



Comparative Profitability of Plant and Ratoon Methods of Sugarcane Cultivation in Kamareddy District of Telangana, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author VV designed the study, performed the analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors BS, ISD and PP managed the analyses of the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study aimed to analyze and compare the cost of cultivation, profitability and farm income measures between fresh (plant) and ratoon sugarcane cultivation methods.

Study Design: A comparative economic analysis was conducted using structured cost concepts and farm income indicators across both methods of sugarcane production.

Place and Duration of Study: The study was conducted in Kamareddy district, Telangana, during the 2023–2024 cropping season.

Methodology: Primary data were collected from a sample of 80 sugarcane farmers (40 plant crop and 40 ratoon sugarcane farmers) through personal interviews using a pre-tested schedule. The data was analyzed using cost concepts such as Cost A1, A2, B1, B2, C1, C2, and C3. Farm profitability was assessed through gross returns, net returns, cost of production per quintal, farm business income, family labour income, and farm investment income.

Results: The total cost of cultivation was ₹2,57,936.66/ha for plant and ₹1,73,729.05/ha for ratoon sugarcane crop. Variable costs accounted for 93.4 per cent and 92.08 per cent of total costs respectively in plant and ratoon, where machine and human labour occupying major share. Cost concepts (A1 to C3) were consistently higher for plant cane. The Gross returns were also higher in plant sugarcane (₹3,57,102/ha) than in ratoon cane (₹ 2,76,426/ha). However, ratoon sugarcane recorded a higher net income (₹1,02,696.94/ha), a lower cost of production (₹169.69/q), and a higher B:C ratio (1.59) when compared to plant cane, which had a net income of ₹99,165.33/ha, a higher cost of production (₹195.02/q), and a lower B:C ratio (1.38). Income indicators such as farm business income and family labour income were also slightly higher in ratoon cultivation.

Conclusion: While plant sugarcane offers higher gross income due to superior yields, ratoon sugarcane provides better net returns, cost efficiency, and profitability. Thus, ratoon cropping is a more economically viable option under the studied production conditions.

Keywords: Cost concepts; cost of cultivation; economic efficiency; farm income measures; plant cane; profitability analysis; ratoon cane; sugarcane cultivation.

1. INTRODUCTION

Sugarcane (*saccharum spp.*) family Gramineae (Poaceae) is widely grown crop in India. *Saccharum* genus mainly comprises five species in which three are cultivated *Saccharum officinarum*, *Saccharum barberi*, *Saccharum sinense*, and two are wild species *Saccharum spontaneum*, *Saccharum robustum*. Origin of the sugarcane is New Guinea (Vishwakarma et al., 2021). Sugarcane occupies a prominent position as a cash and commercial crop. Sugarcane is mainly used for making White sugar, Brown sugar (Khandsari) and Jaggery (Gur). Now Sugarcane is gaining importance due to bioethanol production. In the early days, sugarcane was used for making gur for the consumption of common people (Amala and Rajagopal, 2017). Sugarcane is a moderately large sunny weather loving plant that is growing in two distinct climatic regions; the tropical and sub-tropical. Two core crops, sugarcane and sugar beet are grown for as the raw material for producing of sugar. Two third of total sugar is produced by the sugarcane and it is the focal source of Indian sugar (Kumar et al., 2020). Sugarcane is one of the main crops of earning

foreign exchange. The main byproducts of the sugarcane industry are bagasse and molasses. Bagasse is mainly used as fuel. It is also used for the production of compressed fiber board, paper, plastics and furfural. Molasses is used in distilleries for the manufacture of ethyl alcohol, butyl alcohol, citric acid etc. Rum is the best potable spirits made from molasses. Molasses is also used as an additive to for livestock. Green tops of cane are a good source of fodder for cattle. Press mud is used as a manure in alkaline and saline soils. Sugar industry in India is next in importance only to the textile industry and provides gainful employment to large number of people (Singh and Katiyar, 2016). It is the source crop for both refined sugar and traditional sweeteners like jaggery. Jaggery is classified as a 'Non-Centrifugal Sugar' in international trade because it is produced without removing molasses through centrifugation (Velásquez et al., 2019). India allowed exports of 1 million metric tons of sugar during the current season to help the mills of the world's second-biggest producer export surplus stocks and help prop up local prices (Reuters, 2025). Since sugarcane is a major commercial crop with significant economic importance due to its high returns and

by-product value, the objective of the study is to assess the profitability of sugarcane cultivation under fresh and ratoon methods in Telangana and its major erstwhile districts.

1.1 World Sugarcane Scenario

Total sugarcane production worldwide has increased from 162.2 million metric tons in 2010–11 to 186.02 million metric tons in 2024–25 (Statista 2024-25). Brazil is the largest sugarcane producer, with 782.58 million tons, followed by India at 490.53 million tons. China follows with 104.98 million tons, then Thailand and Pakistan. Brazil also has the largest area under sugarcane cultivation (10.0 million hectares), followed by India (5.88 million hectares). Other major cultivating countries include Thailand, China, and Pakistan. In terms of productivity, Peru leads with 121.503 t/ha, followed by Guatemala (116.253 t/ha) and Senegal (113.905 t/ha). India ranks 16th globally, with a yield of 83.34 t/ha (FAOSTAT, 2025).

1.2 Sugarcane Scenario in India

India is the second-largest producer of sugar in the world, contributing 34.0 million metric tons or around 20 per cent of global sugar production, and it is the largest consumer with a domestic consumption of 28.5 million metric tons (15% of global consumption) (Statista 2024-25). In 2023–24, sugarcane was cultivated on 57.40 lakh hectares across India, producing 453.16 million tons. Uttar Pradesh is the leading producer with 215.81 million tons (45.26%), followed by Maharashtra (112.09 million tons or 24.39%) and Karnataka (41.81 million tons). In terms of area, Uttar Pradesh leads with 26.53 lakh hectares (45.76%), followed by Maharashtra (14.37 lakh ha) and Karnataka (5.43 lakh ha). The most productive state is Tamil Nadu, with a yield of 105.00 tons/ha, followed by Telangana (90.12 t/ha) and Karnataka (77.00 t/ha) (E&S, DAC, 2023–24).

1.3 Sugarcane Scenario in Telangana

In Telangana, sugarcane is a significant commercial crop grown over 0.27 lakh hectares, accounting for 0.50 per cent of India's total sugarcane area, with a production of 2.43 million tonnes (0.56% of the national output). The state ranks 14th in area, 12th in production, and 2nd in productivity with 90.12 tons/ha. Among all the districts, Sangareddy leads with 12,427 hectares under cultivation, producing 9.90 lakh tonnes at

79.69 t/ha. Kamareddy follows with 4,523 hectares area and 3.33 lakh tonnes production, yielding 73.64 t/ha. Khammam, Vikarabad, and Wanaparthy are also major sugarcane-growing districts. In terms of productivity, Khammam ranks highest with 102.57 t/ha, followed by Wanaparthy (101.37 t/ha), and Adilabad, Yadadri, and Mahabubabad (90 t/ha). Siddipet and Jogulamba also show high yields of 89.3 t/ha and 88.4 t/ha, respectively (Directorate of Economics and Statistics 2023-24). Kamareddy district has the highest area in Northern Telangana Zone.

2. METHODOLOGY

For the present study, a multistage random sampling technique was adopted to select the respondents. In the first stage, Kamareddy district was purposively chosen as it recorded the largest sugarcane cultivation area of 4,523 acres in the Northern Telangana Zone during 2023–24 and also had the presence of sugarcane processing units. In the second stage, two mandals Sadasivanagar and Tadwai were selected based on the highest area under sugarcane cultivation. In the third stage, two villages were selected from each mandal based on maximum area under sugarcane cultivation. In the final stage, 10 plant crop sugarcane farmers and 10 ratoon crop sugarcane farmers were randomly selected from each village. Thus, a total sample of 80 farmers was selected across four villages. The data was gathered using a well-structured and pre-tested interview schedule through the personal interview method. Data collection was carried out during the agricultural year 2024–25.

2.1 Analysis of Data

2.1.1 Cost concepts used in analysis

Cost concepts were used in estimating costs and returns. The costs incurred in the cultivation of sugarcane were estimated in terms of Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost2, and Cost C3, here are the details of these Costs.

- a) **Cost A1:** This cost involves value of hired human labour, owned and hired bullock labour, owned and hired machine labour, cost of seeds, fertilizers, farmyard manure, plant protection chemicals, depreciation, land revenue and interest on working capital.
- b) **Cost A2:** Cost A1 + rent paid on leased in land

- c) **Cost B1:** Cost A1 or A2 + interest on owned fixed capital assets (excluding land)
- d) **Cost B2:** Cost B1+ rental value of owned land
- e) **Cost C1:** Cost B1 + imputed value of family labour
- f) **Cost C2:** Cost B2 + imputed value of family labour
- g) **Cost C3:** Cost C2 + 10 per cent of Cost C2 (To account for the managerial input of the farmers)

2.1.2 Income measures

- a) Farm business income or Net return over cost A1 = Gross income - Cost A1
- b) Family labour income or Net return over cost B2 = Gross income - Cost B2
- c) Net income (per hectare) = Gross income - Cost C2
- d) Farm investment income= Farm business income – imputed value of family labour

3. RESULTS AND DISCUSSION

3.1 Cost and Returns in Sugarcane Production

The Detailed comparison of Cost of Cultivation for plant and ratoon sugarcane cultivation has been presented in Table 1.

It was observed from Table 1 that the total cost of cultivation was ₹2,57,936.66/ha for plant sugarcane and ₹1,73,729.05/ha for ratoon sugarcane. The total variable cost accounted for ₹2,40,804.62/ha (93.4%) in plant and ₹1,59,972.63/ha (92.08%) in ratoon sugarcane. Among total variable costs, hired machine labour was the major component, incurring ₹1,10,265.35/ha (42.76%) in plant and ₹85,675.27/ha (49.31%) in ratoon sugarcane. The lower machine labour cost in ratoon is due to the absence of primary tillage. This was followed by hired human labour, costing ₹32,189.95/ha and ₹21,696.54/ha (both 12.48%) in plant and ratoon crops, respectively. This highlights the labour-intensive nature of sugarcane cultivation under both plant and ratoon conditions and underscores the significant role of labour in the overall production process. The findings are in line with (Singh et al., 2025).

Regarding owned human labour cost was ₹8,948.55/ha (3.47%) in plant sugarcane and ₹7,838.24/ha (4.51%) in ratoon sugarcane. Seed cost was much higher in plant sugarcane at

₹34,353.43/ha (13.32%) compared to ₹4,547.27/ha (2.61%) in ratoon, which only requires gap filling. Same findings with (Asha et al., 2019). In plant sugarcane, expenditure on Fertilizer and plant protection costs in plant crop were ₹26,693.89/ha (10.35%) and ₹15,147.78/ha (5.87%), and in ratoon ₹21,254.81/ha (12.23%) and ₹10,149.30/ha (5.84%), respectively. The total inputs costs are more for plant crop when compared to ratoon crop. The findings are in line with (Hassan et al., 2017). Other costs included FYM, owned machine labour, irrigation, and working capital interest (₹8,139.18/ha in plant, ₹5,398.10/ha in ratoon).

The total Fixed costs were ₹17,132.04/ha (6.64%) in plant sugarcane and ₹13,756.42/ha (7.91%) in ratoon sugarcane. Rental value of land was the largest fixed cost, followed by depreciation and interest on fixed capital. Overall, it was observed that the cost of cultivation of plant sugarcane was ₹84,207.61 per hectare higher than that of ratoon sugarcane, mainly due to higher seed and initial land preparation costs.

3.2 Cost of Cultivation in Terms of Cost Concepts

The cost of cultivation for plant and ratoon sugarcane was analysed using standard cost concepts i.e Cost A1, A2, B1, B2, C1, C2, and C3. Among these, Cost C2 is considered the most comprehensive, as it accounts for both variable and fixed costs, including imputed values. Therefore, it was taken as the base for assessing the total cost of cultivation in the present study.

It is observed from Table -2 that as there is no leasing activity in both cases of sample farmers hence, Cost A2 remained the same as Cost A1. All actual paid-out costs excluding family labour are included in Cost A1. The Cost A1 was higher in plant sugarcane accounting to ₹2,38,454.15 per hectare, while for ratoon sugarcane, it stood at ₹1,56,241.09/ha. The cost B1 per hectare was estimated as ₹2,40,011.61 for plant sugarcane and ₹1,57,491.67 for ratoon sugarcane. When the rental value of owned land was included, Cost B2 increased further to ₹2,48,988.11/ha for plant and ₹1,65,890.81/ha for ratoon sugarcane. The Cost C1, in plant sugarcane amounted to ₹2,48,960.16/ha and in ratoon sugarcane it was ₹1,65,329.91/ha. The most inclusive cost concept, Cost C2, which covers all variable costs, fixed costs, and imputed charges, was

calculated as ₹2,57,936.66/ha for plant sugarcane and ₹1,73,729.05/ha for ratoon. Finally, Cost C3, which includes an additional 10% of Cost C2 to account for managerial input, reached ₹2,83,814.83/ha in plant and ₹1,91,101.96/ha in ratoon sugarcane.

This clearly indicates that plant sugarcane involves higher cultivation costs under all cost concepts when compared to ratoon sugarcane. The primary reasons are the additional expenses on seed, field preparation, and planting activities in the plant crop, which are either reduced or entirely absent in ratoon cultivation. These results are aligned with Manju and Dinesha, 2024, Shinde, 2024 and Sulaiman et al., 2015.

3.3 Farm Income Measures and Profitability of Plant and Ratoon Sugarcane

The yield and profitability analysis of plant and ratoon sugarcane is presented in Table 3. The average yield was 132.26 tons/ha for plant cane and 102.38 tons/ha for ratoon cane. The gross returns were ₹3,57,102/ha for plant cane and ₹. 2,76,426/ha for ratoon. Despite higher gross

returns from plant cane due to greater yields, net returns were slightly higher in ratoon cane (₹1,02,696.94/ha) compared to plant cane (₹. 99,165.33/ha), owing to lower cultivation costs in the ratoon crop. The cost of production per quintal was lower in ratoon (₹. 169.69) than in plant cane (₹. 195.02). The B:C ratio was also more favorable for ratoon (1.59) versus plant cane (1.38), reflecting superior cost efficiency. This improved profitability is attributed to reduced input use and operational requirements in ratoon cultivation. These findings are in line with Gawas et al., (2024), who also reported better returns for ratoon cane.

Regarding income indicators, farm business income, which accounts for returns to the farmer's management and owned resources excluding family labour, was ₹1,20,004.91/ha for ratoon and ₹1,18,647.85/ha for plant cane. Family labour income was estimated at ₹1,10,355.19/ha in ratoon and ₹1,08,113.88/ha in plant sugarcane. Similarly, farm investment income, indicating returns over and above the cost of fixed capital investment, was also higher in ratoon sugarcane at ₹1,10,916.09/ha compared to ₹1,08,141.84/ha in plant sugarcane.

Table 1. Comparative cost of cultivation of plant and ratoon sugarcane (₹/ha)

Particulars	Plant sugarcane	Ratoon sugarcane
Variable cost		
1. Owned human labour	8,948.55 (3.47)	7,838.24 (4.51)
2. Hired human labour	32,189.95 (12.48)	21,696.54 (12.48)
Total	41,138.50	29,534.79
1. Owned machine labour	1,215.24 (0.47)	299.60 (0.172)
2. Hired machine labour	1,10,265.35 (42.76)	85,675.27 (49.31)
Total	1,11,480.59	85,974.87
Seed	34,353.43 (13.32)	4,547.27 (2.61)
FYM	3,331.25 (1.29)	2,767.70 (1.59)
Fertilizer	26,693.89 (10.35)	21,254.81 (12.23)
Plant Protection chemicals	15,147.78 (5.87)	10,149.30 (5.84)
Irrigation (electricity charges)	520.01 (0.201)	345.80 (0.19)
Interest on working capital (7%)	8,139.18 (3.15)	5,398.10 (3.10)
Total variable cost	2,40,804.62 (93.4)	1,59,972.63 (92.08)
Fixed cost		
Rental value of owned land	8,976.50 (3.47)	8,399.14 (4.82)
Land revenue	133.47 (0.05)	147.00 (0.084)
Depreciation	6,464.61 (2.50)	3,959.70 (2.27)
Interest on fixed capital (10%)	1,557.46 (0.60)	1,250.58 (0.71)
Total fixed cost	17,132.04 (6.64)	13,756.42 (7.91)
Total cost	2,57,936.66 (100.00)	1,73,729.05 (100.00)

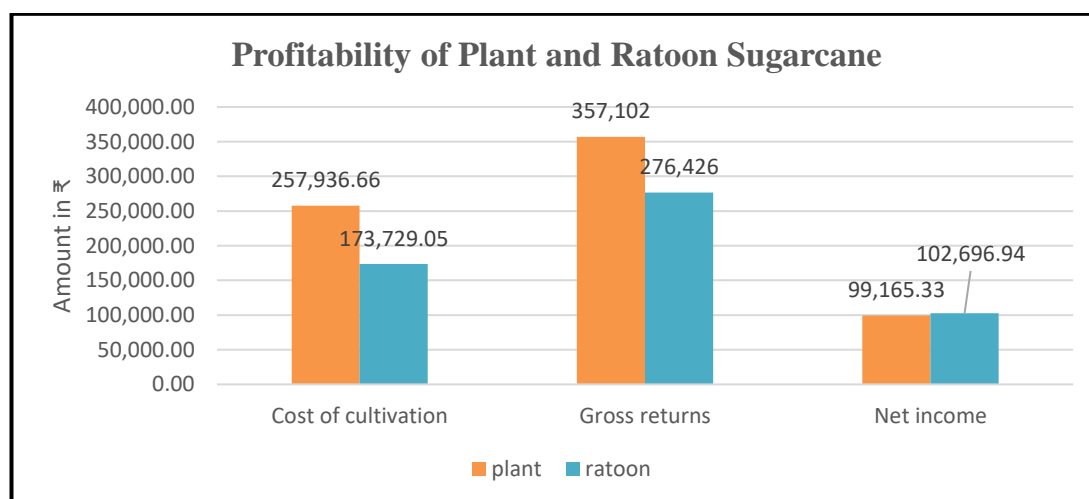
(Figures in the parentheses are percentage to total)

Table 2. Cost of cultivation of fresh and ratoon sugarcane according to cost concepts (₹/ha)

S.No:	Cost Concepts	Plant Sugarcane	Ratoon Sugarcane
1.	COST A1	2,38,454.15	1,56,241.09
2.	COST A2	2,38,454.15	1,56,241.09
3.	COST B1	2,40,011.61	1,57,491.67
4.	COST B2	2,48,988.11	1,65,890.81
5.	COST C1	2,48,960.16	1,65,329.91
6.	COST C2	2,57,936.66	1,73,729.05
7.	COST C3	2,83,814.83	1,91,101.96

Table 3. Farm Income Measures and Profitability of Plant and Ratoon Sugarcane

S. No.	Particulars	Plant sugarcane	Ratoon sugarcane
1.	Cost of cultivation	2,57,936.66	1,73,729.05
2.	Yield(t/ha)	132.26	102.38
3.	Price(₹/ton)	2,700.00	2,700.00
4.	Gross returns	3,57,102.00	2,76,426.00
5.	Net income	99,165.33	1,02,696.94
6.	Cost of production (₹/t)	1950.20	1696.90
7.	Cost of production (₹/q)	195.02	169.69
8.	Farm business income(₹/ha)	1,18,647.85	1,20,004.91
9.	Family labour income(₹/ha)	1,08,113.88	1,10,355.19
10.	Farm investment income (₹/ha)	1,08,141.84	1,10,916.09
11.	Returns per rupee of investment (B:C ratio)	1.38	1.59

**Fig. 1. Profitability of fresh and ratoon sugarcane**

4. CONCLUSION

The study clearly highlights the superior profitability and cost-efficiency of ratoon sugarcane under the given production conditions in Kamareddy district. Though plant sugarcane recorded a higher yield of 132.26 tons/ha and correspondingly greater gross returns of ₹3,57,102/ha, the high input costs particularly for seed, land preparation, and machine labour resulted in a net income of ₹99,165.33/ha. In contrast, ratoon sugarcane, with a yield of

102.38 tons/ha, generated slightly lower gross income (₹2,76,426/ha) but achieved higher net returns (₹1,02,696.94/ha) owing to reduced cultivation costs.

The Benefit-Cost (B:C) ratio was more favorable for ratoon cane (1.59) compared to plant cane (1.38), indicating better returns for each rupee invested. Additional income indicators such as farm business income, family labour income, and farm investment income also showed higher values for ratoon sugarcane. The lower cost of

production (₹169.69/q for ratoon vs. ₹195.02/q for plant) further underscores its economic advantage.

Overall, the results strongly suggest that while plant cane is essential for initiating the crop cycle, ratoon cane provides a more economically viable and sustainable option for farmers due to its lower input requirements and higher profitability.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, manuscript).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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