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Economic analysis of turmeric production and its constraints in Karb I Anglong and Dima Hasao district of Assam

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ABSTRACT

Turmeric is one of the important spices crops grown in India and is known as the "land of spices". The study was done using primary data using well structured pre-tested schedule through personal interview method during 2020 from three villages under Lumbajong Development Block of Karbi Anglong district and three villages from Harangajao Development block of Dima Hasao district making a sample of 90 farmers for the study purpose. The total cost incurred was found be increasing with the larger farm size for different farm category. The B:C ratio was found highest in Marginal farm at 1.85 and for overall it was estimated at 1.60 indicating profitability of ginger cultivation in the study area. For marginal farmers, the regression co-efficient showed increasing return to scale while small and medium as well as overall farm showed decreasing returns to scale. The ratio of MVP to MFC was found to be greater than unity in marginal and medium farm for all the inputs used *i.e.* seeds (X_1), FYM (X_2) and Human labour (X_3) whereas for small farmers, human labour (X_3) indicates negative and for overall farm size it was positive but less than one. Pest and diseases was the major problem associated with the turmeric growers in the study area. Study suggested that establishment of nursery for production of diseases free seed rhizome should be encouraged among the farmers through dissemination of technical knowledge, provision of small farm machineries for land development to solve labour shortage and dissemination of extension service at village level to reach the unreached needy farmers.

1. Introduction

India is considered as the major spice producing and exporting country of the world contributing about 20-25% of the world trade in spices. Most of the spices are native of our country hence, India is known as the "land of spices". The present annual production of spices in India is about 5.1 mt from an area of 3.5 mha and still continues to be the largest producer, consumer, and exporter of spices in the world sharing more than 78% and had a virtual dominance in the international spices trade across the globe. Among the major spices grown in the country turmeric occupies a major portion in terms of area and production. Turmeric is the 3rd important commercial spice of India after chilli and garlic and it is named as "Indian saffron". The total production of turmeric in the country was 926.11 thousand metric ton (MT) from an area of 251.39 thousand ha during the year 2020. Telangana state stood at the top in both the area and production with 55 thousand hectares and 307 thousand tons respectively (dasd.gov.in, 2020). The export of turmeric from India during 2019–20 was 1,36,000 MT valued at ₹1216.40 crore as against 1,33,600 MT valued at Rs.1416.16 crore. The major buyer for Indian turmeric was Bangladesh followed by the USA, Iran, Malaysia, Morocco and the UAE (Spice Board, 2020).At present, Assam is the leading

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producer of major spices contributing an area of 119.9 (50.15 %) thousand ha and a production of 291.3 (38.22%) thousand tons followed by Sikkim and Mizoram. Also, Assam has the highest area and production under ginger and turmeric while Nagaland has the highest production in chilli. Turmeric is one of the major spices grown in the state of Assam and is cultivated on more than 16,800 ha in the state with predominant commercial cultivation in Karbi Anglong, Golaghat, Lakhimpur, Nagoan and Sonitpur (Kalita, 2019). The most popular varieties that are commercially cultivated in Assam is Lakadong and Megha Turmeric-1 because of its high curcumin content of 7.5 and 6.8per cent and high demand in the international market. The area and production of turmeric has significantly increases in the state over the years indicating its immense development possibilities. Among the states in North East Region, Assam has the lion share in area under turmeric with 16.87 thousand ha while Mizoram has the highest production accounting for 29.82 thousand MT.

Having stated the potentiality of the crop in these districts, no systematic study pertaining to economics of production aspect has been done so far, hence it is felt necessary to study the cost, return, efficiency of inputs used and its production constraints which would definitely help the growers as well as the policy makers to develop appropriate policy for production of the crop.

2. Methodology

2.1 Data collection

Primary data were collected using well structured pre-tested schedule through personal interview method from the turmeric growers during 2020. Data were collected from three village's *viz.* Saijong, Hidipi and Manja of Lumbajong Development Block of Karbi Anglong and three village's *viz.* Sontilla, Samparidisa and Retzawl from Harangajao Development block of Dima Hasao district. Thus, a sample of 6 villages from the two blocks from two districts was made for the present study. Again, a list of turmeric growers was made from each of the selected villages and 15 numbers of growers were selected randomly making a total of 90 turmeric growers. Again, the farmers were categorized into three group based on their landholding *viz,* marginal (32), small (31) and medium (27) farmers for the study purpose.

3. Analytical Techniques

3.1 Cost and return estimation

For estimation of cost of production, variable cost items and fixed cost items were considered. Variable cost includes land preparation, seeds, FYM, plantation labour cost, FYM application, weeding, harvesting, cleaning and drying, hired labour, interest on variable expenses and other operational expenses etc. and foxed cost family labour, land revenue, rental value of owned land, depreciation and interest on fixed capital. The total cost was estimated by adding up all the expenditure incurred on variable inputs and fixed cost.

Total cost = Total fixed cost + Total variable cost.

The gross return was computed by multiplying the quantity of main product and by product obtained with respective prices received.

Gross Return = (Production X price per unit)

The net return was computed by subtracting the total cost from gross income.

Net Return = Gross income - Total cost

B/C ratio= Gross return÷Total cost

3.2 Estimation of Resource-use efficiency

The Cobb-Douglas production function which gave best fit was selected to establish the input output relationship with returns as dependent variable and inputs *viz*., saplings/ seed, human labour, FYM and irrigation as independent variables for the three crops under study. However, value of irrigation was not considered as one of the independent variables in case of ginger and turmeric due to non use of irrigation for these crops. The regression coefficients of different inputs used in the production function were estimated separately for each category of large cardamom, ginger and turmeric growers. The general form of the function fitted was specified as follows

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4}$$

Where, Y=Gross returns in rupees;

a =Constant;

X_1 =Value of saplings/ seed in rupees

X_2 =Value of human labour in rupees;

X_3 =Value of FYM in rupees;

X_4 =Value of irrigation in rupees: This variable was not considered for ginger and turmeric

b_1 – b_4 =The Regression coefficient of ith independent variable (i=1 to 4).

To estimate resource use efficiency of crops under study, marginal value product of each input was worked out at its geometric mean level. To examine the economic efficiency of resource use, the marginal value of product of each resource was worked out by using following formula:

$$MVP = bi \frac{\overline{Y}}{\overline{X}}$$

Where, bi= Regression co-efficient for ith independent variable

$\overline{Y}$ = Geometric mean of gross return of large cardamom

$\overline{X}$= Geometric mean of ith independent variable

3.3 Production constraints

Percent Position = 100 X (Rij-0.5)÷N_j

Where, R_{ij} = rank given for ith factor by j^{th} individual

N_j = number of factors ranked by j^{th} individual

4. Result And Discussion

4.1 Cost and return of turmeric cultivation

The details of fixed cost under turmeric cultivation are shown in Table 1(a). It was revealed that the expenditure on fixed cost was highest in medium farm size (₹. 10025.78) and lowest in marginal farm indicating that expenditure on fixed cost gets higher with the larger land holdings. Further, of all the fixed cost incurred, the rental value of owned land accounted for higher share in all the different categories of farm with 86.56, 81.96 and 79.79% followed by depreciation ranging from 7.66 to 14.50% per annum. For overall, the fixed cost incurred was ₹ 9655.85 per ha and the rental value of owned land alone accounted for the major share with 82.85 percent with a depreciation of 9.63% per annum. Again, from table1(b) it was revealed that per hectare variable cost of turmeric cultivation was found similar with that of fixed cost as the expenditure on variable cost becomes higher with the larger land holding size. The reason for this may be probably due to increase in the efficiency in the use of resources in marginal farmers along with the economics of scale in production as compared to small and medium farmers.

For overall farm, the variable cost incurred was estimated at ₹ 105104.50 per hectare. Further, it was also observed that of all the farm categories, seeds contributed the highest share ranging from 36.04 to 37.30 percent to the total variable cost of which the marginal farm size was the highest followed by harvesting and FYM. Similarly, for the overall farm, seeds contributed the highest share with 36.76% to the total variable cost followed by harvesting and FYM.

Table 1. Cost of production of turmeric per hectare.

(a) Fixed cost (₹/ha.)

Particulars	Marginal	Small	Medium	Overall
1. Land Revenue	94.00 (1.01)	94.00 (0.96)	94.00 (0.93)	94.00 (0.97)
2. Rental value of owned land/ha	8000 (86.56)	8000 (81.96)	8000 (79.79)	8000 (82.85)
3. Depreciation @10 % per annum	708.00 (7.66)	1201.94 (12.31)	1454.37 (14.50)	1102.05 (11.41)
4. Interest @ 5% per annum	440.12 (4.76)	464.79 (4.76)	477.41 (4.76)	459.80 (4.76)
Total fixed expenses	9242.12 (100)	9760.73 (100)	10025.78 (100)	9655.85 (100)

Note: Figure in parentheses are percentage of the total

(b) Variable/operational cost (Rs/Ha.)

Particulars	Amount (₹)			
	Marginal	Small	Medium	Overall
1. Land preparation	8485.88 (8.23)	8357.65 (8.02)	8446.34 (7.78)	8429.85 (8.02)
2. Seeds	38451.47 (37.30)	38395.36 (36.86)	39125.84 (36.04)	38634.45 (36.76)
3. FYM	8862.15 (8.60)	8784.20 (8.43)	8895.52 (8.19)	8845.31 (8.42)
4. Plantation labour cost	8094.06 (7.85)	8010.21 (7.69)	8065.67 (7.43)	8056.66 (7.67
5. FYM application	7423.25 (7.20)	7445.19 (7.15)	7864.38 (7.24)	7563.14 (7.20)
6. Weeding	8461.37 (8.21)	8510.67 (8.17)	8742.83 (8.05)	8562.78 (8.15)

7. Harvesting	10048.62 (9.75)	10150.83 (9.74)	11650.41 (10.73)	10564.36 (10.05)
8. Cleaning, boiling and drying	4325.46 (4.20)	4533.54 (4.35)	4608.13 (4.24)	4481.93 (4.26)
9. Any other operational expenses	4000.00 (3.88)	5000.00 (4.80)	6000.00 (5.53)	4944.44 (4.70)
10.Interest on working capital @5%	4931.57 (4.78)	4985.23 (4.79)	5169.96 (4.76)	5021.57 (4.78)
Total variable/operational expenses	103083.82 (100)	104172.89 (100)	108569.07 (100)	105104.50 (100)

Note: Figure in parentheses are percentage of the total

4.2 Total cost of turmeric cultivation

Per hectare total cost of turmeric cultivation is shown in the Table 2. It was observed that the total cost increase with the larger farm size and the maximum cost was incurred in medium farm size accounting for ₹ 118594.85 and minimum cost was incurred in marginal farm size with ₹ 112325.94. Of the two costs, the variable costs constituted the lion share ranging from 91.43 to 91.77% whereas contribution of fixed cost ranges from 8.22 to 8.56% for different farm sizes.For overall farm, the variable cost accounted for 91.58 % and fixed cost with 8.41% to the total cost incurred.

4.3 Return on turmeric cultivation

The net returns as well as the gross returns for different farm categories are presented in the Table 3. The net return per hectare from turmeric cultivation was found to be highest in the marginal farm categories accounting to ₹ 207729.18 followed by small farm with ₹ 205198.66 and medium farm with ₹ 201256.99. For the overall category, it was estimated at ₹ 204915.90.

Further, the benefit cost ratio for all the ranges from 1.70 to 1.85 and the highest was obtained in the marginal.farm category with 1.85 and for overall it was accounted to 1.78. Therefore, it can be concluded that of all the farm categories, marginal sized farms was found to be highly efficient as compared to small and medium farm sizes

4.4 Estimated Cobb Douglas production function

The Cobb-Douglas production function was estimated to know the relationship between the resources used and the productivity of turmeric cultivation in the study areas. The gross return in terms of rupees realized from the output was taken as dependent variables while cost incurred on seeds (X_1), FYM (X_2) and human labours (X_3) were taken as independent variables. Table 5 showed that inputs included in the model explained 89, 80 and 86% variation for marginal, small and medium farmers in the turmeric output as revealed by co-efficient of determination (R^2). The summation of regression co-efficient indicates increasing return to scale for marginal farmers as it was greater than unity. However, a decreasing return to scale was observed for small and medium as well as for overall farm size as the value was found to be less than unity which implies that a one percent increase in those inputs would decrease the output by 0.72, 0.63 and 0.89%.

Table 2. Total cost incurred in production of turmeric (Rs/Ha)

Particulars	Marginal	Small	Medium	Overall
Total fixed cost	9242.12 (8.22)	9760.73 (8.56)	10025.78 (8.45)	9655.85 (8.41)
Total variable/operational cost	103083.82 (91.77)	104172.89 (91.43)	108569.07 (91.54)	105104.50 (91.58)
Total cost	112325.94 (100)	113933.61 (100)	118594.85 (100)	114760.40 (100)

Note: Figure in parentheses are percentage of the total

Table 3. Estimation of return for turmeric cultivation (₹/ha)

Particulars	Marginal	Small	Medium	Overall
Selling price (₹./kg)	57.75	57.75	57.75	57.75
Average yield (Kg/ha)	5542.08	5526.10	5538.56	5535.52

Gross Income ₹	320055.12	319132.28	319851.84	319676.30
Net Income	207729.18	205198.66	201256.99	204915.90
B:C ratio	1.85	1.80	1.70	1.78

Table 4. Estimated Cobb-Douglas production function for turmeric among different size group

(₹/ha).

Sl. No.	Particulars	Size group			
		Marginal	Small	Medium	Overall
1	Constant	6.52 *** (1.57)	6.80 ^{NS} (0.92)	6.91 ** (1.00)	6.73 ^{NS} (1.18)
2	Seeds (X_1)	0.52 ^{NS} (0.70)	0.70** (0.24)	0.39 * (0.21)	0.54 *** (0.39)
3	FYM (X_2)	0.50 * (0.43)	0.32 * (0.16)	0.10 ^{NS} (0.11)	0.32 ** (0.24)
4	Human labour (X_3)	0.25 ^{NS} (0.33)	-0.30 ** (0.10)	0.14 * (0.10)	0.03 ^{NS} (0.18)
5	Σ bi	1.27	0.72	0.63	0.89
5	Coefficient of determination (R^2)	0.89	0.80	0.86	0.85
6	No. of observation	32	31	27	90

Note. Figures in parenthesis are standard errors of regression coefficients

*** Significant at 1% level of significance

** Significant at 5% level of significance

* Significant at 10% level of significance

NS –Non Significant

4.5 Resource use efficiency of turmeric production

To evaluate the economic efficiency of resource used, the marginal factor productivity (MVP) for the explanatory variables were worked out and compared with the marginal factor cost (MFC) which was assumed to constant *i.e.,* one unit for each input. From the Table 5, it was revealed that in marginal farm size the ratio of MVP to MFC was found to be greater than unity for all the resources i.e. seeds (X_1), FYM (X_2) and Human labour (X_3) which implies that used of these inputs were confined at sub optimal level and existence for possibility of enhancing the yield of turmeric by increasing the respective inputs from the existing level.

In case of small farm, seeds (X_1) and FYM (X_2) were found to be greater than one while human labour (X_3) indicates negative which implies excessive use of labour in turmeric cultivation. The findings are in line with those of Naik and Hosamani, 2017 where human labour indicates negative value. This means that additional unit of labour used would decrease the output rather than increasing it which is the reason for diminishing marginal productivity of labour. In medium farm size, the ratio of MVP to MFC for all the inputs used is greater than one which implies that increase usage of seeds (X_1), FYM (X_2) and human labour (X_3) would increase the gross return from turmeric production. Similarly for overall farm, the value of seeds (X_1) and FYM (X_2) were found to be greater than unity; indicating under-utilization of these inputs. However, the value of human labour (X_3) showed positive but less than one which means over-utilization of human labour in turmeric production in the study area.

4.6 Constraints faced by the producers

As presented in Table 6, pest and diseases was the major problem associated with the turmeric growers in the study area and the least with the lack of technical know-how of the farmers. Incidence of pest and diseases is prominent during the post monsoon season. Most of the farmers used previous year harvested rhizome for sowing in the next season that are prone to infestation of pest and diseases. Also, used of modern inputs like fertilizer, pesticides, herbicides etc. are very minimal in the study area.

Table 5. Resource use efficiency of turmeric among different size group (₹./ha)

Farm Inputs	Marginal			
	Prodn Elasticities	MVP	MFC (₹.)	MVP/MFC (r)
Seeds (X_1)	0.52	19.28	1	19.28
FYM (X_2)	0.50	66.91	1	66.91
Human Labour (X_3)	0.25	7.39	1	7.39
	Small			
Seeds (X_1)	0.70	22.22	1	22.22
FYM (X_2)	0.33	39.95	1	39.95
Human Labour (X_3)	-0.30	-7.87	1	-7.87
	Medium			
Seeds (X_1)	0.39	6.15	1	6.15
FYM (X_2)	0.10	6.36	1	6.36
Human Labour (X_3)	0.15	1.51	1	1.51
	Overall			
Planting materials(X_1)	0.54	16.35	1	16.35
FYM (X_2)	0.32	39.45	1	39.45
Human Labour (X_3)	0.03	0.36	1	0.36

Table 6. Production problem of turmeric in the study area

Sl. No.	Constraints	Percent position	Rank
1	Labour shortage	53.89	III
2	High cost of cultivation	58.70	II
3	Pest & Diseases	61.66	I
4	Non availability of quality planting materials and other inputs	43.02	V
5	Lack of govt. intervention	46.68	IV
6	Lack of technical know how	24.53	VI

Even though, many high yielding varieties have been identified and recommended by the researchers in the region but large scale production of good quality seeds is lacking because of the absence of agencies responsible for its production. On the other hand, majority of the farmers are engaged with the traditional method of cultivation practices and due to the lack of improved scientific cultivation practices hinders the production of turmeric. Furthermore, various initiatives have been taken up to enhance the productivity of turmeric in the region however, basic infrastructure such as transport and communication, power and electricity, capital overheads credit and financial institution are totally lacking and also due to the remoteness of the area, monitoring of extension personals for technological interventions like rhizome treatment, soil application of bio-control agents, manure, fertilizer, mulching and appropriate plant protection measures is almost negligible in the study area.

5. Conclusion

Based on the findings of the study conducted on the economic analysis of turmeric production in Karbi Anglong and Dima Hasao district of Assam, it can be concluded that cultivation of turmeric was found productive and profitable in the study area with benefit cost ratio ranging from 1.70 to 1.85 in all the farm sizes. Among the variable cost incurred, cost of seeds was the major cost item ranging from 36.04 to 37.30%to the total variable cost for all the farm sizes. For marginal farmers, the regression co-efficient showed increasing return to scale but for small and medium as well as for overall farm size a decreasing return to scale was observed. For marginal farm size, the ratio of MVP to MFC was found to be greater than unity for all the resources i.e. seeds (X_1), FYM (X_2) and Human labour (X_3). For small farm, seeds (X_1) and FYM (X_2) were found to be greater than one while human labour (X_3) indicates negative. In medium farm size, the ratio of MVP to MFC for all the inputs used is

greater than one. And for overall the seeds (X_1) and FYM (X_2) were found to be greater than unity but human labour (X_3) showed positive but less than one. Pest and diseases was the major problem associated with the turmeric growers in the study area. Study suggested that availability of disease free quality planting materials is pre-requisite for enhancing the production. Establishment of nursery for production of diseases free seed rhizome should be encouraged among the farmers through dissemination of technical knowledge, provision of small farm machineries for land development to solve labour shortage and dissemination of extension service at village level to reach the unreached needy farmers.

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