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ASSESSING THE COST AND RETURNS OF TURMERIC CULTIVATION IN SURGUJA DISTRICT, CHHATTISGARH STATE

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ABSTRACT
Turmeric is one of the most important commercial spice crops in India and is extremely important to rural incomes and livelihoods. This paper studies the economics of turmeric cultivation in the Surguja district of Chhattisgarh, which is one of the state's important turmeric producing districts. A survey and personal interviews were the primary data collection methods used. Data were analyzed using standard cost concepts and farm business analysis. The average cultivation cost was found to be ₹203,509.74 per hectare, and the average net income was ₹510,949.39. The cost of production was estimated to be ₹866.00 per quintal, and the input–output ratio was 1:3.51, which shows turmeric cultivation is a highly successful venture in the area. The results show that the supply of quality turmeric rhizomes at a reasonable cost, better farm mechanization, and better market access and value addition can further improve profitability. Better production and marketing methods and the education of farmers are also factors that improve profitability. From the results of the study, it is proposed that the government improves marketing infrastructure, provides financial aid, and offers better extension services in order to improve the competitive nature and sustainability of turmeric cultivation in the study area.

KEYWORDS: Turmeric Cultivation, Cost and Return, Farm Profitability, Input-Output Ratio, Agricultural Economics, Chhattisgarh.

INTRODUCTION

India is popularly known as the "Spice Bowl of the World" as premium quality spices are grown in the country since ancient times. Turmeric (Curcuma longa), an ancient and sacred spice of India known as 'Indian saffron', is an important commercial crop grown in India Viraj *et al.* (2018); Growing spices for various purposes has been famous since ancient times. There are records about various spices and their properties in the Vedas as early as 6000 BC Angles and Hosamani, (2005); Turmeric (Curcuma longa L.) is native of India and China. It is the dried underground rhizome belonging to the family 'Zingiberaceae'. The word "turmeric" is derived from the French word 'Terre-merite', meaning merit of the earth. The genus name "Curcuma" is probably derived from the Persian word 'kurkum', a name also applied to saffron Dhok et al. (2020); Turmeric is one among the blood thinner foods, which have antiplatelet, anticoagulant, and fibrinolytic properties Chinnadurai *et al.* (2019); Turmeric is a spice used widely and commonly by people all over India. It is one of India's most ancient and traditional export commodities Choudhury and Kalita (2018); Turmeric (Curcuma longa L.), one of the first crops to be domesticated, has been farmed in India and China for thousands of years. Many claim that turmeric, the primary spice in Indian cuisine curry, is the most potent herb on earth for preventing and maybe curing disease Ram *et. al.* (2023); Indian turmeric is considered the best in the world market due to its high curcumin content. India accounts for approximately 80 percent of world turmeric production and 60 percent of world exports Kumar *et. al.* (2018);

The use of organic manure and organic amendments in turmeric cultivation plays a vital role in improving the quality of turmeric as well as enhancing soil health. Turmeric is closely related to human diets, and hence, the demand for organically grown turmeric is increasing tremendously worldwide Fernando and Ekanayake (2022); Turmeric has been known in India since ancient times. It is used in vegetable preparation and consumed in daily diets. Additionally, it is useful in preparing dyes, drugs, and cosmetics. Turmeric holds unique importance in performing pooja and many religious and marriage ceremonies in Indian culture Patil et. al. (2009); During the Vedic period, turmeric was referred to as the "earthy herb of the Sun," with its orange-yellow rhizome regarded as the "sacred spice." Turmeric is valued for its deep yellow colour (0.2-8% curcumin), pungency (2.2-4.2% termerol), and aromatic flavor of volatile oil (1.5-5%) Mirjanaik and Vishwanath (2020); Turmeric contains more than 300 naturally occurring components, including beta-carotene, ascorbic acid, calcium, flavonoids, fiber, iron, niacin, potassium, zinc, and other nutrients, but the chemical having high health benefit in turmeric is curcumin. Pseudo stems of turmeric are used as a colouring and flavouring agent Chhetri *et. al.* (2020).

The plant is propagated from rhizomes. The rhizomes are generally planted in May-June and are ready for harvesting in about 8 to 10 months after planting. It is used in diversified forms as a condiment, flavouring, and colouring agent.

Curcuma is now gaining importance all over the world as a mighty cure to combat a variety of ailments, as the genus carries molecules credited with anti-inflammatory, hypocholesterolemic, choleric, antimicrobial, antirheumatic, anti-fibrotic, anti-venomous, antiviral, antidiabetic, antihepatotoxic, and anticancerous properties as well as insect repellent activity. Sahoo and Sarangi (2018); some farmers continue to rely on traditional methods; however, turmeric is typically grown in uplands, hill slopes, and even hilltops where shifting cultivation (PODU) is practiced Sahoo *et al*. (2023). Turmeric (Curcuma longa L.) is a popular spice in many countries of Asia. It is now important in medical science because the curcumin and volatile oils of turmeric rhizomes have anti-inflammatory, antimutagenic, anticancer, antibacterial, antioxidant, antifungal, antiparasitic, and detoxifying properties. Hossain and Ishimine (2005); Turmeric, as a dried rhizome of an herbaceous plant, is closely related to ginger. It is part of Indian culture, being an important ingredient in curry dishes, used in many religious observances, as a cosmetic, a dye, and it enters into the composition of many traditional remedies. Singh *et. al.* (2020); The multifaceted utility of turmeric as a food spice, medicinal herb, and income generator is indeed a significant driving force behind its production. Despite its immense potential, turmeric has sometimes been overlooked in discussions about addressing global nutritional challenges. Uchechukwu (2020)
India's dominance in the production and export of value-added turmeric products is indeed significant, with other countries like Thailand, Southeast Asian nations, Central and Latin America, and Taiwan also contributing to the global market. The UAE stands out as the largest importer of turmeric from India, followed by the USA. Other key importers include Bangladesh, Japan, Sri Lanka, the UK, Malaysia, South Africa, the Netherlands, and Saudi Arabia. This distribution of trade highlights the widespread demand for turmeric across various regions for its culinary and medicinal uses. Directorate of arecanut and spices development Ministry of agriculture and Farmer welfare Government of India, Calicut (2017);

MATERIALS AND METHODS

Source of Data

The data for the present study on the cost and returns of turmeric cultivation in Surguja District, Chhattisgarh, are drawn from different sources to make the analysis complete and dependable. The main sources of data are: Surveys: A well-designed survey was conducted among the local turmeric-growing farmers to obtain primary information on different cultivation practices. It was related to the yield, cost of inputs, labourers, and market prices. The qualitative dimension was expanded upon by conducting interviews with farmers, agricultural experts, and local market traders to supplement and verify the hard, quantitative data collected through the surveys. Various reports on agriculture, research papers, and government and non-governmental publications were the sources of relevant data regarding turmeric cultivation and market trends. Analysis of Data: The data collected was analysed to work out the cost of cultivation per hectare, net returns, and profitability under various cost concepts (A1, A2, B1, B2, A2+FL, C1, C2 and C3). Market Prices: The price amount prevailing in specific markets of turmeric on the day of data collection was elicited from market records and agricultural market committees as a means to rest status in earnings for the turmeric growers.

Cost Analysis

Estimation of the cost and returns of the turmeric crop was done by adopting the standard method of cost concept of the Commission for Agricultural Costs and Prices (CACP). To make the economic analysis complete and sound, the appraisal was based on the following the cost concepts:

1. Cost A1 – All expenses paid out by the farmer and/or the wages in Kind to the agricultural labour for the services actually rendered during the specified reference period, including the value of the hired human labour and bullock labour actually utilized for the various operations in the field.

- The hired and owned machinery value
- Seeds value, where the seeds could be farm-produced or purchased
- Value of bought substances like insecticides and pesticides
- The value of manure, whether it is owned or bought
- Depreciation of farm implements and farm buildings
- Interest on working capital
- Miscellaneous expenses that arise notably charges for irrigation

1. Cost A2, which equals cost A1 with the addition of rent paid on leased-in land
2. Cost B1 equals cost A2 with the addition of interest on the.
3. Cost B2: Cost B1 + imputed rental value of owned land (net of land revenue) + rent paid for leased-in land.
4. Cost C1: Cost B1 + imputed wage of family labour
5. Cost C2: Cost B2 + imputed wage of family labour
6. Cost C3: Modified**—It equals to Cost C2 + 10% of Cost C2 for

Cost concepts form the basis for estimation of the different economic magnitudes: ascertaining the profitability or otherwise of turmeric cultivation. The CACP thus presents an all-encompassing view of the costs connected with farming, accounting for imputed cost items like family labour and owned resources, besides actual expenses. This exercise helps to evaluate the economic feasibility of diversified farming practices and to transact a fair and remunerative price to the farmers.

Gross Returns

The gross turmeric returns can be calculated as follows:
Gross Returns=Yield per hectare × Market Price
Were
Yield per hectare= Amount of the harvestable yield of turmeric from one hectare of land.
Market Price per quintal= The price of turmeric at which it is sold for the quintal (100 kg).

Gross returns are calculated to make a farmer understand the total income derived from turmeric cultivation. This information forms the vision for farmers to estimate the profitability of the crop and decide on how the cost repercussion on input application and marketing strategies will be overcome. Such gross returns, besides the total cost of cultivation, serve as the input for estimating net returns, thereby indirectly helping arrive at the overall economic viability of cultivating turmeric.

Net returns

Net returns for turmeric account for profitability after deduction of all costs of production from the gross returns. The following equation would represent the net returns:

Net Returns = Gross Returns − Total Cost of Cultivation

Where:

Gross Returns: This is total revenue earned on account of turmeric cultivation and is calculated as

Total Cost of Cultivation: The sum total of all costs incurred in producing turmeric. It includes inputs, labour, machinery, land rent, etc.

Net returns convey a concrete idea to farmers about the allowable profitability after recovering all matters of costs involved in production. Turmeric net returns help to evaluate the financial success of this farming activity and decide on the future planning of the crop, investments in inputs, and pricing strategies. Higher net returns indicate better profitability and economic sustainability of turmeric farming practice.

RESULT AND DISCUSSION

Cost of cultivation of turmeric at different farm size

The cost of cultivation of turmeric: The cost of cultivation of turmeric is provided here in tables 1 and Fig. 1. From the stated table for the cost of cultivation of turmeric (Rs. /Ha.), the results are as under: -Variable Costs: i. Human Labour: The total cost of human labor to accomplish all activities varied significantly and was as low as Rs. 44,443.32 and as high as Rs. 49,008.65 per hectare. Family labour: Family labour cost was very significant as a share of total cost, ranging from 22.00% to 24.%. The power cost for bullock and machinery power cost ranged from Rs. 7,754.09 to Rs. 10,253.82 per hectare, accounting for 3.85% to 5.21% of the total expenditure. Seed (Rhizome): Seed cost was highest, proportionately costing from 51.45% to 55.88% in average costing Rs. 107,961.74 per hectare. Manure & Fertilizers, Plant Protection, Irrigation, and Miscellaneous Costs. Individually, these costs were minimum, but taken together, it was a big amount. Manure & fertilizers, plant protection, irrigation, and miscellaneous costs contributed 2.90% to 2.94%, 0.48to 0.80% and 0.11 to 0.34, respectively, to the total cost. Land Revenue - Depreciation - Interest on fixed capital - Rental value of owned land: The fixed costs were more or less stable among the different farm sizes where rental value of owned land was the highest with more or less approximate 9.80% to 9.93% of the total cost. The general cost of cultivation of turmeric per hectare ranged from Rs 201,311.76 to Rs 204,084.61, respectively with overall value of Rs 203,509.74. The primary source of variation in the total cost across the farm sizes was differences in labour, machinery, and seed costs. Major contributors to the total cost were the human labour, especially the family workers, and the cost of seed (rhizome). That variation, in essence, measures the impact of farm size and its operational scale in the economic estimation of turmeric production in Uganda. Familiarity with these cost structures is of prime importance to the farmers and the policy maker in designing multipliers optimizing production practices and price management of inputs, thereby increasing profitability in nurturing turmeric. The analysis provides insight into the economic dimension of turmeric farming, stuffed with major cost drivers and their implications on managing the farm and policy decisions.

Table No.: 1 Input-wise cost of cultivation of Turmeric (Rs. /Ha.)

S. No.	Particular	Marginal	Small	Medium	Large	Overall
A	Variable cost					
1	Human labour					
	a) Family labour	31592.24	26041.66	17804.92	7757.67	18415.64
		(15.69)	(12.80)	(8.73)	(3.80)	(10.26)
	b) Hired labour	12851.08	20430.42	28963.11	41250.98	28702.57
		(6.38)	(10.04)	(14.20)	(20.21)	(12.71)
	Total human labour	44443.32	46472.09	46768.03	49008.65	47118.21
		(22.08)	(22.8)	(22.94)	(24.01)	(22.97)
2	Bullock and machinery power					
	a) Bullock	3401.70	1755.50	1872.72	1073.96	1777.96
		(1.69)	(0.86)	(0.92)	(0.53)	(1.00)
	b) Machinery	4352.39	7281.84	8741.28	9179.86	7963.83
		(2.16)	(3.58)	(4.29)	(4.50)	(3.63)
	Total Bullock and machinery	7754.09	9037.34	10613.99	10253.82	9741.79
		(3.85)	(4.44)	(5.21)	(5.02)	(4.63)
3	Seed (Rhizome)	112500	110000	107500	105000	107961.74

		(55.88)	(54.08)	(52.72)	(51.45)	(53.53)
4	Manure & Fertilizers	5921.68	5921.77	5921.68	5921.68	5921.70
		(2.94)	(2.91)	(2.90)	(2.90)	(2.91)
5	Plant protection	1741.82	1895.58	1999.70	2029.14	1950.50
		(0.87)	(0.93)	(0.98)	(0.99)	(0.94)
6	Irrigation Charges	956.56	1277.52	1488.87	1639.65	1416.92
		(0.48)	(0.63)	(0.73)	(0.80)	(0.66)
7	Miscellaneous cost	218.00	273.00	524.00	687.00	473.98
		(0.11)	(0.13)	(0.26)	(0.34)	(0.21)
8	Interest on working capital	5677.73	5953.43	6280.45	6671.29	6246.77
		(2.82)	(2.93)	(3.08)	(3.27)	(3.02)
	Total Variable Cost	179213.20	180830.73	181096.72	181211.24	180831.55
		(89.02)	(88.90)	(88.82)	(88.79)	(88.88)
B	Fixed capital					
9	Land revenue	12.00	12.00	12.00	12.00	12.00
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
10	Depreciation	652.86	1092.28	1311.19	1376.98	1194.58
		(0.32)	(0.54)	(0.64)	(0.67)	(0.54)
11	Interest on fixed capital	1445.70	1476.46	1491.78	1496.39	1483.62
		(0.72)	(0.73)	(0.73)	(0.73)	(0.73)
12	Rental value of owned land	20000.00	20000.00	20000.00	20000.00	20000.00
		(9.93)	(9.83)	(9.81)	(9.80)	(9.84)
	Total Fixed Cost	22098.56	22568.74	22802.97	22873.37	22678.20
		(10.98)	(11.10)	(11.18)	(11.21)	(11.12)
C	Total Cost (A+B)	201311.76	203399.47	203899.69	204084.61	203509.74

Note: Figures in the parenthesis indicate the percentages to the total cost.

Cost and Return on Cost Concept

Based on Table No. 2, and Fig No. 2, which provides a break up of total costs and income over different cost scenarios for Turmeric cultivation (Rs. /Hectare) Cost A1 and Cost A2 (Rs. 163610.48, and Rs.163610.48): These Costs are uniform under all the sizes of farm, whether marginal, small, medium, large, or in aggregate meaning there is no difference under these specific heads of costs. Cost B1 and Cost B2: Cost B1 Rs.165094.10 is marginally higher

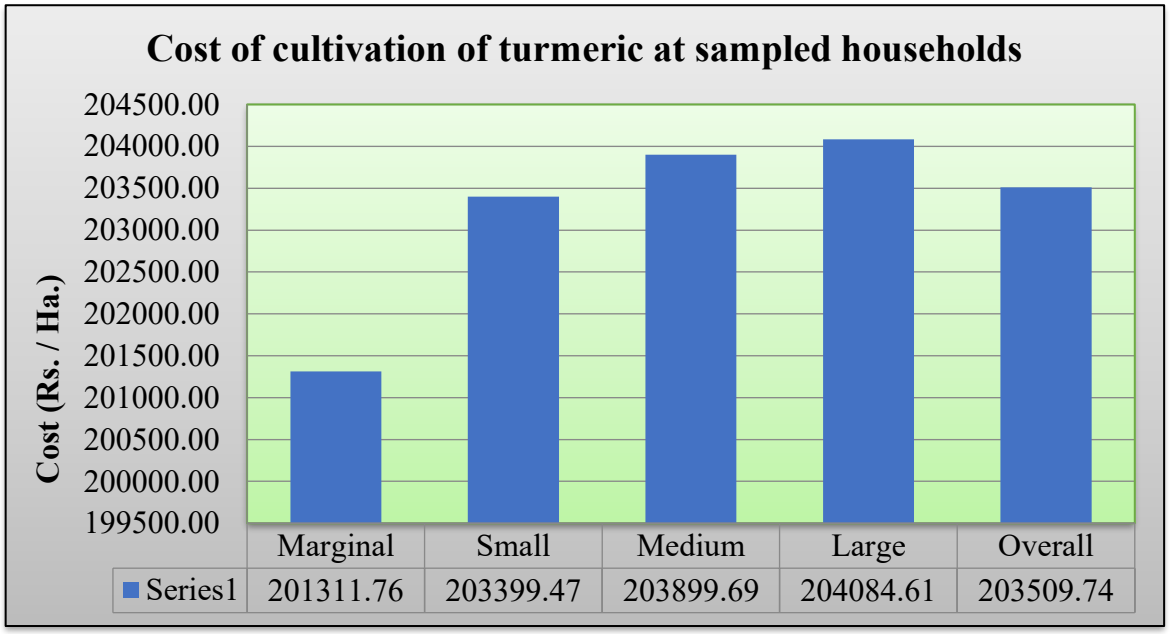

Fig. 1 Cost of cultivation of turmeric at sampled households (Rs. / Ha.)

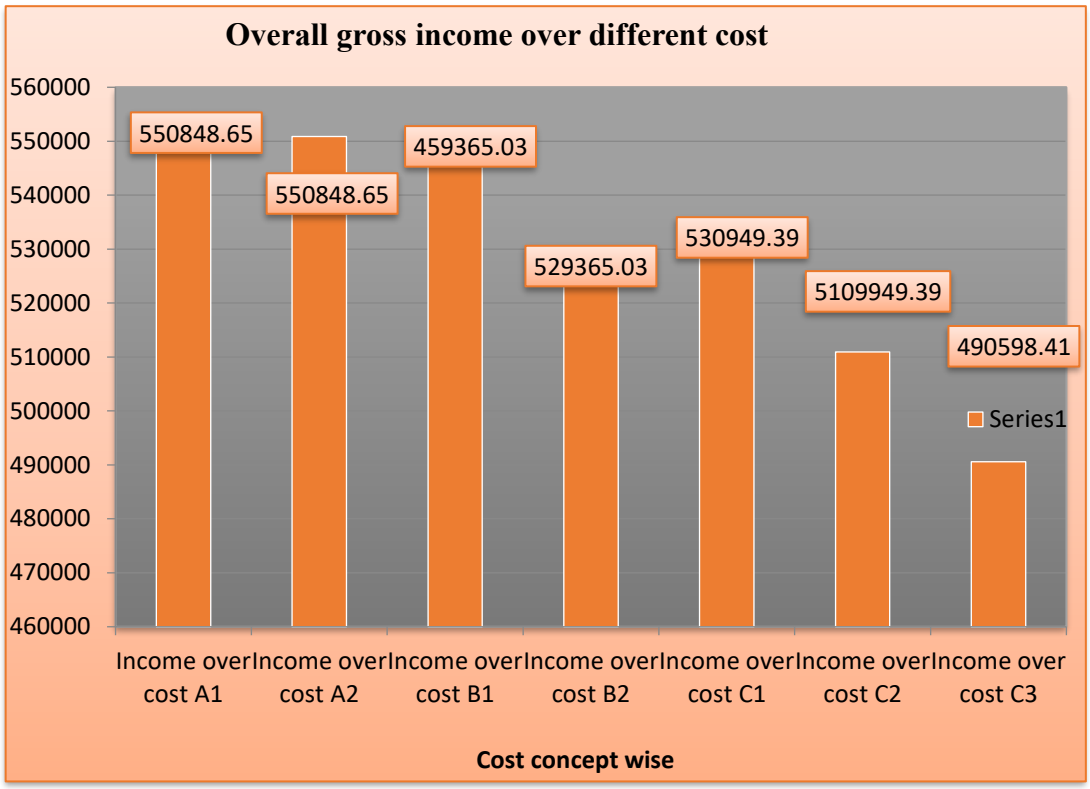

Fig. 2 Income over different cost of turmeric (Rs. /ha)

Compared to Cost A1, while Cost B2, Rs.185094.10, is generally higher in all farm sizes, indicating some more expenditure or may be a different way of looking at the cost structure. A2+FL Rs.182026.12 It looks like this category combines Cost A2 and some component of "FL" (Fixed Labor) or 'Fixed Costs' a nd has relatively constant values throughout the farm-size classes. Cost C1, Cost C2, Cost C3: (Rs.183509.74 to Rs.223860.71) These costs increase progressively from C1 to C3, representing disparity or different categories of total costs incurred in turmeric production. That C3 estimates the highest and C1 the lowest, for all categories of farm sizes, shows a general trend.

Table No.: 2 Break-up of total cost, cost concept wise income over different cost of turmeric (Rs. /hectare)

S. No.	Particular	Marginal	Small	Medium	Large	Overall
A.	**Break-up of cost**					
1	Cost A1	148273.82	155881.34	164602.99	174830.55	163610.48
2	Cost A2	148273.82	155881.34	164602.99	174830.55	163610.48
3	Cost B1	149719.52	157357.80	166094.77	176326.93	165094.10
4	Cost B2	169719.52	177357.80	186094.77	196326.93	185094.10
5	A2+FL	179866.06	181923.01	182407.91	182588.22	182026.12
6	Cost C1	181311.76	183399.47	183899.69	184084.61	183509.74
7	Cost C2	201311.76	203399.47	203899.69	204084.61	203509.74
8	Cost C3	221442.93	223739.41	224289.66	224493.07	223860.71
B	**Gross income over different cost**					
1	Income over cost A1	511726.18	534118.66	555397.01	575169.45	550848.65
2	Income over cost A2	511726.18	534118.66	555397.01	575169.45	550848.65
3	Income over cost B1	510280.48	532642.20	553905.23	573673.07	549365.03
4	Income over cost B2	490280.48	512642.20	533905.23	553673.07	529365.03

5	Income over cost C1	478688.24	506600.53	536100.31	565915.39	530949.39
6	Income over cost C2	458688.24	486600.53	516100.31	545915.39	510949.39
7	Income over cost C3	438557.07	466260.59	495710.34	525506.93	490598.42

(Figures in the parenthesis indicate the cost concept-wise total cost)

Net Income over Various Costs - Income over Cost A1 and Cost A2: I Rs.550848.65. and Rs.550848.65 Income is over both the costs for all the size classes of the farm, which reveals the fact that the level of profit from these two costs is profitable. Income over Cost B1 and Cost B2: Rs. 549365.03 and Rs. 529365.03. Income remains positive, but it varies as compared to A1 and A2 scenarios; this means that it will lead to different levels of profitability or scenarios when costs like B1 and when costs like B2 are put into the equation. Profit over Cost C1, Cost C2, Cost C3: (, Rs. 530949.39, Rs. 510949.39 and Rs. 490598.42) From the above results, it is rational that the income decreases and shows the challenges that may exist in profitability at higher cost level. Scenario C3 is rated the least in both income relations with cost across the board.

Turmeric yield and benefit in the farm under consideration

Yield and Benefit data of turmeric cultivation on sample farms is presented in table and fig 3 it reveals that the marginal farms produce 220 quintals per hectare; large farms produce 250 quintals per hectare. Overall yield is 235 quintals per hectare. The price per quintal of turmeric is the same for all farm sizes, i.e. Rs.3,000 per quintal.

Table No.: 3 Yield and benefit of turmeric at sample farm (Rs/hac.)

S. No.	Particulars	Marginal	Small	Medium	Large	Overall
1	Main yield (qt /ha.)	220.00	230.00	240.00	250.00	235.00
2	Price/qt.	3000.00	3000.00	3000.00	3000.00	3000.00
3	Gross Return (Rs. /Ha.)	660000.00	690000.00	720000.00	750000.00	714459.13
4	Cost of cultivation (Rs. /Ha.)	201311.76	203399.47	203899.69	204084.61	203509.74
5	Net Return (Rs. /Ha.)	458688.24	486600.53	516100.31	545915.39	510949.39
6	Cost of production (Rs/qt.)	915.05	884.35	849.58	816.34	866.00
	Input - output ratio	1:3.28	1:3.39	1:3.53	1:3.67	1:3.51

(figures in parenthesis indicate to input- output ratio)

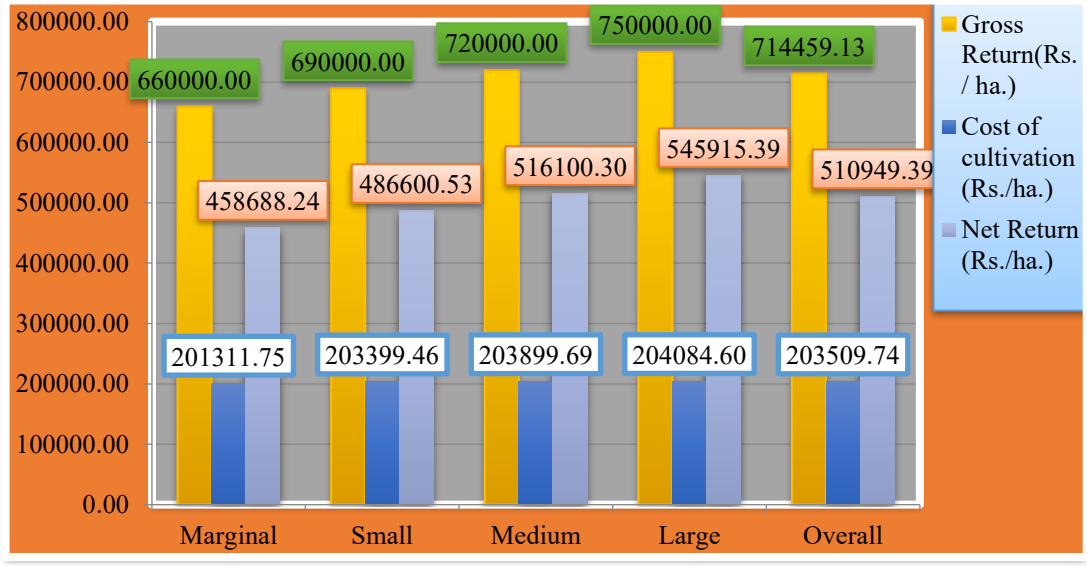

Fig. 3 Economics value of turmeric at deferent sample farms (Rs/ha.)

Gross returns increase as the in-farm size increases, ranging from Rs. 660,000 for marginal farms to Rs. 750,000 for large farms; it is Rs. 714,459.13 for the average. The cost of cultivation is almost the same in all the categories of farms: Rs.

201,311.76 per hectare of marginal farms, and Rs. 204,084.61 per hectare of large farms. The average cost is Rs. 203,509.74 per hectare. Again, the net returns vary with the farm size and are from Rs. 458,688.24 for marginal to Rs. 545,915.39 for large farms. The average net return of overall comes out to be Rs. 510,949.39 per Hectare. On marginal to large farms, the cost of production per quintal decreases with an increase in size of farm Rs. 915.05-816.34. The overall cost of production to be Rs. 866.00/quintal. The input-output ratio is increases as the farm size increase. The input output Ratio for marginal, small, medium and large size farm were 1:3.26, 1:3.39, 1:3.53 and 1:1:3.67 respectively.

SUMMARY AND CONCLUSION

India dominated the international market of turmeric. So, the present study adopted a turmeric-economy emphasis. The total numbers of households are 150, which are marginal, small, medium, and large farmers, respectively. The cost for turmeric rhizomes was high. High-quality turmeric rhizome at an affordable rate will increase the use by farmers and subsequently increase the profitability. It, therefore, becomes important to understand these cost-income relationships among farmers and policymakers to increase profitability and sustainability in the cultivation of turmeric and to provide the economic feasibility at different cost scenarios. Overall, turmeric has been profitable at all levels of price, and larger farms enjoy more benefits due to scale effects. The increased yield, lowering of the cost per quintal, and hence, higher returns in net reveal the importance of scale and cost management in the profitability of agriculture. The turmeric farmers were more educated, and education of farmers played a critical role in adopting the turmeric cultivation to enhance the returns through value addition and increase their profit. In the study area, farmers were many times facing a condition of price that was less; it was noticed that the produce was sold at less than MSP. That, the government should improve the new marketing facilities and policies of turmeric crops. The non-availability of labour was the most burning problem faced by the farmers while cultivating turmeric. Therefore, the introduction of labour-saving machineries in the study area represents an increase in the area under cultivation with respect to turmeric. So, financial assistances to the producers not only help increase their productivity but also prepare a way to come out of the clutches of the middlemen.

Statements and Declarations

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Competing Interests

The authors declare that they have no competing interests.

Consent for Publication

All aouthos have read and approve the final manuscript for the publication.

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