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Economic viability of sugarcane cultivation under different farm sizes in Surajpur district of Chhattisgarh

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Abstract

The current study was carried out from 2024-2025 in Surajpur district of Chhattisgarh to analyze the cultivation cost and farm profitability in sugarcane. The state comprises 33 districts, among which Surajpur ranks second in sugarcane cultivation area and production. Owing to this, Surajpur district was chosen, and within it, Pratapur and Surajpur blocks were selected for the study due to their largest area under sugarcane cultivation. A total of 150 farmers were randomly chosen from the two blocks, with a minimum of 15 respondents from each of the four farm size categories: marginal (0-1 ha), small (up to 2 ha), medium (2-4 ha), and large (above 4 ha) The average size of farm among the surveyed households was 3.65 hectares, with a literacy rate of 70.53%. The cropping intensity was recorded at 172.16% and the average irrigated area per household was 3.91 hectares, with tube wells predominant covering 95.90% of the irrigated area. The total cost of sugarcane cultivation was estimated to be ₹1,30,010.90 Per hectare, with a production cost of ₹1555.11 Per quintal. Average yield recorded on sample farms was 83.60 tons per hectare and input-output ratio, based on total cost, stood at 1:2.80. From the total sugarcane produced, 68.06% was sold to sugar factories, while the remaining 8.46% was used for seed and domestic consumption. Promote drip irrigation and water saving practices enhanced stakeholder coordination to sustainably boost sugarcane production and improve farmers' livelihoods.

Keywords: Cultivation cost, sugarcane, farm profitability, Surajpur district

Introduction

Sugarcane is a significant commercial crop worldwide, with its cultivation in India tracing back to the Pre-Vedic era (around 2000 B.C.). India is considered one of the original centers of sugarcane domestication. The crop is cultivated under both tropical and sub-tropical climates, and India is unique in growing sugarcane in both these climatic zones. Botanically known as *Saccharum spp. hybrid complex*, sugarcane holds a crucial position in India's agricultural and industrial economy.

Currently, sugarcane is cultivated in about 115 countries for sugar production, contributing approximately 180 million tonnes — about three-fourths of the global sugar output, which stands at 240 million tonnes. The rest is derived from sugar beet. Countries like Brazil, India, Thailand, and Mexico are among the top producers, with nearly 78% of global sugar made from sugarcane, especially in tropical and sub-tropical regions of the southern hemisphere. (Singh. 2024)

The State Government of Chhattisgarh requires approximately 57,500 metric tonnes of sugar annually to supply ration card holders through the Public Distribution System (PDS). In the year 2023-24, the total sugar output from the state's three major sugar mills located in Kawardha, Surajpur, and Balod amounted to approximately 70,500 metric tonnes. Chhattisgarh the state, which has been known as "rice bowl" of the country in the country's agriculture map, is now set to create a niche for itself in the sugar production. The state government requires 57,500 metric tonnes of sugar per annum for distribution to the ration card holders through the public distribution system. The sugar production in all the four factories (Kawardha, Balod, Pandariya and Surajpur) in the state had reached 1,750,000 (2020-21) tonnes.

Objective

To Find Out the Cost and Returns of Sugarcane in Surajpur District of Chhattisgarh.

Material and methods

The Chhattisgarh state comprises 33 districts, in which Surajpur District which belong to northern hill agro-climatic sub zone, ranks second in terms of both sugarcane cultivation area and production. Hence, it was selected as the study area. Among the six blocks of Surajpur district, Pratapur and Surajpur blocks were selected for the study based on their highest area under sugarcane cultivation. A total of 150 farmers were randomly chosen from the two blocks, with a minimum of 15 respondents from each of the four farm size categories: marginal (0-1 ha), small (up to 2 ha), medium (2-4 ha), and large (above 4 ha)

Data Analysis

Costs and return of sugarcane cultivation

The cost and return of sugarcane cultivation were calculated on a per-hectare basis (₹/ha), considering input, labour, and power expenses. Owned resources and family labour were valued using imputed prices based on prevailing market rates in the study area. The statistical tools employed to estimate the cost of cultivation included averages, percentages, and the standard cost of cultivation method.

Net income

Net income is calculated as the difference between the gross income and the total cost incurred.

Thus,

Net Income = Gross Income - Total Expense

Input-output ratio

The input-output ratio represents the relationship between the total output obtained and the total input used.
It is calculated as:

$$Input - Output\ Ratio = \frac{Total\ Output}{Total\ Input}$$

Cost of production per quintal/cost concept

The cost of production per quintal refers to the total expenditure incurred in cultivating sugarcane, divided by the total quantity of sugarcane produced. It helps assess the efficiency and profitability of production.

$$Cost\ of\ Production\ per\ Quintal = \frac{Total\ Cost\ of\ Cultivation\ (₹/ha))}{Total\ Yield\ (quintals/ha)}$$

Results and Discussion

Demographic Characteristics of Sample Households

Table 1 presents the demographic profile of the sample households. The average household size was observed to be 5.7 members. A significant proportion of the respondents (approximately 62%) belonging to the Scheduled Tribe (ST). Age-wise distribution revealed that most respondents (36.36%) fell within the 46-60 years age bracket, suggesting a relatively young and potentially economically active farming population. Furthermore, the educational level within the sample households was relatively high, with an overall literacy rate of approximately 70.53%. This indicates a considerable level of educational awareness among rural farming communities in the region.

Table 1: Demographic characteristics of sample households

S. No.	Particulars	Marginal	Small	Medium	Large	Total
1.	No. of sample households	40 (100.00)	39 (100.00)	49 (100.00)	22 (100.00)	150 (100.00)
2.	No. of family members					
	Male	34 (85)	22 (56.41)	30 (61.22)	16 (72.72)	102 (68)
	Female	6 (15)	17 (43.58)	19 (38.77)	6 (27.27)	48 (32)
	Avg. family size	5.4	4.5	5.6	8.8	5.7
3.	No. of sample households by caste					
	Scheduled tribe	15 (37.5)	12 (30.76)	24 (48.97)	6 (27.2)	57 (38)
	Scheduled caste	7 (17.5)	8 (20.51)	14 (28.57)	7 (31.81)	36 (24)
	Other backward caste	12 (30)	11 (28.20)	12 (24.48)	5 (22.7)	40 (22)
	General	6 (15)	8 (20.51)	10 (20.40)	4 (18.1)	28 (15.33)
	Total	40 (100)	39 (100)	49 (100)	22 (100)	150 (100)
4.	Age of family members					
	0–18	120 (55.5)	106 (60.57)	95 (34.67)	42 (21.64)	363 (42.27)
	18–25	7 (3.24)	6 (3.42)	7 (2.55)	1 (0.52)	21 (2.44)
	26–35	8 (3.70)	10 (5.71)	14 (5.11)	4 (2.06)	36 (4.18)
	36–45	12 (5.55)	19 (10.85)	21 (7.66)	4 (2.06)	56 (6.51)
	46–60	7 (3.24)	14 (8.0)	14 (5.11)	4 (2.06)	39 (4.54)
	60+	62 (28.7)	20 (11.42)	123 (44.89)	139 (71.13)	344 (40.02)
	Total	216	175	274	194	859
	Level of Education					
	High school	17	12	4	0	33
	Graduate	4	7	4	2	17
	Illiterate	5	7	5	12	29
	Middle	8	11	5	1	25
	Primary	6	5	1	1	13
	Literacy (%)	60.90	68.48	71.49	81.25	70.53

Source: Primary Data
Note: Figures in the parentheses indicates percentages of the total

Distribution of Cropped Area and Irrigation Sources Across Sample Households

Table 2 the data indicate that the average farm sizes were 1.00 hectares for marginal farmers, 1.98 hectares for small farmers, 3.98 hectares for medium farmers, and 10.16 hectares for large farmers. Sugarcane emerged as the dominant crop across all farm categories, occupying the highest proportion of the total cropped area. Among marginal farmers, sugarcane accounted for 59.0% of the cultivated land, followed by 81.9% in small farms, 75.37% in medium farms, and 75.68% in large farms. In terms of irrigation, tubewells were the primary source, contributing to 95.90% of the total irrigated area across all households. Canal irrigation accounted for 1.27% and remaining 2.80% of irrigated area was supported by other sources. Despite the relatively high proportion of irrigated land, approximately 5.56% of the total operated area remained unirrigated, indicating the continued dependence on rainfall or lack of access to reliable irrigation infrastructure for a segment of the farming population.

Table 2: Cropped area and source of irrigation (*n*=150)

S. No.	Particulars	Marginal	Small	Medium	Large	Overall
A.	Average farm size	1.00 (100)	1.99 (100)	3.98 (100)	10.16 (100)	4.17 (100)
B.	Area under Sugarcane	0.59 (59)	1.63 (81.9)	3.00 (75.37)	7.69 (75.68)	2.69 (64.5)
C.	Irrigation source					
1.	Tubewell	0.55 (73.33)	1.26 (75.44)	3.05 (88.15)	8.18 (93.48)	3.75 (95.90)
2.	Canal	0.06 (8.00)	0.12 (7.18)	0.07 (2.02)	0.12 (1.37)	0.05 (1.27)
3.	Tank	0.08 (10.66)	0.16 (9.58)	0.25 (7.22)	0.33 (3.77)	0.06 (1.53)
4.	Others	0.05 (6.66)	0.13 (7.78)	0.09 (2.60)	0.12 (1.37)	0.05 (1.27)
D.	Irrigated land	0.75 (75)	1.67 (83.91)	3.46 (86.93)	8.75 (86.12)	3.91 (94.44)
E.	Unirrigated land	0.25 (25)	0.32 (16.09)	0.52 (13.07)	1.41 (13.88)	0.26 (5.56)

Source: Primary Data

Note- Figures in the parentheses indicates percentages of the total

Cost of Cultivation of Sugarcane

This section examines the economics of sugarcane cultivation in the study area. Table 3 presents the cost of sugarcane cultivation per hectare. It reveals that, regardless of farm size, the average total cost of cultivation for the sample farms was Rs 130010.91 per hectare. Of this, variable costs accounted for 86.33%, while fixed costs constituted the remaining 13.66%. Within the variable costs, human labour represented the largest share at 36.41%, followed by material costs at 35.22%. The cost of power use accounted for 9.54%, and the interest on working capital was 5.14%. Among material inputs, seed and fertilizer were the major expenses, contributing 17.47% and 12.12% respectively. Regarding human labour, family labour costs made up a larger portion (18.57%) compared to hired labour (17.83%). In terms of power sources, machine power contributed 7.64%, which was higher than the cost of bullock power at 1.90%.

In the fixed cost category, the rental value of land in Surajpur district was Rs 15,000 per hectare, with an additional Rs 5.00 paid as land revenue. Overall, fixed costs were higher than the interest charged on working capital.

The total cost of sugarcane cultivation increased with farm size. It was highest for large farms at Rs 139,725.00 per hectare and lowest for marginal farms at Rs 110,453.65 per hectare. Notably, variable costs also rose with the increase in farm size.

In conclusion, the rising total cost of cultivation with increasing farm size suggests that larger farms tend to spend more on material inputs, contributing to higher overall expenditures.

Table 3: Costs of cultivation of sugarcane under different farm size (Rs/ha)

Particular	Farm Size				
	Marginal	Small	Medium	Large	Overall
A. Material Cost					
I. Seed	21875.15	22507.80	22700.19	22900.32	22721.80
	(19.80)	(19.71)	(18.39)	(16.38)	(17.47)
II. Fertilizer	10297.09	12136.95	15102.16	18418.81	15747.66
	(9.31)	(10.62)	(12.23)	(13.18)	(12.12)
III. Plant protection	3224.72	3677.43	4012.62	4934.47	4300.93
	(2.91)	(3.22)	(3.25)	(3.53)	(3.30)
IV. Irrigation charges	1789.50	2388.73	2944.77	3498.84	3022.56
	(1.62)	(2.09)	(2.38)	(2.50)	(2.32)
Total material cost	37186.46	40710.92	44759.73	49752.44	45792.95
	(33.66)	(35.65)	(36.26)	(35.60)	(35.22)
B. Human Labour Cost					
I. Family labour	32109.35	28160.60	23975.49	21702.18	24153.63
	(29.07)	(24.66)	(19.42)	(15.53)	(18.57)
II. Hired labour	11072.19	12243.74	21577.94	30383.05	23191.93
	(10.02)	(10.72)	(17.48)	(21.74)	(17.83)
Total human labour cost	43181.54	40404.34	45553.42	52085.23	47345.56
	(39.09)	(35.38)	(36.91)	(37.27)	(36.41)

C. Power use cost					
I. Bullock labour	2506.42	2437.63	-	-	2472.03
	(2.26)	(2.13)			(1.90)
II. Machine power	5334.61	7709.72	9083.87	12159.29	9940.27
	(4.82)	(6.75)	(7.36)	(8.70)	(7.64)
Total power use cost	7841.03	10147.35	9083.87	12159.29	12412.30
	(7.09)	(8.88)	(7.36)	(8.70)	(9.54)
D. Interest on working capital	5362.63	5635.02	6403.21	7525.78	6692.83
	(4.85)	(4.93)	(5.18)	(5.38)	(5.14)
Total variable cost	93571.66	96897.64	105800.24	121522.74	112243.64
	(84.71)	(84.86)	(85.72)	(86.97)	(86.33)
D. Fixed cost					
I. Land revenue	5	5	5	5	5
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
II. Rental value of land	15000	15000	15000	15000	15000
	(13.58)	(13.13)	(12.15)	(10.73)	(11.53)
III. Interest on fixed capital	1343.53	1509.71	1702.38	1981.32	1768.24
	(1.21)	(1.32)	(1.37)	(1.41)	(1.36)
IV. Depreciation on implement	533.46	770.97	908.39	1215.93	994.03
	(0.48)	(0.67)	(0.73)	(0.87)	(0.76)
Total fixed cost (B)	16881.99	17285.69	17615.77	18202.25	17767.27
	(15.28)	(15.13)	(14.27)	(13.02)	(13.66)
Total cost(A+B)	110453.65	114183.33	123416.01	139725.00	130010.91
	(100)	(100)	(100)	(100)	(100)

Note: Figures in parentheses indicates percentage to total variable cost

Measures of Farm Profit in Sugarcane

The profitability of sugarcane cultivation was assessed using key economic indicators such as yield, cost of cultivation, gross returns, net returns, cost of production, and the input-output ratio, as presented in Table 4. The empirical findings revealed that the net return over the total cost of cultivation for sugarcane was ₹ 234,149.11 per hectare, irrespective of farm size. However, net returns varied across farm sizes, ranging from ₹ 141,966.36 per hectare for marginal farms to ₹ 274,379.64 per hectare for large farms, indicating higher profitability with an increase in farm size.

The cost of production per tonne exhibited a declining trend as farm size increased, with figures of ₹1636.35, ₹1484.05, ₹1495.40, ₹1581.65, and ₹1555.11 per tonne for marginal, small, medium, and large farms, respectively. This reduction in per unit production cost reflects the economies of scale enjoyed by larger holdings. Furthermore, the input-output ratio demonstrated an increasing trend with farm size, highlighting greater resource use efficiency among larger farms. On an overall basis, the input-output ratio was observed to be 1: 2.80, signifying that for every rupee invested in sugarcane cultivation, farmers realized a return of ₹2.80.

Table 4: Measures of farm profit in sugarcane

S. No	Particular	FARM SIZE				
		Marginal	Small	Medium	Large	Overall
1.	Yield (t/ha)	67.50	76.94	82.53	88.341	83.60
2.	Cost of cultivation (Rs/ha)	110453.65	114183.33	123416.00	139724.99	130010.90
3.	Gross return (Rs/ha)	252420.01	305349.18	349894.15	414104.64	364160.01
4.	Net return (Rs/ha)	141966.36	191165.85	226478.14	274379.64	234149.11
5.	Cost of production (Rs/tonne)	1636.35	1484.05	1495.40	1581.65	1555.11
6.	Input -Output ratio	1: 2.29	1: 2.67	1: 2.84	1: 2.96	1: 2.80

Note: Procurement price of sugarcane was Rs 315/q plus bonus provided by Govt. of Chhattisgarh is Rs 50/q.

Conclusions

1. Returns over total cost were higher on larger farms.
2. Sugarcane occupied less cropped area than other major crops on all farm sizes.
3. Cost and returns per hectare increased with landholding size.
4. Sugar factory's procurement process was found inefficient.
5. Farmers faced labour shortages, lack of high-yielding seeds, transport issues, and payment delays.
6. Processing constraints included low juice recovery in summer and in sufficient raw material.

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