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Turmeric production in polypropylene bags for higher profitability

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Abstract: Turmeric cultivation is cost intensive. It has a long gestation period from planting to processing and sale. The present research tried to reduce the cost without compromising the yield and net returns. Five turmeric varieties/ cultivar were evaluated in 45kg bio-fertilizer enriched substrate filled in polypropylene bags (PPBs). Among 162 PPBs with turmeric, 81 PPB had green coriander along with turmeric. The turmeric yield in PPBs with green coriander varied from 658.66g to 1776.69g, while in PPBs with only turmeric, it varied from 810g to 1674.17g. PPBs without green coriander had to do two hand weedings which was saved due to coriander grown in other set of PPBs. The total income from PPBs with turmeric and green coriander varied from Rs. 98.80 to Rs. 205.33, in contrast to Rs. 78.00 to Rs. 164.42 per PPB with only turmeric. Growing crops in PPB prevents nutrient leaching, spread of rhizome rot and weed growth, besides also reduces cost of land preparation and inter-culture operation.

Keywords: Intensive cropping, turmeric, PPB, Jawahar Model, Doubling farmer's income

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1. Introduction

Turmeric (*Curcuma longa*) is spice rhizome cultivated on 2.34 lakh ha in India (Thomas et al. 2015). It is used in culinary (Tilak et al., 2004; O'Mahony et al., 2005) and in ayurvedic preparation (Kapur, 1990; Aggarwal et al., 2006; Garodia et al., 2007). India exports 1.71 lakh tonnes (78% of the world) of turmeric to various countries (Muthusamy, 2013; Anon, 2021). In the country, turmeric is mainly cultivated in various states including Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal, Gujarat, Maharashtra and Assam (Thomas et al. 2015). Generally this cost intensive crop is cultivated by small and marginal farmers (Kavita et al. 2019) from June to March during the year (Thomas et al. 2015). Long gestation period for cash returns (Jabborova et al. 2021), high initial investment (Prasad and Aggarwal, 2011) and losses due to rhizome rot (Kuttiyil et al. 2014) are the major constraints. Turmeric growers may increase their income if they follow 'Jawahar model for doubling the income of resource constrained small and marginal farmers'. Crop intensification and diversification, low initial investment, regular inflow of income from intercrops, easy adoption of organic farming and effective resource management are the few benefits of the Model. The present research was conducted to generate data in the field condition to convince farmers and extension workers towards the Model.

2. Materials and Methods

In a field trial during the year 2020-21, six cultivars of turmeric (Black turmeric, Mango ginger, Kadpa, Waigaon, Ranga and Sonali) and coriander (Green aroma hybrid) were grown in substrate (enriched with consortium of bio-fertilizer) filled polpypropylene bags (PPBs) of 24 inches (diameter) x 36 inches (length), kept at a spacing of 3feet apart in between pigeon pea plants also raised in PPBs. The substrate (45kg) had a composition

of river bed basin soil (Kapu) and FYM in 2:1 ratio. The consortium of biofertilizers composed of *Trichoderma spp., Azatobacter spp.,* PSB (Phosphate solubilizing bacteria*), Aspergillus spp.,* VAM *(*Vesicular Arbuscular Mycorrhiza*), Pseudomonas spp., and Rhizobium spp.* @0.5g of each.

The PPBs were filled in the month of May in a layerwise fashion. The base layer with one basket of *Kapu* in PPB was followed by a layer of FYM and again layer of *Kapu* was filled.

Table 1: Cost of production per PPB

Particulars	Expenses (Rs./PPB)		Remarks
	With coriander	Without coriander	
Fresh polypropylene bag	16/-	16/-	Rs.16/bag (excluding transportation)
Substrate	18/-	18/-	Rs.1200/trolley of 200 *taslas* Soil and FYM @ Rs. 0.4/kg each
Consortium	1.75/-	1.75/-	0.5g of each biofertilizer (250/kg)
Turmeric planting material	5/-	5/-	Rs. 100/kg
Coriander seed	0.3/	**Nil**	Rs. 300/kg
Labour charges of filling PPB	3/-	3/-	100bag/day @Rs. 300/day wages
Irrigation and electricity charges	3/- (Approx.)	3/- (Approx.)	Provided through drip irrigation
Weeding charges	**Nil**	1.5x2= 3/-	200bags/day @ Rs. 300/day wages (2 hand weeding per PPB in sole turmeric)
Harvesting of turmeric	2.15/-	2.15/-	140 bags/day @ Rs. 300/day wages
Total(Rs./PPB)	49.2	51.9	

Substrate:

a) 30kg River basin soil (*Kapu*) @ Rs. 0.4/kg = Rs.12/PPB
b) 15kg FYM @ 0.4/kg =Rs. 6/PPB
c) Biofertilizer consortium: 0.5g each

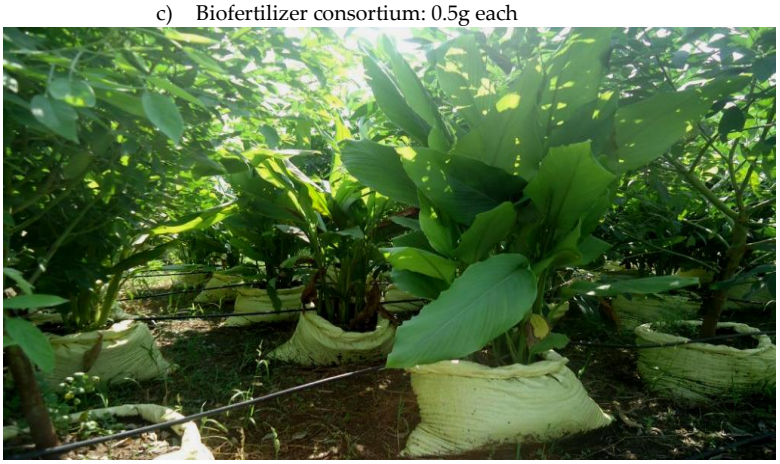

Fig. 1 Turmeric plants in polypropylene bags

The turmeric cultivars were planted (50g/PPB) on 5th June, 2020 in substrate filled PPBs. After one month *i.e.,* 1st week of July; among the 162 PPBs with turmeric plants, 81 PPBs were sown with crushed coriander and overnight presoaked seeds @ 1g/PPB; while the remaining PPBs with turmeric were without coriander. No irrigations was done during

the monsoon period, while during the post-monsoon period the PPBs were irrigated at 10 days interval till the last of January 2021 through drip irrigation system. Hand weedings were done to check the weed growth, while there were no weeds observed in turmeric PPBs with coriander (Table 1).

3. Results

Fresh green Coriander sown in the first week of July 2020 was ready for the harvest of green coriander from 15th August to 31st August 2020 in 81 PPBs. Coriander leaves were sold at the rate of Rs. 200/kg. The mean weight of coriander per PPB varied from 120.66g (Kadpa) to 164.66g (Waigaon). There was variation in the yield of green coriander per PPB depending upon the cultivars of turmeric (Table 2). When compared the green coriander yield from the PPB with Kadpa, it was 36.47 percent more coriander from the PPB with Waigaon turmeric plants. Thus the income from the sale of green coriander between 45 to 60 days of its sowing varied from Rs. 24.13 to Rs. 32.93 per PPB. This produce was missing from 81 PPBs with only turmeric. However, these PPBs without coriander was hand weeded twice during the crop season, incurring additional cost. Growing short duration crop (green) coriander along with turmeric influenced the yield of latter. The PPBs with only turmeric had higher yield in comparison to those with coriander in most of the cases.

The excellent growth of foliage of turmeric by 15th August covered the entire PPB, therefore only one crop of green coriander was harvested.

The mean yield of turmeric in PPB was maximum (1776.67g) in Mango ginger (*Ama haldi*) followed by Sonali (1345.83g), Kadpa (1332.00g), Ranga (1332g) and Black turmeric (813.33g); while it was minimum (658.66g) in Waigaon. The average income of turmeric per PPB with coriander was maximum (Rs.177.37) in Mango ginger and it was minimum in Waigaon (Rs.65.87). The total income of turmeric with coriander per PPB varied from Rs.98.80 in Waigaon to Rs. 205.33 in Mango ginger (*Ama haldi*).

The mean yield of turmeric per PPB without coriander varied from 810g (Waigaon) to 1674.17g (Mango ginger). The latter was followed by Kadpa (1515.83g), Sonali (1461.67g), Ranga (1238.33g) and Black turmeric (965.19g). The average income per PPB of turmeric without coriander cultivation varied from Rs. 78/- (Waigaon turmeric) to Rs. 164.42/- (Mango ginger) excluding the charges incurred for hand weeding.

Table 2: Details of yield, income and B:C ratio of both systems

Turmeric variety	Turmeric and coriander per PPB						Only Turmeric per PPB		
	Coriander		Turmeric		Total	B:C ratio	Turmeric/PPB		B:C ratio
	Yield (g)	Income (Rs.)	Yield (g)	Income (Rs.)			Yield (g)	Income (Rs.)	
Black turmeric	134.44	26.88	813.33	81.33	108.21	2.20	965.19 (18.67)	93.52* (-14.69)	1.86
Mango ginger	138.33	27.66	1776.67	177.67	205.33	4.17	1674.17 (-5.77)	164.42* (-40.91)	3.23
Kadpa	120.66	24.13	1332.00	133.20	157.33	3.20	1515.83 (13.80)	148.58* (-8.75)	2.92
Waigaon	164.66	32.93	658.66	65.87	98.80	2.01	810.00 (22.98)	78.00* (-20.80)	1.56

Ranga	128.00	25.60	1259.33	125.93	151.53	3.08	1238.33 (-1.67)	125.83* (-25.70)	2.48
Sonali	147.5	29.50	1345.83	134.58	164.08	3.33	1461.67 (8.61)	143.17* (-20.91)	2.82
Figures in the parenthesis are percent difference in the yield and difference in income in Rs. respectively *Rs. 3 is deducted from the each as charges incurred for handweeding per PPB									

Except Mango ginger and Ranga, all the remaining cultivars of turmeric recorded decline in the mean yield varying from 8.61 percent (Sonali) to 22.98 percent (Waigaon) due to cultivation of coriander. In Black turmeric and Kadpa there was 18.67 and 13.80 percent decline in yield respectively. Mango ginger and Ranga recorded an increase in the mean yield of 5.77 percent and 1.67 percent respectively.

However the total income of turmeric with green coriander system per PPB was higher than that of PPB with only turmeric. The decline in the total income due to sole cropping of turmeric varied from Rs. 8.75/- to Rs. 40.91/- per PPB.

4. Discussion

Gill et al. (2008) recommended the cultivation of fenugreek under three year old Poplar. According to Das et al. (2014) intercropping not only increases productivity but also increases the income of farmers. It also generates employment and minimizes losses under changed climatic conditions. They recommended the intercropping of short duration vegetables like green coriander, *Amaranthus* etc with pigeonpea for first 45 days. Singh et al. (2019) also emphasized thorough cropping of *Colocasia* and coriander in Himachal Pradesh. Similarly turmeric, coriander, onion, chilly and pigeonpea intensive cropping generated an additional net benefit of Rs. 9,66,000/- with a B:C ratio of 2.88 (NAIP).

Intercropping is the cropping of more than one crop at the same time in the same field (Bedoussac et al., 2015). At present, intercropping system attracted the farmers of Asia, Africa, and Latin America due to its efficiency in the yield improvement (He et al., 2013). Intercropping system also showed better growth and performance of plants.

5. Conclusions

Small and marginal farmers constitute a major group within the farming community in India. The cash inflow period between sowing and harvest of their major field crop is too wide to meet their household expenses. Intercropping, diversification of short duration cash crops ensures inflow of cash at very short intervals. In this context, especially for cost intensive turmeric cultivation, with long gestation period, the present method of cultivation in PPB with intercropping may prove beneficial without major additional investment.

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