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COST STRUCTURE, RETURNS AND PROFITABILITY OF SORGHUM CULTIVATION IN BANDA DISTRICT OF UTTAR PRADESH INDIA

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ABSTRACT

The present study deals with the Input wise cost of cultivation. The multi stage random sampling method was used to choose the respondents. In the first stage Banda district was selected based on highest sorghum area in the Bundelkhand region of Uttar Pradesh. In the second stage, Blocks having highest area under sorghum crop were selected in the third stage, sample of 15 farmers were chosen from each of these selected villages randomly. Thus, the total sample size selected for the present study was totalled to 120. Tabular analysis techniques were used to analyze the data. The data pertained to the agricultural year 2022-2023. The overall Cost of Cultivation of Sorghum was found to be Rs.23481.66, Gross returns were Rs.49049.17, Net returns were Rs.25567.51, Family labour income Rs.30515.06, Farm business income was Rs.41039.61. The cost of Production per quintal was Rs. 1996.50, overall Benefit-Cost ratio was 2.01.

Keywords **:** Cost of cultivation, sampling, Benefit-cost ratio, gross returns.

Introduction

Sorghum, locally called jowar, belongs to the family *Poaceae.* It is the world's fifth major cereal in terms of area and production after wheat, rice, maize, and barley. It is one of the main staple food crops for the world's poor and food-insecure people (Basavaraja *et al.,* 2005). Sorghum has adaptive features that favour its growth in areas where other staple cereals such as wheat, maize, and rice would not be suitable. It is grown during both the rainy (kharif) and post-rainy (rabi) seasons for multiple uses, such as food, feed, stover, and fuel crops. Sorghum originates from Ethiopia, located in East Central Africa. In the first millennium, sorghum was brought from East Africa to India. The height of the plants ranges from 0.6 to 4.0 meters. White, yellow, or brownish-yellow seed.

Globally, 57.7 million tonnes of sorghum were produced in 2022–2023. In terms of overall production, the United States of America leads with 8.07 million tonnes, followed by African nations such as Sudan with 5.15 million tonnes, Ethiopia with 5.06 million tonnes, and Nigeria with 6.4 million tonnes. In terms of total sorghum produced, India produced with 3.81 million tonnes, a decrease from the previous period whereas foreign production totalled 59.06 million tonnes in 2022–2023, spread across 40.9 million hectares, with a yield of 1.45 tons per hectare.

The total area under sorghum cultivation in India in 2022-2023 was 3.53 million hectares, with an average productivity of 10.79 quintals per hectare and a production of 3.81 million tonnes. In contrast, the Bundelkhand region alone reported a significantly higher area under sorghum cultivation 6.54 million hectares with a productivity of 16.07 quintals per hectare and a production of 10.52 million tonnes. This suggests that Bundelkhand not only cultivated sorghum on a wider area than the national average, but also

attained a far better level of productivity. In comparison to the national picture, the higher yield in Bundelkhand may indicate more effective agricultural methods, favourable agroclimatic conditions, or better input utilisation in the area.

Uttar Pradesh is the sixth-largest producer of sorghum in the nation. Though the U.P.'s sorghum crop area decreased from 0.18 million hectares in 2016–2017 to 0.17 million hectares in 2020–2021, production and productivity showed a steady upward trend. Productivity has risen from 10 quintals per hectare to an all-time high of 15.78 quintals per hectare, while production has increased from 0.18 million tonnes to 0.27 million tonnes.

The Bundelkhand region of Uttar Pradesh, particularly Banda district, is marked by semi-arid agro-climatic conditions, uncertain rainfall, and recurring droughts, which pose serious constraints on agricultural activities. Under such conditions, sorghum (*Sorghum bicolor*) emerges as an important coarse cereal crop due to its tolerance to moisture stress and low-input requirements. Sorghum is predominantly grown during the kharif season under rainfed farming systems and contributes significantly to food security, livestock feed, and farm income in rural areas.

However, the profitability of sorghum cultivation in Banda district is influenced by multiple factors such as increasing costs of inputs, low productivity levels, limited adoption of improved production technologies, and price fluctuations in the market. The total cost of cultivation includes expenses on seeds, fertilizers, human labour, machinery, irrigation, and plant protection. Returns from sorghum cultivation vary depending on yield performance, prevailing market prices, and the efficiency of marketing systems. Hence, a systematic analysis of the cost and return structure is necessary to evaluate the economic performance of sorghum farming in the study area.

Scenario of Sorghum in the Banda District of Uttar Pradesh

Banda district is the leading producer of sorghum. 2.07 million hectares are used for sorghum agriculture in Banda, 2022–2023. Production, on the other hand, doubled from 2.18 million tonnes in 2017–18 to 4.03 million tonnes in 2020–2021, and productivity also increased, rising from 16.13 quintals per hectare in 2017–2018 to 19.44 quintals per hectare in 2022–2023. (Directorate of Statistics & Economics, Government of India)

The cost of production, at a particular price point, is a key indicator of sorghum cultivation's profitability. For sorghum growers, consumers, and policymakers who seek to establish a current interaction between sorghum producers and consumers in order to fix the price of sorghum effectively, it is a significant economic indicator. Therefore, an attempt was made to determine the economics of sorghum production in the current study.

Materials and Methods

The study has been undertaken in the district Banda of U.P Bundelkhand region. An appropriate sample of Sorghum growers of marginal, small, medium and large size categories have been selected for required information. The cost concept developed by CACP (Commission for Agricultural Cost and Prices) have been used in the present study.

Cost of cultivation

The Cost of Cultivation of sorghum crops was estimated with the help of standard cost concepts given by CACP. The details of the standard cost concept used in the present study is given below:

Cost A1 = All actual expenses in cash and kind incurred in production by the owner. It includes 14 cost items:

(i) Value of hired and attached human labour
(ii) Value of bullock labour
(iii) Value of hired bullock labour
(iv) Value of machine labour
(v) Value of hired machine labour
(vi) Value of owned and purchased seed
(vii) Value of owned and purchased manure
(viii) Value of fertilizers charges
(ix) Value of Irrigation charges
(x) Land revenue ceases and other taxes
(xi) Plant protection measures
(xii) Interest in working capital
(xiii) Depreciation charges
(xiv) Miscellaneous costs

- **Cost A2 :** Cost A1 + Rent paid for leased land
- **Cost B1 :** Cost A1 + Interest on fixed capital (excluding land)
- **Cost B2 :** Cost B1 + Imputed rental value of owned land
- **Cost C1 :** Cost B1 + Imputed value of family labour
- **Cost C2 :** Cost B2 + Imputed value of family labour
- **Cost C3 :** Cost C2 + 10 Per cent of Cost C2 (As managerial cost)

Income measures

Farm business income = Gross return – Cost A / Cost A2

Family labour income = Gross return – Cost B2

Net returns = Gross returns – Cost C3

Benefit-Cost ratio = Gross returns / Cost C3

Cost of Production

It is the ratio of the total cost incurred of Sorghum production and physical output obtained on sample farms.

$$\text{Cost of production (Rs. Per quintal)} = \frac{\text{Cost of Cultivation/hectares}}{\text{Quantity of main product/hectares}}$$

Results and Discussion

Costs and returns

The cost of cultivation is a significant factor based on which marketing decisions are made. A farmer whether small or large chooses to sell his produce in market only when the market price covers the cost of cultivation so as to get a profit.

For analysing the cost of cultivation of the Sorghum crop between several categories of sample farms CACP'S methodology is used. In fixing the support prices, CACP depends on the cost concept which covers all items of costs of cultivation including in that the imputed value of inputs owned by growers such as the rental value of the own land and interest on the working capital. The cost concept involves Cost A1, Cost A2, Cost B2, Cost C1, Cost C2, and Cost C3. They are as follows:

Table 1: Cost of Cultivation of Sorghum crop on category-wise farms in the Study area (Per ha)

Particulars	Marginal	Small	Medium	Large	All farms
Total Human labour	4838.71	6546.44	6054.71	5781.81	5805.42
Family labour	3870.96	5027.32	620.75	327.27	2461.57
Hired labour	967.74	1519.12	5433.96	5454.54	3343.84
Expenditure on Machinery labour	1194.35	925.68	1037.73	1085.22	1060.74
Seeds(kg)	387.09	401.45	389.97	452.55	407.77
Fertilizer(kg)	-	-	-	-	-
Manures(tonnes/trolly)	2322.58	2550.09	3205.03	3336.36	2853.51
Irrigation(Rs.)	-	-	-	-	-
Plant protection	-	-	-	-	-
Total Working Capital	**8708.06**	**10442.62**	**10683.58**	**10655.97**	**10122.55**
Interest in working capital	**206.77**	**208.85**	**145.7**	**213.11**	**193.61**
Total Variable Cost	**8914.83**	**10651.48**	**10829.28**	**10869.09**	**10316.17**
The rental value of land	**9873.77**	**10000**	**10000**	**10000**	**9968.44**
Depreciation	-	-	-	-	-
Rent paid for the land	-	-	-	-	-
Interest on Fixed capital	**582.25**	**600**	**600**	**600**	**595.56**
Total Fixed Cost	**10456.03**	**10600**	**10600**	**10600**	**10564.00**
Cost A1	**5595.81**	**5624.15**	**10276.5**	**10541.81**	**8009.56**
Cost A2	**5595.81**	**5624.15**	**10276.5**	**10541.81**	**8009.56**
Cost B1	**6178.72**	**6224.15**	**10876.5**	**11141.81**	**8605.29**
Cost B2	**15893.99**	**16224.15**	**20876.5**	**21141.81**	**18534.11**
Cost C1	**11454.78**	**11251.48**	**11497.26**	**11469.09**	**11418.14**
Cost C2	**21170.04**	**21251.48**	**21497.26**	**21469.09**	**21346.96**
Cost C3	**23287.05**	**23376.62**	**23646.98**	**23615.99**	**23481.66**

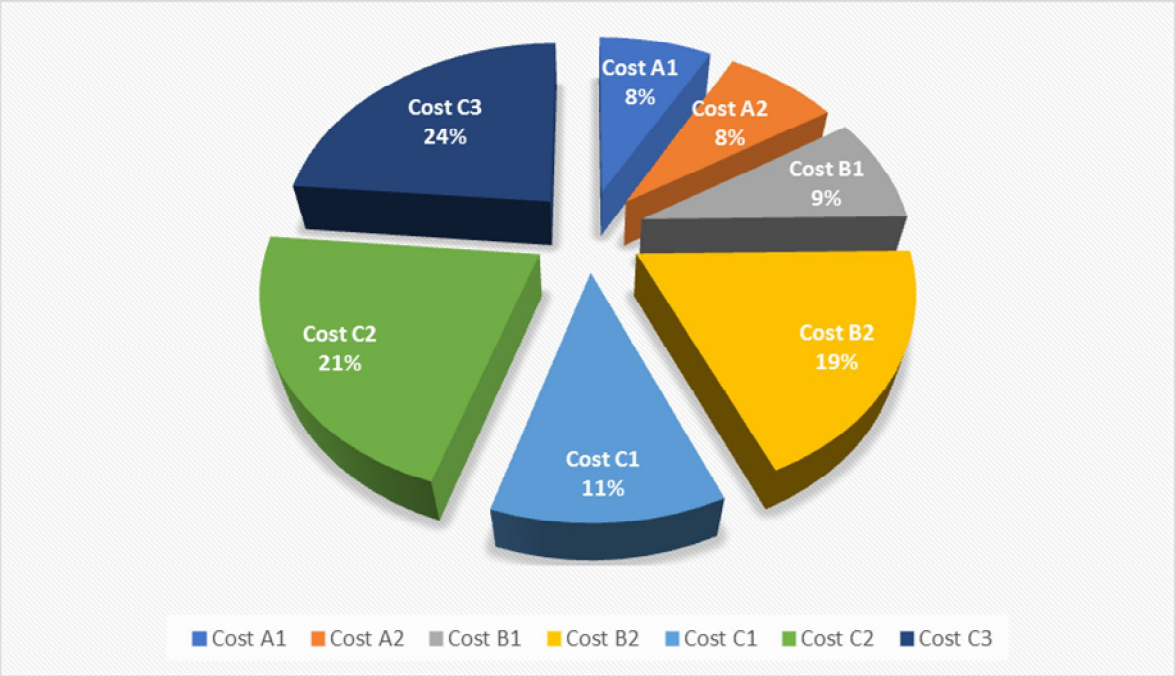

Fig. 1 : Share of Cost of Cultivation of Sorghum

Table 1 shows the per hectare cost of cultivation of Sorghum crops among 120 sample farms in the study area. Human labour cost in case the of the marginal farm was found (Rs.4838.71), small farm (Rs.6546.44), medium (Rs. 6054.71 in the case of the large farms (Rs.5781.81) and overall Human labour cost was found (Rs. 5805.42). Among the all farms machinery cost was found in marginal (Rs.1194.35), small farm (Rs. 925.68), medium farm (Rs.1037.73), large (Rs. 1085.22) and overall machinery cost was (Rs. 1060.74). Overall seed cost was found (Rs.407.77), in the case of a marginal farm (Rs. 387.09), small farm (Rs. 401.45), medium farm (Rs.389.97), large (Rs. 452.55). The cost incurred on fertilizer was zero because not any farmer used fertilizer dose. Manure cost was found highest in large farms (Rs.3336.36), followed by medium farms (Rs.3205.03), small farms (Rs.2550.09), marginal farm (Rs. 2322.58), and the overall cost was (Rs. 2853.51). In the case of irrigation, the cost was zero because sorghum is drought resistant crop and the water requirement is 450-600 mm, which was fulfilled by seasonal rain. The overall total working capital was (Rs.10122.55), in the case of marginal farms (Rs. 8708.06), small farms (Rs. 10442.62), medium farms (Rs. 10683.58), large farms (Rs. 10655.97). The total variable cost was found highest in the large farm (Rs. 10869.09), followed by medium (Rs.10829.28), small farm (Rs.10651.48), marginal farm (Rs.8914.83), and the overall total variable cost was (Rs.10316.17). The rental value of own land for the marginal farm was (Rs.9873.77), small (Rs.10000), medium (Rs.10000), large(Rs.10000). Total fixed cost of marginal was (Rs.10456.03), small (Rs. 10600), medium (10600), large (Rs.10600), and overall cost was (Rs.10564). Cost A1 was (Rs. 8009.56), for marginal farms (Rs.5595.81), small (Rs.5624.15), medium (Rs.10276.5), and large (Rs.10541.81). Cost A1 was equal to Cost A2 because not a single farmer did sorghum cultivation on leased land. This finding is supported by (Gautam *et al*. 2020). Cost B1 was (Rs.8605.29), in case of marginal farms (Rs.6178.72), small farms (Rs. 6224.15), medium (Rs. 10876.5), large (Rs. 11141.81). Cost B2 was (Rs. 18534.11), in case of marginal farms (Rs. 15893.99), small (Rs. 162241.5), medium (Rs.20876.5), large (Rs. 21141.81). Cost C1 (Rs.11418.14), in case of marginal farms (Rs. 11454.78), small (Rs. 11251.48), medium (Rs. 11497.26), large (Rs.11469.07). Cost C2 was (Rs. 21346.96), in case of marginal farms (Rs. 21170.04), small (Rs. 21251.48), medium (Rs. 21497.26), large (Rs.21469.09). The overall Cost C3 was (Rs.23481.66), in case of marginal farms (Rs. 23287.05), small (Rs.23376.62), medium (Rs. 23646.98), large (Rs.23615.99). This study is supported by (Sreedhar, *et al*. 2021), (Sharma *et al*. 2022)

Table 2: Profitability of Sorghum cultivation at the different size of farms

S.No	Particulars	Marginal	Small	Medium	Large	Overall
1.	Yield of main product(q/ha)	15.71	11.48	10.72	10.43	12.08
2.	Yield of by product(q/ha)	27.98	31.34	31.32	26.98	29.41
3.	Gross income	59543.75	48032.79	45361.64	43258.52	49049.17
4.	Net income	36256.7	24656.16	21714.65	19642.53	25567.51
5.	Family labour income	43649.76	31808.64	24485.14	22116.71	30515.06
6.	Farm business income	53947.94	42408.64	35085.14	32716.71	41039.61
7.	Cost of production	1481.48	2035.49	2205.20	2263.84	1996.50
8.	B:C ratio	2.25	2.05	1.9	1.83	2.01

It is evident from table 2 that Yield of main product was 12.08 q/ha, in case of marginal farms (15.71q/ha), small (11.48q/ha), medium (10.72 q/ha), large (10.43 q/ha), yield of by product was (29.41 q/ha), in case of marginal farms (27.98 q/ha), small (31.34 q/ha), medium (31.32 q/ha), large (26.98 q/ha). Overall Gross income was (Rs. 49049.17), in case of marginal farms (Rs. 59543.75), small (Rs. 48032.79), medium (Rs.45361.64), large (Rs. 43258.52) and Overall net returns was (Rs.25567.51), in case of marginal farms (Rs.36256.7), small (Rs. 24656.16), medium (Rs. 21714.65), large (Rs. 19642.53). The overall family labour income was (Rs.30515.06), in case of marginal farms (Rs. 43649.76), small (Rs. 31808.64), medium (Rs. 24485.14), large (Rs. 22116.71), overall farm business income was (Rs.41039.61), in case of marginal farms (Rs. 53947.94), small (Rs. 42408.64), medium (Rs. 35085.14), large (Rs. 32716.71). Cost of production was (Rs. 1996.50), in case of marginal farms (Rs.1481.48), small (Rs. 2035.49), medium (Rs. 2205.20), large (Rs. 2263.84). The overall Benefit-Cost ratio was 2.01, in case of marginal farms 2.25, small 2.05, medium 1.9 and in large 1.83.

Conclusions

The present investigation was intended to depict the picture of sorghum growers in the Banda district of Uttar Pradesh Bundelkhand region In terms of cost of cultivation, medium-sized farms incurred the highest cost at Rs. 23,646.98 per hectare, followed closely by large farms at Rs. 23,615.99 per hectare. The average total cost of production per quintal was Rs. 1,996.50. Among different farm sizes, the cost of production was highest for large (Rs. 2,263.84), followed by medium (Rs. 2,205.49), small (Rs. 2,035.49), and marginal (Rs. 1,481.48). The overall Benefit-Cost (B:C) ratio was 2.01. Marginal reached the highest B:C ratio of 2.25, followed by small (2.05), medium (1.90), and large (1.83). Efforts should be made by seed agencies to afford quality seed sorghum at the proper time to the farmers because the seed is one of the important inputs to improve the production of sorghum. The government would effort to supply the essential fertilizer at the proper time with a reasonable price to the growers. This recommends that smaller farms were more efficient in terms of returns on investment compared to larger ones.

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