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RESEARCH ARTICLE

ORGANIC TURMERIC CULTIVATION IN THE EASTERN GHAT HIGH LAND ZONE OF ODISHA

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ABSTRACT

An investigation was carried out for popularization of organic turmeric cultivation through frontline demonstrations in Koraput district of Odisha in India during 2013-14 under National Horticulture Mission. An average yield of 124.8 q / ha was obtained under organic cultivation of turmeric in contrast to average yield of 142.8 q / ha from inorganic plots (farmers practice) during Kharif'2013. The average cost of production of turmeric per hectare was found to be Rs. 191560 and Rs. 179600 from organic and inorganic field respectively. The average gross return per hectare from FLD (organic) and inorganic field (Farmers Practice)was recorded as Rs. 374400 and Rs.285600respectively.However, the average net return/ ha of organic turmeric in different FLD plots was obtained as Rs. 185840 in contrast to Rs.106000 in different farmers field under inorganic cultivation. The Cost : Benefit ratio was found to be 1: 1.95 in Organic turmeric and 1:1.59 in Inorganic turmeric. Organic turmeric growers were highly satisfied with their organic production and higher economic return. High cost : benefit ratio also advocated the economic viability of the demonstration and motivated the farmers towards adoption of interventions demonstrated.

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INTRODUCTION

Turmeric is rhizomatous herbaceous plants botanically known as *Curcuma longa*. It is an important commercial spice crop grown in India since ancient times and is also known as Indian saffron or golden spice or spice of life. The world production of turmeric stands at around 8,00,000 tonnes, of which India has a share of approximately 75-80 per cent (Thiripurasundari and Selvarani, 2014).Turmeric is used from antiquity as condiments, a dye and as an aromatic stimulant in several medicines. In India, the state Orissa has 14.6 % of the national turmeric area and 23.24 % of annual production (Ministry of Agriculture, 2014). Odisha contributes about 21 % of India's turmeric cultivation in terms of area and Kandhamal makes up for over 50 % of the state' s share. Kandhamal district stands first in turmeric area as well as production (28,828 t from 11,088 ha) while Koraput is the second largest producing district with 7,761 t from 3,168 ha (Babu *et al*., 2015). The chemical method of farming is becoming unsustainable as evidenced by declining productivity, damage to environment, chemical contaminations, etc. The necessity of having an alternative method which can function in a friendly ecosystem while sustaining and increasing the crop productivity is realized now. Organic cultivation of turmeric is recognized as the best known alternative to the conventional method. Application of different organic amendments in combinations and in a cumulative manner can supply the nutrient requirement of organic medicinal plants cropping system (Raei and Milani, 2014). Ayeni *et al.* (2010) have equally reported that organic manures when properly used have proven to be very efficient in increasing soil nutrient contents, ensuring positive residual effects and enhancing soil's physico-chemical properties. Anitha *et al.* (2015) reported that different organic manures,

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inorganic fertilizers and bio-fertilizers in INM combinations significantly influenced the grain yield in fenugreek. Organic farming has attracted increasing attention for environmental protection, improved quality and better market demands (Yadav *et al*., 2004). Technology transfer is paramount to spread new ideas from originating sources to the users (Prasad *et al*., 1987). There is considerable latent interest among farmers in conversion to organic cultivation. However, some farmers are reluctant to convert because of the perceived high costs and risks involved in organic farming. However very little information exists on the costs and returns of organic turmeric cultivation.Considering the above mentioned facts in view, an attempt has been made to popularize organic cultivation of turmeric in this zone with an objective of combating low economic return and obtaining quality produce of the farmers through front line demonstrations.

MATERIALS AND METHODS

The investigation was carried out in Koraput district of Odisha in India as the organic cultivation of vegetable and spices is practiced largely in the district. The turmeric crop was selected for the study as large number of farmers practise the organic cultivation of turmeric. The rainfall in the current year was recorded as 1518.2 mm and during the cropping season it was recorded as 1410.8 mm. There was no dry spell observed during the investigation period.The present study was conducted during 2013-14 in the Eastern Ghat High Land zone of Koraput district of Odisha in India under National Horticulture Mission for popularisation of organic turmeric cultivation through frontline demonstrations. Frontline demonstration is a most suitable method for assessing the performance of improved technology with the existing technology, as it directly involves the scientists in conducting the demonstrations at the farmers' field which enables them to have first hand information related to technology. Also, skill trainings and exposure field visits were organized for skill up gradation of farmers in organic cultivation of Turmeric. After preliminary survey, five randomly selected farmers were selected with adopted method of organic turmeric cultivation. A total 05 frontline demonstrations were conducted at 05 farmer's fields. The selection of farmers was made in consultation with the local Assistant Agriculture Officers of Semiliguda area of Koraput district in Odisha and scientists of KrishiVigyan Kendra, Koraput, Semiliguda, Odisha, India.

Survey, farmers meeting and field visit were made during cropping season and they were educated about advantage of organic method of turmeric cultivation considering less market price due to poor quality produce. The area considered under each demonstration was 0.5 ha. Procedure for site and farmers selection, layout of demonstration and farmers participation etc. were followed as per the methodology followed by Choudhury (1999). Visits of the farmers and extension functionaries were organized at demonstration plots to show profitability of organic cultivation of turmeric.The variety Roma was supplied to the farmers. The different organic inputs were supplied to FLD farmers to popularise the technology. Before planting turmeric, weeding was done manually and left on the soil as a mulch. Preparation of land starts with the receipt of early summer showers. Land is ploughed 2 to 3 times to get the fine soil. Beds of 1m width, 15cm high and of convenient length are prepared with the channel of 40-50 cm width in between beds. Farmers make drainage channels around the field. A seed rate of 20 q / ha was used for planting. The seed rhizome with pieces of 20 to 22 g having 2 to 3 eye buds were used for planting. The seeds were treated with *Trichodermaviridae* and *Psuedomonasfluorescens* for 30 minutes and shade dried for 3 to 5 hours as a safeguard against diseases and to induce early sprouting.Seed treatment was done by putting rhizomes in prepared slurry containing 3Kg cow dung, 1kg *Trichodermaviridae* and 1kg *Pseudomonas fluorescence*, 250g jaggery and 250g gram powder in 10 litre of water for 30m and dried in shade. The treated seed rhizomes were planted in the bed with the spacing of 25 cm X 30 cm. Neem cake was applied at the time of transplanting by mixing with FYM and Vermicompost. After 15-20 days of germination hoeing and weeding was done. Application of 10 Kg *Trichodermaviridae*, 10Kg *Pseudomonas fluorescence*, 10 kg *Azotobacter*, 10 kg PSB, 10 kg *Potash bacter*, 10 kg Bio NPK, 10 kg Bio Zinc with FYM was done for better growth followed by mulching with green leaves and straw @ 5t per ha. The same dose was applied at 45 days and 90 days after germination. The foliar spray of Bio NPK @ 5ml per litre was done thrice at 15 days interval. Mulching of the turmeric beds with green leaves was done to enhance germination of seed rhizomes and to prevent washing off soil due to heavy rain. Fields were irrigated at fortnightly interval in October and November followed by weeding was twice to keep the field free from weeds, once at 45 days of sowing and the next after 45 days of the first weeding. Neem oilwas sprayed @ 3 ml/l at 10-12 days interval after transplanting to control incidence of termites and shoot borer. Mixed spraying of *Trichodermaviridae* and *Pseudomonas fluorescens* was done three times at 20 days interval starting from 30 days after sowing. Data on yield / ha, cost of production (Rs /ha), gross return (Rs/ ha), net return (Rs /ha) and C : B ratio were taken in both organic and inorganic method of turmeric cultivation and were presented in the tables. The B: C ratio was calculated by using the formula Gross returns / Cost of cultivation.

RESULTS AND DISCUSSION

The Front line demonstrations were conducted on organic cultivation of turmeric with assistance under National Horticulture Mission at different farmers field in Koraput district of Odisha in India during 2013-14 (Table 1). The selection of farmers were made in consultation with the local Assistant Agriculture Officers of Semiliguda and Scientists of KrishiVigyan Kendra, Koraput, Semiliguda in Odisha of India. The turmeric variety Roma was supplied to the farmers. The different organic inputs were supplied to FLD farmers to popularize the technology.

Table 1. Area allotment under front line demonstrations on organic turmeric cultivation during 2013-14

S.No.	Farmer	FLD Area (ha)	Variety
1	Farmer 1	0.5	Roma
2	Farmer 2	0.5	Roma
3	Farmer 3	0.5	Roma
4	Farmer 4	0.5	Roma
5	Farmer 5	0.5	Roma

Table 2. Yield performance of organic turmeric in comparison to inorganic turmeric

S.No.	Farmer	Area (ha)		Plot Yield of fresh rhizome (q) from 0.5 ha area		Plot Yield of fresh rhizome (q) from 1 ha area	
		FLD	FP	FLD	FP	FLD	FP
1	Farmer 1	0.5	0.5	65	72	130	144
2	Farmer 1	0.5	0.5	63	74	126	148
3	Farmer 1	0.5	0.5	62	73	124	146
4	Farmer 1	0.5	0.5	60	70	120	140
5	Farmer 1	0.5	0.5	62	68	124	136
	Average	0.5	0.5	62.4	71.4	124.8	142.8

Table 3. Cost: Benefit analysis from organic turmeric in comparison to inorganic turmeric cultivation (from 0.5 ha area)

S.No.	Farmer	Total cost of production (Rs.)		Gross return (Rs.)		Net return (Rs.)		C:B ratio	
		FLD	FP	FLD	FP	FLD	FP	FLD	FP
1	Farmer 1	1,00,000	98,000	1,95,000	1,44,000	95,000	46,000	1.95	1.47
2	Farmer 1	98,000	86,000	1,89,000	1,48,000	91,000	62,000	1.93	1.72
3	Farmer 1	95,000	89,000	1,86,000	1,46,000	91,000	57,000	1.96	1.64
4	Farmer 1	92400	86000	1,80,000	1,40,000	87,600	54,000	1.95	1.63
5	Farmer 1	93500	90000	1,86,000	1,36,000	92,500	46,000	1.99	1.51
	Average	95780	89800	187200	142800	91420	53000	1.95	1.59

FLD- Front Line Demonstration (Inorganic turmeric cultivation),
FP- Farmers Practice (Inorganic turmeric cultivation)
Selling Price of organic turmeric (TL Seed) = Rs. 3000/- /q & Inorganic turmeric (TL seed) = Rs.2000/- /q

Yield

It was revealed from the recorded data depicted in the Table-2, that rhizome yield of organic turmeric in FLD plots was lower than the inorganic turmeric rhizome yield in farmers practice . The fresh turmeric rhizome yield per FLD plots (Organic) from 0.5 ha varied from 60 to 65 q where as it varied from 68 to 74 qin Farmers Practice (inorganic plots). The average fresh turmeric rhizome yield in organic plots was 62.4 q in comparison with average yield of 71.4 q of inorganic plots in farmers practice from 0.5 ha area during Kharif'2013. Similarly, the average fresh turmeric rhizome yield in organic plots was 124.8 q ha^{-1} in comparison with average yields142.8 q ha^{-1} of inorganic plots in farmers practice during Kharif'2013. Similar observations were also recorded by Amarnath and Sridhar (2012) under Tamil Nadu condition. Higher yield and quality under traditional methods of cultivation has been recorded in turmeric (Swain *et al*., 2007). Similarly, Sahoo *et al*. (2015) obtained a yield of 17.3 t ha^{-1} from variety cv. Roma under West Central Table Land Zone of Odisha. Singh *et al.* (2013) also reported that addition of organic manures like FYM, compost, vermicompost etc. played a vital role in the sustenance of soil fertility and crop production.

The data clearly revealed that the net returns from the demonstration plots were substantially higher than control plots. Barua and Tripathy (2015) obtained an average net return of Rs 305302 in demonstrated plots in comparison to Rs.127071 in control plot under Meghalaya condition. It has been reported by (Ayub *et al*., 2015), that organic manure gave significant higher rhizome yield of between 114.3 and 250.6% relative to the control and highest yield of 11.42t ha^{-1} was obtained from plots treated with 30 t ha^{-1} cow dung and 10 t ha^{-1} poultry litter. Similarly, the average fresh turmeric rhizome yield in organic plots was 70.4 q ha^{-1} in comparison with average yields 76.0 q ha^{-1} of inorganic plots in farmers practice during Kharif'2013. Shah and Zala (2006) obtained average yield of turmeric in Gujarat as 133 q/ha under Gujarat condition. However, Babu*et al*. (2015) obtained an average yield of 12-15 tons from 1 hectare area. But according to Singh and Dhillon (2015) yield of turmeric on an average worked out to be 1467 kg/ha. Farmers believed that application of neem cake @ 2 t /ha as basal dose helps reduce the incidence of soft rot of turmeric and thereby increased the yield. Neerja and Korla (2010) studied effect of organic manure and inorganic fertilizer on yield and quality of turmeric and recorded highest yield of 11.59 t / ha with biofertilizer Azospirillum alone in comparision to inorganic fertilizers and the quality attributes significantly increased by all the organic fertilizer treatments under Solan condition.

Cost of Production

From the data depicted in the Table 3 & Figure 1, it was obvious that from 0.5 ha area, the cost of production of turmeric ranged from Rs. 92400 to Rs.100000 in different farmers filed under organic plots. Similarly it varied from Rs. 86000 to Rs.98000 in different farmers' field under inorganic plots (Farmers practice). The average cost of production of turmeric was found to be Rs. 95780 and Rs. 89800 from organic and inorganic field respectively. Similarly, from the data presented in the Table 4, it was found that the cost of production ha^{-1} varied from Rs.184800 to Rs. 200000 from organic turmeric cultivation and from the inorganic turmeric cultivation, it varied from Rs. 172000 to Rs. 196000. The average cost of production of turmeric was found to be Rs. 191560 and Rs. 179600 from organic and inorganic field respectively (Table 4). According to Karthik and Amarnath (2014) the cost of cultivation of turmeric per hectare was found to be Rs. 119873 under Tamil Nadu condition.

Gross Return

From the data depicted in the Table 3, it was prominent that from 0.5 ha area, the gross return varied from Rs. 186000 to Rs. 195000 in different farmers filed under organic plots. Similarly it varied from Rs. 136000 to Rs. 148000 ha^{-1} in different farmers field under inorganic plots (Farmers practice).

Table 4. Cost: Benefit analysis from organic turmeric in comparison to inorganic turmeric cultivation (from 1 ha area)

S.No.	Farmer	Total cost of production (Rs.)		Gross return (Rs.)		Net return (Rs.)		C:B ratio	
		FLD	FP	FLD	FP	FLD	FP	FLD	FP
1	Farmer 1	2,00,000	196000	390000	288000	190000	92000	1.95	1.47
2	Farmer 1	196000	172000	378000	296000	182000	124000	1.93	1.72
3	Farmer 1	190000	178000	372000	292000	182000	114000	1.96	1.64
4	Farmer 1	184800	172000	360000	280000	175200	108000	1.95	1.63
5	Farmer 1	187000	180000	372000	272000	185000	92000	1.99	1.51
	Average	191560	179600	374400	285600	185840	106000	1.95	1.59

FLD- Front Line Demonstration (Inorganic turmeric cultivation),
FP- Farmers Practice (Inorganic turmeric cultivation)
Selling Price of organic turmeric (TL Seed) = Rs. 3000/- /q & Inorganic turmeric (TL seed) = Rs.2000/- /q

The average gross return was found to be Rs. 187200 and Rs. 142800 from organic and inorganic field respectively. Similarly, from the data presented in the Table 4, it was obvious that the gross return ha^{-1} varied from Rs. 360000 to Rs.390000 from organic turmeric cultivation and from the inorganic turmeric cultivation, it varied from Rs. 272000 to Rs.296000. The average gross return per hectare from FLD plot (organic) and inorganic field was recorded as Rs. 374400 and Rs. 285600 respectively (Table 4).On the other hand, Sahoo *et al.* (2015) obtained a gross return of Rs.3, 16,920/- from turmeric cv..Roma with scientific cultivation from the West Central Table Land zone of Odisha. However, under Tamil Nadu condition, Karthik and Amarnath (2014) obtained the gross income per hectare as Rs.247754.

Net Return

It was noticed that the net return from different farmers' field ranged from Rs.87600 to Rs.95000 from FLD farmers' field (organic method) and from Rs.46000 to Rs.62000 from FLD farmers' field (inorganic method) from 0.5 ha area. The corresponding average net return of Rs 91420 and Rs.53000 was obtained from recommended practice and farmers practice respectively (Table 3). Similarly, from Table 4, it was clear that the net return varied from Rs.175200 to Rs. 19000 from FLD farmers' field and from Rs. 92000 to Rs. 124000 from inorganic farmers' field (Farmers practice) from 1 ha area. The average net return ha^{-1} of organic turmeric in different FLD plots was obtained as Rs. 185840 in contrast to Rs.106000 in different farmers' field under inorganic cultivation (Figure3). The organic farming recorded higher net return than that of the Farmers Practice. Amarnath and Sridhar (2012) also reported that even though the productivity of organic turmeric was less as compared to conventional turmeric but net income was higher for organic farmers than conventional farmers by 45.36 per cent under Tamil Nadu condition. Karthik and Amarnath (2014) obtained the gross income per hectare as Rs.247754 with net income as Rs. 127881 per ha.

Cost : Benefit ratio (C:B ratio)

The return structure in turmeric clearly indicated that the average gross returns per ha were higher on organic fields compared to that of inorganic fields. The C : B ratio from different farmers filed ranged from 1: 1.93 to 1: 1.99 from the front line demonstrated farmers field (organic turmeric) and from 1 : 1.47 to 1 : 1.72 from inorganic turmeric fields. The average C: B ratio was recorded as 1: 1.95 and 1:1.59 from organic and inorganic turmeric cultivation respectively.(Table 4 and Figure 4). High benefit: cost ratio also advocated the economic viability of the demonstration and motivated the farmers towards adoption of interventions demonstrated. Favourable Cost: Benefit ratio proved the economic viability of the intervention made under demonstration and convinced the farmers on the utility of intervention. Similar findings were reported by Sharma (2003) in moth bean, Gurumukhi and Mishra (2003) in sorghum and Kumar *et al.* (2012) in ginger. The organic turmeric has been found quite successful in the study area and has offered several benefits as compared to those by conventional farming. However, Singh (2011) obtained a cost: benefit ratio (1:5.27) in organic turmeric than control under Muzzafarpur (Bihar) region of India. The yields have been observed to be relatively high in inorganic turmeric but are compensated by the price premium fetched by the organic turmeric cultivation. The organic cultivation increases farmers' income, thereby enhancing their economic well-being and livelihood security. Thus, organic turmeric is important in achieving the goal of sustainable agriculture. It has been suggested that organic farming should receive prime attention to realize its full potential in increasing profitability and providing the much sought after sustainability of agriculture. The consumption of inorganic fertilizers (53.20 kg/ha) and pesticides (143g /ha) is very low in Odisha as compared to national average (121.60 kg/ha and 500 g/ha, respectively) (Rai *et al,* 2011). Therefore, the scope of production of turmeric organically in Odisha is high. Farmers were interested in taking up organic turmeric cultivation on commercial scale due to higher demand in local as well as in International markets. The results of front line demonstration convincingly proved that the net return of turmeric could be increased by organic method of its cultivation. Favourable Cost: Benefit ratio is self-explanatory of economic viability of the demonstration and motivated the farmers towards adoption of interventions demonstrated. The net returns per hectare received from organic farming were relatively higher than conventional farming of sample farmers. Hence the line department officials should take appropriate steps to encourage organic cultivation by conducting vigorous campaigns to increase the awareness of traditional turmeric farmers. The extension infrastructure of agriculture department has to arrange for training programmes to popularize organic inputs and also give technical guidance to organic farmers.

Conflict of interest

The authors declare that they have no conflict of interest.

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