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Economic analysis of sugarcane production in Sitapur district of Uttar Pradesh

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Abstract

Sugarcane cultivation constituted a vital part of the agricultural economy in Uttar Pradesh, contributing significantly to rural livelihoods and farmer incomes. The study titled "Economic Analysis of Sugarcane Production in Sitapur District of Uttar Pradesh" examined the economic dimensions of sugarcane farming in Mahmudabad block. For the study, five percent of sugarcane cultivating potential villages were randomly selected from the selected block, and ten percent of the total respondent population were taken as sample randomly. The analysis revealed that marginal farms incurred the highest cost of cultivation at ₹1,03,551.29, while the lowest cost of ₹1,00,791.49 was observed on large farms. The average cost of cultivation across all farm categories was ₹1,02,792.30, indicating substantial expenditure regardless of farm size. The primary cost components included rental value of land (23.35%), seed cost (17.91%), human labour (13.75%), manure and fertilizer (7.71%), irrigation charges (7.68%), and machinery charges (6.55%). The average gross income was ₹2,24,423.28, with large farms earning the highest at ₹2,29,467.60. Net income averaged ₹1,21,630.98, and profitability increased with farm size, with large farms recording a net income of ₹1,28,676.11. The average farm investment income and farm business income were ₹1,59,339.24 and ₹1,64,656.85, respectively, both showing a positive correlation with farm size. Family labour income averaged ₹1,36,293.35, indicating a notable contribution from unpaid labour, particularly on larger holdings. The average yield was estimated at 623.40 quintals per hectare. The overall benefit-cost ratio was 1:2.18, improving from 1:2.09 on marginal farms to 1:2.28 on large farms, demonstrating better economic efficiency with increasing farm size.

Keywords: Sugarcane cultivation, cost of cultivation, farm size, yield and benefit-cost ratio

Introduction

Sugarcane was a vital cash crop cultivated primarily in tropical and subtropical regions, where warm temperatures, fertile soils, and adequate rainfall facilitated its growth. The cultivation process began with land preparation, involving plowing, harrowing, and levelling to ensure optimal soil conditions. Farmers planted sugarcane using setts, or stem cuttings, which were placed in furrows and covered with soil. The crop required consistent moisture, leading to dependence on both rainfall and irrigation systems, while fertilizers were applied to enhance yield. Weed control was managed through manual weeding, herbicides, or intercropping, and pests such as borers and diseases like red rot were mitigated using chemical and biological methods. Harvesting occurred after 12 to 18 months, depending on the variety and climate, with manual laborers cutting mature cane stalks using machetes or mechanical harvesters in more advanced systems. Post-harvest, the cane was transported to mills for processing, where it was crushed to extract juice for sugar production, while bagasse, molasses, and ethanol were derived as byproducts. Sugarcane farming historically supported rural economies, providing employment and raw materials for industries, though challenges such as fluctuating prices, labor shortages, and environmental concerns influenced its sustainability over time.

Research methodology

The research utilized a purposive-multistage random sampling methodology to select respondents from Sitapur district in order to ensure a representative and diverse sample of sugarcane farmers. To begin with, Sitapur district was purposively chosen as the study area, primarily to minimize logistical challenges and time constraints for the investigator. Within Sitapur district, Mahmudabad block was selected due to its substantial involvement in sugarcane cultivation, which made it a focal point for this research. A comprehensive list of all villages within Mahmudabad was created, from which five percent of the sugarcane cultivating potential villages were randomly selected. Following this, ten percent of the total sugarcane farming population in these selected villages was randomly chosen, leading to a final sample size of 110 farmers. These selected respondents were then classified into five distinct landholding size categories, which included: Marginal (less than 1 hectare), Small (1-2 hectares), Semi-medium (2-4 hectares), Medium (4-10 hectares), and Large (greater than 10 hectares). Primary data for the study was collected through direct personal interviews with the respondents, using a carefully designed and structured schedule. In addition, secondary data was gathered from various official reports, books, journals, and records

maintained by the district and block headquarters. The data collection process took place during the 2024-2025 agricultural year, and the collected data was analysed using appropriate statistical tools to draw meaningful conclusions from the study.

Analytical Tools

Cost of Sugarcane Production

Cost - A1

- Value of hired human labour
- Value of hired bullock labour
- Value of owned bullock labour
- Value of owned machinery labour
- Hired machinery charges
- Value of seed (purchased)
- Value of insecticide and pesticide
- Value of manures (owned and purchased)
- Value of fertilizer
- Depreciation on implements and farm buildings
- Irrigation charge
- Land revenue, cases and other taxes
- Interest on working capital
- Miscellaneous expenses (artisans etc.)

Cost A2: Cost A1 +rent for leased in land.

Cost B1: Cost A1 + interest on value of owned fixed capital assets (excluding land).

Cost B2: Cost B1 + rental value of owned land (net of land revenue) and rent paid for leased –in land.

Cost C1: cost B1 + imputed value of family labour.

Cost C2: cost + imputed value of family labour

Cost C2*: Cost C2 adjusted to take into account valuation of human labour at market rate or statutory minimum wage rete whichever is higher

Cost C3: Cost C2* + value of management input at 10%of total cost (C2*) Cost C is the total cost of cultivation.

- **Farm business income** = Gross income – Cost A1 or A2
- **Family labour income** = Gross income – Cost B
- **Net income** = Gross income – Cost C
- **Farm investment income** = Farm business income – Imputed value of family labour.

• Benefit: Cost ratio = $\frac{\text{Gross Income}}{\text{Total cost}}$

Results and Discussion

Table 1: Per hectare costs of different inputs used in Sugarcane production (₹).

| Sl. No. | Particulars | Size group of farms | | | | | All farm average |
|---------|--|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | | Marginal | Small | Semi-Medium | Medium | Large | |
| A | Family labour | 9895.76 (9.56) | 5039.71 (4.87) | 4900.00 (4.74) | 3662.59 (3.56) | 3090.00 (3.07) | 5317.61 (5.17) |
| B | Hired labour | 3544.18 (3.42) | 7906.38 (7.64) | 9100.00 (8.81) | 11200.05 (10.89) | 12310.00 (12.71) | 8812.12 (8.57) |
| 1. | Total Labour Cost (A+B) | 13439.94 (12.98) | 12946.09 (12.51) | 14000.00 (13.56) | 14862.64 (14.45) | 15400.00 (15.28) | 14129.73 (13.75) |
| 2. | Machinery charges | 7370.90 (18.98) | 7256.81 (7.01) | 6903.75 (6.68) | 6390.57 (6.21) | 5724.05 (5.68) | 6729.22 (6.55) |
| 3. | Seed | 19649.95 (8.11) | 19375.23 (18.72) | 18800.15 (18.20) | 17346.59 (16.87) | 16855.43 (16.72) | 18405.47 (17.91) |
| 4. | Manure and fertilizer | 8400.56 (8.23) | 8000.39 (7.73) | 7827.00 (7.58) | 7713.21 (7.50) | 7710.00 (7.65) | 7930.23 (7.71) |
| 5. | Irrigation | 8525.16 (4.54) | 8317.74 (8.04) | 8006.31 (7.75) | 7813.33 (7.60) | 6805.24 (6.76) | 7893.56 (7.68) |
| 6. | Plant protection | 4704.46 (59.96) | 6130.93 (5.92) | 6280.42 (6.08) | 7300.42 (7.10) | 7142.93 (7.09) | 6311.83 (6.14) |
| 7. | Total Variable Cost/ Working Capital (1+2+3+4+5+6) | 62090.97 (59.96) | 62027.19 (59.93) | 61817.63 (59.86) | 61426.76 (59.72) | 59637.65 (59.17) | 61400.04 (59.73) |
| 8. | Interest on working capital @ 6% | 3725.46 (3.60) | 3721.63 (3.60) | 3709.06 (3.59) | 3685.61 (3.58) | 3578.26 (3.55) | 3684.00 (3.55) |
| 9. | Rental value of land | 24000.00 (23.18) | 24000.00 (23.19) | 24000.00 (23.24) | 24000.00 (23.34) | 24000.00 (23.81) | 24000.00 (23.35) |
| 10. | Interest on fixed capital @10% | 4321.11 (4.17) | 4338.14 (4.19) | 4358.21 (4.22) | 4387.32 (4.27) | 4412.72 (4.38) | 4363.50 (4.24) |
| 11. | Total (7+8+9+10) | 94137.54 (90.91) | 94086.96 (90.91) | 93884.90 (90.91) | 93499.69 (90.91) | 91628.63 (90.91) | 93447.54 (90.91) |
| 12. | Managerial cost @ 10% of sub total | 9413.75 (9.09) | 9408.70 (9.09) | 9388.49 (9.09) | 9349.97 (9.09) | 9162.86 (9.09) | 9344.75 (9.90) |
| 13. | Grand Total (11+12) | 103551.29 (100.00) | 103495.66 (100.00) | 103273.39 (100.00) | 102849.65 (100.00) | 100791.49 (100.00) | 102792.30 (100.00) |

Table 1: The cost of cultivation exhibited a declining trend with an increase in farm size, being highest on marginal farms at ₹103,551.29, followed closely by small farms at ₹103,495.66, semi-medium farms at ₹103,273.39, medium farms at ₹102,849.65, and lowest on large farms at ₹100,791.49. The overall average cost of cultivation across all sample farms was estimated at ₹102,792.30. This pattern indicates that smaller farm holdings incur relatively higher cultivation expenses, possibly due to limited economies of scale and greater dependence on external inputs. A detailed

assessment of cost components reveals that the rental value of land constituted the largest share at 23.35 percent of the total cost, followed by seed cost (17.91%), human labour (13.75%), manure and fertilizers (7.71%), irrigation charges (7.68%), machinery charges (6.55%), and plant protection measures (6.14%). These findings underscore the significance of land-related expenses and input costs in determining overall cultivation expenditures, with implications for farm profitability and resource allocation across different farm sizes.

Table 2: Per hectare costs and income from the production of sugarcane crop on various costs concept (₹)

| Sl. No. | Particulars | Size group of farms | | | | | All farm average |
|---------|-------------------------------------|---------------------|-----------|-------------|-----------|-----------|------------------|
| | | Marginal | Small | Semi-medium | Medium | Large | |
| 1. | Cost A ₁ /A ₂ | 55920.67 | 60709.11 | 60626.69 | 61449.78 | 60125.91 | 59766.43 |
| 2. | Cost B ₁ | 60241.78 | 65047.25 | 64984.90 | 65837.10 | 64538.63 | 64129.93 |
| 3. | Cost B ₂ | 84241.78 | 89047.25 | 88984.90 | 89837.10 | 88538.63 | 88129.93 |
| 4. | Cost C ₁ | 70137.54 | 70086.96 | 69884.90 | 69499.69 | 67628.63 | 69447.54 |
| 5. | Cost C ₂ | 94137.54 | 94086.96 | 93884.90 | 93499.69 | 91628.63 | 93447.54 |
| 6. | Cost C ₃ | 103551.29 | 103495.66 | 103273.39 | 102849.65 | 100791.49 | 102792.30 |
| 7. | Gross Income | 216482.40 | 221630.40 | 226432.80 | 228103.20 | 229467.60 | 224423.28 |
| 8. | Net Income | 112931.11 | 118134.74 | 123159.41 | 125253.55 | 128676.11 | 121630.98 |
| 9. | Family labour income | 132240.62 | 132583.15 | 137447.90 | 138266.10 | 140928.97 | 136293.35 |
| 10. | Farm business income | 160561.73 | 160921.29 | 165806.11 | 166653.42 | 169341.69 | 164656.85 |
| 11. | Farm investment income | 150665.97 | 155881.58 | 160906.11 | 162990.83 | 166251.69 | 159339.24 |
| 12. | Cost of Production | 172.20 | 168.11 | 164.19 | 162.32 | 158.13 | 164.99 |
| 13. | Yield (q/ha) | 601.34 | 615.64 | 628.98 | 633.62 | 637.41 | 623.40 |
| 14. | Benefit-Cost Ratio | 1:2.09 | 1:2.14 | 1:2.19 | 1:2.22 | 1:2.28 | 1:2.18 |

Table 2: The analysis of farm-level economics indicates that, on average, the cost of cultivation across various cost concepts—namely Cost A₁/A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂, and Cost C₃—amounted to ₹59,766.43, ₹64,129.93, ₹88,129.93, ₹69,447.54, ₹93,447.54, and ₹102,792.30, respectively. The average gross income realized was ₹224,423.28, while the corresponding net income stood at ₹121,630.98. Among the different farm sizes, large farms recorded the highest gross income at ₹229,467.60, followed by medium farms (₹228,103.20), semi-medium farms (₹226,432.80), small farms (₹221,630.40), and the lowest on marginal farms (₹216,482.40). Similarly, net income was found to be the highest on large farms at ₹128,676.11, followed by medium farms (₹125,253.55), semi-medium farms (₹123,159.41), small farms (₹118,134.74), and marginal farms (₹112,931.11). With regard to other income measures, the average farm investment income, farm business income, and family labour income were observed to be ₹159,339.24, ₹164,656.85, and ₹136,293.35, respectively. Farm investment income followed a descending trend from large to marginal farms, while farm business income was highest on large farms, followed by medium, semi-medium, marginal, and small farms. Similarly, family labour income was highest on large farms, decreasing progressively down to small farms. The average yield across all sample farms was estimated at 623.40 quintals per hectare, indicating a reasonably high level of productivity. The benefit-cost ratio (BCR) also demonstrated an increasing trend with farm size, being 1:2.09 for marginal farms, 1:2.14 for small farms, 1:2.19 for semi-medium farms, 1:2.22 for medium farms, and peaking at 1:2.28 for large farms. On average, the BCR across all farms stood at 1:2.18, suggesting a relatively favorable return on investment in agricultural production.

Conclusion

The findings of the study underscore the economic significance and viability of sugarcane cultivation in Sitapur district of Uttar Pradesh, particularly in the Mahmudabad block. The cost of cultivation showed a decreasing trend with increasing farm size, indicating that marginal and small farmers bear comparatively higher cultivation costs, potentially due to limited access to economies of scale and

modern resources. The major cost components included rental value of land, seed, human labour, and fertilizers, which together formed the bulk of total expenditure. Despite the high cost, the average gross income per hectare was ₹2,24,423.28, resulting in a substantial net income of ₹1,21,630.98, with both figures increasing consistently with farm size. Larger farms demonstrated greater profitability, evidenced by higher farm business, investment, and family labour incomes. Yield per hectare was also positively associated with farm size, with an average of 623.40 quintals per hectare. The benefit-cost ratio, a critical measure of farm efficiency, averaged 1:2.18 and improved progressively from 1:2.09 for marginal farms to 1:2.28 for large farms. These results highlight that while sugarcane cultivation remains a profitable venture across all farm categories, larger holdings enjoy superior economic returns, indicating the need for supportive policies that enhance the productivity and profitability of smaller farms.

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