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Effect of bio-fertilizers and organic manures on essential oil content of turmeric

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Abstract
An investigation was made to determine the "Effect of bio-fertilizers and organic manures on quality parameter of turmeric during Kharif and Rabi season of 2012-2013. Among the treatment combinations, T_7 O_3 B_1 (VC 5t/ha + Azospirillum 5kg/ha) recorded maximum 4.94% essential oil and was significantly lowest 2.11% in treatment combination T_1 (O_0 B_0 No organic manure + No bio-fertilizer i.e. control). With regards to organic manures, the treatment O_3 (Vermicompost 5t/ha) resulted significantly maximum essential oil 4.51% and with least (2.87%) under the treatment O_1 (No organic manures) whereas, with regard to bio-fertilizers, Treatment B_1 (Azospirillum 5 kg/ha) exhibited maximum 3.98% essential oil in leaves, while the treatment B_0 (No bio-fertilizer) was recorded the minimum 3.25% essential oil in leaves.

Keywords: Turmeric, bio-fertilizer, organic manure, essential oil

1. Introduction
Turmeric (*Curcuma longa* L.) is one the most important and ancient spice of India, contains about 69.49 carbohydrate 6.30 protein, 5.10 oil and 3.50% mineral and other important elements in dry turmeric (Swain *et al.,* 2007) [5]. Turmeric contains up to 5% essential oils and up to 5% curcumin, a polyphenol. Curcumin is the active substance of turmeric and curcumin is known as C.I. 75300, or Natural Yellow 3. The keto form is preferred in solid phase and the enol form in solution. Curcumin is a pH indicator. In acidic solutions (pH 8.6) solutions it turns bright red. Turmeric has anti-inflammatory (painkiller), carminative, anti-flatulent, anti-microbial, anti-tumor, antioxidant, anti-arthritic, anti-amyloid, anti-ischemic and anti-inflammatory properties. The herb contains health benefiting essential oils such as *turmerone, zingiberene, cineole, and p-cymene*. This traditional herb does not contain any cholesterol; however, it is rich in antioxidants and dietary fiber, which helps to control blood LDL or "bad cholesterol" levels. It contains good amounts of minerals like calcium, iron, potassium, manganese, copper, zinc, and magnesium. Nutritive value of Turmeric (*Curcuma longa*), per 100 g has been presented in Table 1.

Table 1: Nutritive value of Turmeric (*Curcuma longa*), per 100 g.

Principle	Nutrient Value	Percentage of RDA	Vitamins	Nutrient Value	Percentage of RDA
Energy	354 Kcal	17%	Folates	39 µg	10%
Carbohydrates	64.9 g	50%	Niacin	5.140 mg	32%
Protein	7.83 g	14%	Pyridoxine	1.80 mg	138%
Total Fat	9.88 g	33%	Riboflavin	0.233 mg	18%
Cholesterol	0 mg	0%	Vitamin A	0 IU	0%
Dietary Fiber	21 g	52.5%	Vitamin C	25.9 mg	43%
Minerals			Vitamin E	3.10 mg	21%
Calcium	183 mg	18%	Vitamin K	13.4 µg	11%
Copper	603 µg	67%	**Electrolytes**		
Iron	41.42 mg	517%	Sodium	38 mg	2.5%
Magnesium	193 mg	48%	Potassium	2525 mg	54%
Manganese	7.83 mg	340%			
Phosphorus	268 mg	38%			
Zinc	4.35 mg	39.5%			

Source: USDA National Nutrient data base

Most usage of turmeric is in the form of rhizome powder, in some regions leaves of turmeric are used to wrap and cook food. It is intensively grown in the highland with sandy loam soil. Turmeric ranks 4thas foreign exchange earner among the spices. Constant use of chemical fertilizers under monoculture over a long period of time was found to impair the ecological balance in huge dimensions. Therefore it is inevitable to adopt a strategy for judicious use of organic manures and bio-fertilizers. Likewise the use of bio-fertilizers have a supplementary nutritive role in productivity are ecofriendly, cost effective and enhance the soil fertility status. Importance of bio-fertilizer and organic manures in turmeric was reported by various workers in relation to quality and productivity of crop (Velmurugan *et al.,* 2009) [7]. However, the information regarding the effect of bio-fertlizers and organic manure on quality aspect is very limited. In view of the above facts, the present study was conducted to find out the effect of bio-fertilizers and organic manure on quality parameter of turmeric.

2. Material and methods

An experiment was conducted at Horticulture Complex, Department of Horticulture, JNKVV, Jabalpur (MP) during 2012-13 to study the effect of bio-fertlizers and organic manures on recovery of essential oil in turmeric. The two factors were chosen as a treatment. Factor A consisted of Organic manure and factor B related with bio-fertilizers. The treatment details are presented (Table 1). The average annual rainfall was 1350 mm, which was mostly received during June to October from Southwest monsoon. The average maximum temperature was 46^0 C and minimum temperature 6.8^0C. The average annual relative humidity was 74%. Organic carbon 0.22%, available nitrogen 332.50 (kg/ha), available phosphorus 40.60 (kg/ha), available potash 312.27 (kg/ ha), soil pH 7.03, electrical conductivity 0.14 (m mhos per cm) indicates the status of soil type. The previous crop in the field was onion. The seed rhizomes of turmeric var. Guntur was obtained from Horticultural research station Guntur Andhra Pradesh. Doses of organic manure and bio fertilizers were applied as per treatment plot as basal dose.

Table 2: Treatment combinations

Treatment code	Treatment symbol	Treatment Details
T_1	O_1B_0	No organic manure + No bio fertilizers
T_2	O_1B_1	No organic manure + Azospirillum 5kg/ha
T_3	O_1B_2	No organic manure + PSB 5kg/ha
T_4	O_2B_0	FYM 15t/ha+ No bio fertilizer
T_5	O_2B_1	FYM 15t/ha+ Azospirillum 5kg/ha
T_6	O_2B_2	FYM 15t/ha+PSB 5kg/ha
T_7	O_3B_0	vermicompost 5t/ha + No bio bertilizer
T_8	O_3B_1	vermicompost 5t/ha+ Azospirillum 5kg/ha
T_9	O_3B_2	vermicompost 5t/ha + PSB 5kg/ha
T_{10}	O_4B_0	poultry manure + No bio fertilizer
T_{11}	O_4B_1	poultry manure + Azospirillum 5kg/ha
T_{12}	O_4B_2	poultry manure + PSB 5kg/ha

The experimental sowing was done on 26 June, 2012 maintaining the spacing of 70 cm between two rows and 30 cm between plants. The furrows were opened with the help of kudali and seeds were sown in furrows by manual labour and were covered immediately with soil. The data on dry leaves were recorded at the harvesting stage of the crop growth. Leaves from whole plots were collected and weighed and than average was worked out. The data on essential oil percentage were recorded from dry leaves after harvesting of corps then the essential oil was calculated through distillation method (Braga *et al.,* 2007) [1].

3. Results and discussion

The data on essential oil percentage were recorded from dry leaves after harvesting of crop then the essential oil was calculated through distillation method. Interaction effect and individual effects of bio-fertilizers and organic manures on essential oil per cent of turmeric indicated that among the treatment combinations, T_7 (O_3B_1VC 5t/ha + Azospirillum 5kg/ha) was recorded maximum 4.94% essential oil and it was significantly lowest 2.11% in treatment combination T_1 (O_0B_0 No organic manure + No bio-fertilizer i.e. control) (Table 2& 3). These results are in agreement with (Tiwari *et al.,* 2003) [6] who reported the application of N at 150 kg/ha resulted as the optimum dose for essential oil yield. (Velmurugan *et al.,* 2009) [7] reported that the maximum essential oil content was obtained with farmyard manure + *Azospirillum lipoferum* + phosphate-solubilizing bacterium (*Bacillus megaterium*) + VAM (vermiculite based inoculum *Glomus fasciculatum*, *G. mosseae* and Gigaspora sp.). The essential oil estimated in turmeric leaves was significantly affected by the treatments of bio-fertilizers and organic manures. With regards to organic manures, the treatment O_3 (Vermicompost 5t/ha) was significantly maximum essential oil 4.51% and it was minimum (2.87%) under the treatment O_1 (No organic manures). Similar trend was notices by (Rao *et al.,* 2005) [4] reported that the essential oils were more in vermicompost 1.0 t/ ha alone (4.38%) over RFD (essential oils 3.56%) (Table 3). The treatment B_1 (Azospirillum 5 kg/ha) yielded maximum 3.98% essential oil in leaves, while, minimum (3.25%) was recorded in treatment with No bio-fertilizer. The present findings are in agreement with (Padmapriya *et al.,* 2007) [3] and (Padmapriya *et al.,* 2009) [2] reported that the highest essential oil (5.68%) content were registered in the treatment, shade with application of 50% FYM + coir-compost + Azospirillum (10 kg/ha) + phosphobacteria (10 kg/ha) + 3% panchagavya.

Table 3: Interaction effect of bio-fertilizers and organic manures on leaf area duration dry leaves /plot and essential oil per cent of turmeric.

Treat. Sym.	Code	Treatment details	Essential oil per cent
T_1	O_1B_0	No organic manure + No biofertilizer	2.11
T_2	O_2B_0	FYM 15t/ha + No biofertilizer	3.48
T_3	O_3B_0	VC 5t/ha + No biofertilizer	3.82
T_4	O_4B_0	PM 5t/ha + No biofertilizer	3.58
T_5	O_1B1	No organic manure +Azospirillum 5kg/ha	3.48
T_6	O_2B_1	FYM 15t/ha + Azospirillum 5kg/ha	3.71
T_7	O_3B_1	VC 5t/ha + Azospirillum 5kg/ha	4.94
T_8	O_4B_1	PM 5t/ha + Azospirillum 5kg/ha	3.77
T_9	O_1B_2	No organic manure +PSB 5kg/ha	3.01
T_{10}	O_2B_2	FYM 15t/ha + PSB 5kg/ha	3.65
T_{11}	O_3B_2	VC 5t/ha + PSB 5kg/ha	4.77
T_{12}	O_4B_2	PM 5t/ha + PSB 5kg/ha	3.68
SEm±			0.042
CD at 5% levels			0.13

Table 4: Individual effect of bio-fertilizers and organic manures on essential oil per cent of turmeric.

Code	Treatment details	Essential oil per cent
Organic manure		
O_1	No organic manure	2.87
O_2	FYM 15t/ha	3.61
O_3	VC 5t/ha	4.51
O_4	PM 5t/ha	3.68
SEm±		0.024
CD at 5% levels		0.071
Bio-fertilizer		
B_0	No biofertilizer	3.25
B_1	Azospirillum 5kg/ha	3.98
B_2	PSB 5kg/ha	3.78
SEm±		0.021
CD at 5% levels		0.062

4. Conclusion

It is concluded from the present studies that among the treatment combinations T_7 (O_3B_1VC 5t/ha + Azospirillum 5kg/ha) was recorded maximum 4.94% essential oil. Alone organic manures, the treatment O_3 (Vermicompost 5t/ha) was observed significantly maximum essential oil 4.51% and biofertilizer B_1 (Azospirillum 5 kg/ha) was exhibited maximum 3.98% essential oil in leaves.

5. References

1. Braga MEM, Meireles MA. Accelerated solvent extraction and fractioned extraction to obtain the *Curcuma longa* volatile oil and oleoresins. Journal of Food Process Engin. 2007; 30(2):501-521.
2. Padmapriya S, Chezhiyan N. Effect of shade, organic, inorganic and bio-fertilizers on morphology, yield and quality of turmeric. Indian Journal of Horti. 2009; 66(3):333-339.
3. Padmapriya S, Chezhiyan N, Sathiyamurthy VA. Effect of shade and integrated nutrient management on biochemical constituents of turmeric (*Curcuma longa* L.). Jo of Horti Sci. 2007; 2(2):123-129.
4. Rao AM, Rao PV, Reddy YN, Reddy MSN. Effect of organic and inorganic manurial combinations on growth, yield and quality of turmeric (*Curcuma longa* L.). Jo of Plantation Crops. 2005; 33(3):198- 205.
5. Swain SC, Rath S, Ray DP. Effect of NPK levels and mulching on growth, yield and economics of turmeric in rainfed uplands. Orissa Jo of Horti. 2007; 35(1):58-60.
6. Tiwari G, Shah P, Agrawal VK, Harinkhede DK. Influence of nitrogen application on the growth, biomass productivity and leaf essential oil yield in turmeric. JNKVV Res Jo. 2003; 37(2):90-91.
7. Velmurugan M, Chezhiyan N, Jawaharlal M. Influence of organic manures and inorganic fertilizers on cured rhizome yield and quality of turmeric (*Curcuma longa* L.) cv. BSR-2. Internat Jo of Agric Sci. 2009; 4(1):142-145.