.35

Note: DAS – Days after Sowing

Table 2: Effect of integrated application of nutrients on yield and yield parameters in turmeric

Treatments	No. of primary fingers/plant	No. of secondary fingers/plant	Rhizome yield per plant (g)	Yield per plot (kg)	Yield per hectare (t)
T_1: NPK (100%) + *Azospirillum*	3.58	5.22	158.61	6.39	20.63
T_2: NPK (100%) + VAM	3.67	5.51	162.34	6.34	20.46
T_3: NPK (100%) + PSB	3.54	5.41	169.51	6.85	21.74
T_4:NPK (100%)+ *Azos*.+ VAM+PSB	5.23	6.15	185.52	7.70	23.40
T_5: NPK (75%) + *Azospirillum*	3.41	5.06	150.80	6.28	19.95
T_6: NPK (75%) + VAM	3.35	5.49	153.58	6.19	19.64
T_7: NPK (75%) + PSB	3.76	5.38	146.44	5.94	18.86
T_8: NPK (75%) + Azos.+ VAM+PSB	3.87	5.64	158.85	6.50	20.65
T_9: NPK (50%) + *Azospirillum*	3.52	4.75	127.93	5.52	17.52
T_{10}: NPK (50%) + VAM	3.21	4.85	132.13	5.33	16.93
T_{11}: NPK (50%) + PSB	3.25	4.58	131.42	5.22	16.58
T_{12}:NPK (50%)+ Azos.+ VAM+PSB	3.59	4.81	138.47	5.75	18.26
T_{13}: CONTROL (100% RDF)	3.56	4.98	146.89	6.05	20.20
SEm ±	0.13	0.09	1.97	0.08	0.29
CD 5%	0.38	0.25	5.74	0.23	0.85
CV (%)	6.23	2.87	5.78	6.99	11.01

Conclusion

The findings of the study revealed that integrated application of nutrients has proven beneficial in turmeric than application of chemical fertilizers alone. Application of organic and bio fertilizers to soil, in long run helps in restoring and improving the soil fertility status which in turn might help in reducing the level of application of inorganic fertilizers.

References

1. Blane D, Gilly G, Gras R. Comparative effects of organic manures and fertilizers on soil and vegetable yield in Mediterranean climate. I. organic manure. Comptes rendus De-1 Academid. Agric. De France. 1989; 75(1):29-36.
2. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR Publication, New Delhi. 1967, 152-174.
3. Singh SP. Effect of integrated nutrient management on growth, yield and economics of turmeric *(Curcuma longa* L) var. Rajendra Sonia. The Asian J Hort. 2012; 7(2):478-480.
4. Padmapriya S, Chezhiyan N. Effect of shade, organic, inorganic and biofertilizers on morphology, yield and quality of turmeric. Indian J Hort. 2009; 66(3):333-339.
5. Rajeswari R, Arumugam Shakila. Effect of integrated nutrient management practices on yield characters of ambrette (*Abelmoschus Moschatus* medic.). Plant Archives. 2009; 15(1):537-540.
6. Tesfaye B, Netra P, Anil Kumar S. Response of onion (*Allium cepa* L.) to combined application of biological and chemical nitrogenous fertilizers, Acta agric. Slovenica. 2007; 89(1):107-114.
7. Velmurugan M, Chezhiyan N, Jawaharlal M. Studies on the effect of organic manures and biofertilizers on rhizome yield and its attributes of turmeric cv. BSR-2. The Asian J Hort. 2007; 2(2):23-29.
8. Shamrao BS, Jessykutty PC, Duggi S, Santoshkumar M, Harish KH, Shruthi D. Studies on growth, yield and economic parameters of kasthuri turmeric (*Curcuma aromatica* Salisb.) under organic manuring practices. Int. J Advancements in Res. & Techn. 2013; 2(5):414-420.