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# Economic analysis of castor cultivation and constraints faced by castor growers

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### Abstract
The present study examines the cost and returns of castor cultivation in Middle Gujarat, focusing on two major castor-growing districts: Ahmedabad and Vadodara. A total of 120 farmers were selected through multistage random sampling from four talukas and twelve villages. Data were collected via personal interviews using a pre-tested questionnaire. The findings revealed that the average Cost $C_2$ of castor cultivation was ₹ 76,359.18 per hectare, with marginal farmers incurring the highest cost among all farm categories. The average net return over Cost $C_2$ was ₹ 67,771.97 per hectare, indicating significant profitability. The overall input-output ratio based on Cost $C_2$ was 1:1.86, confirming that castor cultivation remains economically viable across all farm sizes despite cost variations. Major production constraints identified were high labour cost, followed by adverse weather conditions pest infestations and high input cost.

**Keywords:** Castor cultivation, economics, cost and returns, input-output ratio, production constraints

## Introduction
Oilseeds are crucial to Indian agriculture due to their economic importance. India is a major global contributor to both the production and consumption of edible oils. India ranks first in the production of castor, safflower, sesame and Niger; second in groundnut, rapeseed and mustard; third in linseed and fifth in sunflower production (Dubeya *et al*., 2023) [3].

Castor (*Ricinus communis L.*) belongs to the Euphorbiaceae family, is an important non-edible oilseed crop widely utilized for various industrial applications. Castor is primarily grown for its seeds which are rich in castor oil, a non-edible oil with a wide variety of applications in industries like pharmaceuticals, cosmetics, textiles, lubricants, biodiesel and others. Global demand for castor oil is rising constantly at 3 to 5 per cent/annum (www.castoroil.in).

India ranked first with an area of 1019.00 thousand hectares (70.37%) and production of 1979.30 thousand metric tonnes (89.12%), recording the highest yield (1942.30 kg/ha). Followed by Mozambique, Brazil, China, Myanmar and Thailand have smaller shares in both area and production. Ethiopia, Paraguay, Vietnam and South Africa make minor contributions to global castor production (Anonymous 2023) [1, 2]. Gujarat is the leading state with an area of 724.80 thousand hectares (70.01%) and production of 1595.20 thousand metric tonnes (81.43%), followed by Rajasthan, Andhra Pradesh, Odisha, Tamil Nadu, Karnataka, Maharashtra, Telangana and Madhya Pradesh contributed marginally to both area and production (www.cmie.com). In Middle Gujarat, Vadodara and Ahmedabad districts emerge as notable contributors to castor cultivation with area of 399.60 hundred hectares and 449.32 hundred hectares, respectively (Anonymous 2023) [1, 2].

## Materials and Methods
The study was conducted exclusively in the districts of Middle Gujarat. Multistage random sampling was used for the study. Three villages were randomly chosen from each selected taluka. Thus, a total of 12 villages were chosen for the study. A total of 120 castor growers were selected for the study. The respondents were categorized based on their land holdings into four groups: 25 marginal farmers (up to 1.00 ha), 49 small farmers (>1.00 to 2.00 ha), 28 medium farmers (>2.00 to 4.00 ha) and 18 large farmers (>4.00 ha).

## Data Collection
The primary data for the study was collected from the Ahmedabad and Vadodara areas using an interview schedule. The data pertains to the agricultural year 2024-25 and covers aspects related to costs in the study area.

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## Calculation of Cost and Return

The collected data was analysed and presented in tables for easy comparison. This tabular analysis method was used to estimate the costs, returns and profitability of crop cultivation of castor. The CACP cost concept, including cost A, cost B, cost $C_1$ and cost $C_2$, was employed to compute the cost of cultivation and production.

| Cost A = | Value of hired human labour<br>+ Value of bullock labour (owned / hired)<br>+ Value of seeds (owned/ purchased)<br>+ Value of manure (owned / purchased)<br>+ Value of fertilizer<br>+ Value of pesticides and insecticides<br>+ Irrigation charges<br>+ Charges for machinery (owned/hired)<br>+ Other paid out expenses if any<br>+ Depreciation on farm Building and implements<br>+ Interest on working capital |
|---|---|
| Cost B = | Cost A + Rental value of owned land + Interest on fixed capital assets (excluding land) |
| Cost $C_1$ = | Cost B + Imputed value of family labour |
| Cost $C_2$ = | Cost $C_1$ + 10 per cent of the Cost $C_1$ as a managerial charge |
| **Cost of Production per quintal** | Cost $C_2$/Yield of main product in quintal |

## Garrett's Ranking Technique

Garrett's ranking technique was used to identify the constraints in the castor cultivation and marketing in the study area. Garrett ranking is applied to rank a set of items or factors as perceived by the sample respondents based on certain criteria. The order of merit assigned by the respondents were converted into scores using the formula given by Garrett and Woodworth (1971) [5].

Per cent position of each rank = 100 ($R_{ij}$ - 0.5) /$N_j$
Where,

$R_{ij}$ = Rank given for the ith constraint by the jth individual.
$N_j$ = the number of items ranked by the $j^{th}$ individual
Scores were calculated and ranked to identify the most severe constraints.

## Results and Discussion
### Cost and Returns Analysis of Castor Growers

Cost and Returns Analysis of castor growers among all farm expenses, human labour accounted for the highest share (22.82%). The results revealed that the average total cultivation cost per hectare of castor farms was ₹ 76359.18.

**Table 1:** Break-up of the total cost of cultivation for castor (₹/ha)

| Sr. No. | Particulars | Group of farms | | | | |
|---|---|---|---|---|---|---|
| | | Marginal | Small | Medium | Large | Overall |
| 1. | Human labour | 17700 (23.16) | 17572.80 (23.00) | 17184.90 (22.50) | 17004.90 (22.31) | 17423.60 (22.82) |
| | (a) Family labour | 10200 (13.34) | 9965.76 (13.04) | 7254.82 (09.50) | 6567.16 (08.61) | 8872.21 (11.62) |
| | (b) Hired labour | 7500 (09.81) | 7607.04 (09.95) | 9930.07 (13.00) | 10437.73 (13.69) | 8551.38 (11.20) |
| 2. | Tractor | 4528.84 (05.92) | 4512.22 (05.90) | 4117.30 (05.39) | 4058.21 (05.32) | 4355.44 (05.70) |
| 3. | Seed | 2713.46 (03.55) | 2712.50 (03.55) | 2729.69 (03.57) | 2785.75 (03.65) | 2727.70 (03.57) |
| 4. | Manures | 4661.53 (06.01) | 4622.59 (06.05) | 4703.80 (06.16) | 4659.62 (06.11) | 4655.20 (06.10) |
| 5. | Fertilizers | 6657.69 (08.71) | 6704.21 (08.77) | 6711.54 (08.79) | 6749.71 (08.85) | 6703.05 (08.78) |
| 6. | Plant protection | 4180 (05.46) | 4225.02 (05.53) | 4221.31 (05.53) | 4313.66 (05.65) | 4228.07 (05.54) |
| 7. | Irrigation | 6150.96 (08.04) | 5944.38 (07.78) | 5836.70 (07.64) | 5663.22 (07.43) | 5920.12 (07.75) |
| 8. | Harvesting | 2765.83 (03.61) | 2583.33 (03.38) | 2576.54 (03.37) | 2553.96 (03.33) | 2615.36 (03.43) |
| 9. | Miscellaneous | 1121.79 (01.46) | 1260.15 (01.61) | 1383.75 (01.81) | 1492.45 (01.95) | 1295.01 (01.70) |
| 10. | Depreciation | 936.53 (01.22) | 1112.67 (01.45) | 1396.95 (01.83) | 1416.79 (01.85) | 1187.92 (01.56) |
| 11. | Interest on working capital | 3297.33 (04.31) | 3302.74 (04.32) | 3488.61 (04.56) | 3530.49 (04.63) | 3379.14 (04.43) |
| 12. | Rental value of owned land | 13935.89 (18.21) | 14021.60 (18.35) | 14091.37 (18.45) | 14052.83 (18.43) | 14024.70 (18.37) |
| 13. | Interest on fixed capital | 827.26 (01.08) | 867.53 (01.13) | 964.46 (01.26) | 1003.01 (01.31) | 902.07 (01.18) |
| 14. | Managerial Cost | 6947.71 (09.09) | 6944.17 (09.09) | 6940.70 (09.09) | 6928.46 (09.09) | 6941.74 (09.09) |
| 15. | Cost A | 44514 (58.24) | 44586.84 (58.37) | 47096.36 (61.68) | 47661.63 (62.53) | 45618.44 (59.74) |
| 16. | Cost B | 59277.20 (77.56) | 59475.94 (77.86) | 62152.19 (81.40) | 62717.48 (82.29) | 60545.22 (79.29) |
| 17. | Cost $C_1$ | 69477.20 (90.91) | 69441.70 (90.91) | 69407.02 (90.91) | 69284.65 (90.91) | 69417.44 (90.91) |
| 18. | Cost $C_2$ (Total Cost) | 76424.88 (100.00) | 76385.87 (100.00) | 76347.72 (100.00) | 76213.11 (100.00) | 76359.18 (100.00) |

**Source:** Field Survey
**Note:** Figures in parentheses indicate the percentage

## Yield, Price, Gross return and Net return

Information about yield, farm harvest price and gross income per hectare from castor production across various farm size categories provided in Table 2.

**Table 2:** Group wise production and income per hectare

| Sr. No. | Particulars | Category of farm | | | | |
|---|---|---|---|---|---|---|
| | | Marginal | Small | Medium | Large | Overall |
| 1. | Main product | | | | | |
| | Yield (q/ha) | 21.85 | 22.41 | 24.13 | 25.07 | 23.10 |
| | Price (₹/q) | 6080.98 | 6087.50 | 6114.96 | 6146.71 | 6101.44 |
| | Income (₹/ha) | 132924.03 | 136458.88 | 147612.79 | 154131.88 | 140975.99 |
| 2. | By product | | | | | |
| | Yield (q/ha) | 13.92 | 13.93 | 13.96 | 14.00 | 13.95 |
| | Price (₹/q) | 105.93 | 106.09 | 106.03 | 106.11 | 106.05 |
| | Income (₹/ha) | 1475.00 | 1478.88 | 1481.21 | 1485.55 | 1479.62 |
| | Gross Income (₹/ha) | 134399.03 | 137937.77 | 149094.01 | 155617.44 | 142455.61 |

*Source*: Field Survey

Overall, the production of the main product quantity was (23.10 q/ha), generating an income of (₹ 140975.99/ha). The quantity of by-product was (13.95 q/ha), yielding an income of (₹ 1479.62/ha). Thus, the total gross income from castor production amounted to (₹ 142455.61/ha). Large farms reported the highest gross income per hectare by ₹ 155,617.44 Medium farms followed with ₹ 149094 per hectare. Small farms earned ₹ 137,937.77 per hectare, while marginal farms had the lowest income at ₹ 134,399.03 per hectare.

**Net Returns over costs**
Table 3 shows that large farms achieved the highest net return over Cost A at ₹ 1,07,955.81 per hectare followed by medium farms (₹ 1,01,997.65/ha), small farms (₹ 93,350.93/ha) and marginal farms (₹ 89,885.03/ha). The overall average return was ₹ 96,837.17 per hectare. These results indicate that even after meeting actual cash expenditures, farmers retained substantial earnings. The increasing trend in returns with farm size can be attributed to better input use efficiency, mechanization and higher productivity among large farms.

**Table 3:** Net returns over different costs (₹/ha)

| Different costs | Category of farm | | | | |
|---|---|---|---|---|---|
| | Marginal | Small | Medium | Large | Overall |
| Cost A | 89885.03 | 93350.93 | 101997.65 | 107955.81 | 96837.17 |
| Cost B | 75121.87 | 78461.83 | 86941.82 | 92900.96 | 81910.39 |
| Cost $C_1$ | 64921.83 | 68596.07 | 79686.99 | 86332.79 | 73038.17 |
| Cost $C_2$ | 57974.15 | 61551.90 | 72746.29 | 79404.33 | 66096.43 |

*Source*: Field Survey

Overall, the highest net return over Cost $C_2$ was observed in large farms (₹ 79,404.33/ha) followed by medium farms (₹ 72,746.29/ha), small farms (₹ 61,551.90/ha) and marginal farms (₹ 57,974.15/ha). The overall average net return over Cost $C_2$ was ₹ 66,096.43 per hectare. Although total costs were higher for large farms, marginal farms incurred relatively higher costs per unit of output due to limited access

to economies of scale.

**Cost Price Relationship**
Table 4 provides a comprehensive account of the per quintal cost of castor cultivation across different farm sizes, based on various cost concepts.

**Table 3:** Cost of production per quintal of castor over different costs (₹/q)

| Different costs | Category of farm | | | | |
|---|---|---|---|---|---|
| | Marginal | Small | Medium | Large | Overall |
| Cost A | 1968.93 (57.42) | 1923.07 (57.55) | 1889.63 (60.91) | 1841.39 (61.79) | 1912.56 (58.85) |
| Cost B | 2644.32 (77.12) | 2587.29 (77.42) | 2513.33 (81.04) | 2441.82 (81.95) | 2560.09 (78.78) |
| Cost $C_1$ | 3110.94 (90.73) | 3031.86 (90.73) | 2813.87 (90.73) | 2703.71 (90.73) | 2948.24 (90.73) |
| Cost $C_2$ | 3428.79 (100.00) | 3341.65 (100.00) | 3101.39 (100.00) | 2980.02 (100.00) | 3249.49 (100.00) |

*Source*: Field Survey
**Note:** Figures in parentheses indicate the percentage of total

The cost of cultivation per quintal of castor varied across farm sizes, reflecting differences in cost efficiency. The overall Cost A was ₹ 1912.56, accounting for 58.85 per cent of the total production cost. Cost B was ₹ 2560.09 (78.78%) and Cost $C_1$ stood at ₹ 2948.24 (90.73 %). The total cost (Cost $C_2$) averaged ₹ 3249.49 per quintal. Among the farm categories, Cost $C_2$ was highest for marginal farms (₹ 3428.79/q) and lowest for large farms (₹ 2980.02/q), indicating an inverse relationship between cost and farm size.

**Input output ratio**
Based on the detailed cost analysis, input-output ratios were

calculated for different categories of farms and are presented in Table 5.

**Table 5:** Input-output ratio

| Different costs | Category of farm | | | | |
|---|---|---|---|---|---|
| | Marginal | Small | Medium | Large | Overall |
| Cost A | 1:3.02 | 1:3.10 | 1:3.17 | 1:3.26 | 1:3.12 |
| Cost B | 1:2.26 | 1:2.32 | 1:2.40 | 1:2.48 | 1:2.35 |
| Cost $C_1$ | 1:1.93 | 1:1.98 | 1:2.15 | 1:2.24 | 1:2.04 |
| Cost $C_2$ | 1:1.75 | 1:1.80 | 1:1.95 | 1:2.04 | 1:1.86 |

*Source*: Field Survey

The overall input-output ratio for all farm categories under Cost A was 1:3.12. Similarly, for Cost B, it was 1:2.35, for Cost $C_1$, it stood at 1:2.04 and for Cost $C_2$, it was 1:1.86. Additionally, it was noted that the input-output ratio based on Cost A was highest (3.26) for large farms, followed by medium farms (3.17) and small farms (3.10), conversely, it was lowest (3.02) on marginal farms. Similar results were observed in the thesis of Joshi *et al* (2024) [4].

## Production constraints faced by castor growers
To understand the major constraints in castor cultivation and marketing, farmers' responses were analysed through the Garrett ranking method.

**Table 6: Production constraints (n=120)**

| Sr. No. | Constraints | Garret score | Rank |
|---------|-------------|--------------|------|
| 1. | Labour shortage and high wages | 72 | I |
| 2. | Adverse weather conditions | 62 | II |
| 3. | Pest and disease incidence | 54 | III |
| 4. | High input cost | 47 | IV |
| 5. | Instability of yield | 40 | V |
| 6. | Lack of technical guidance | 30 | VI |
| 7. | Lack of mechanization | 06 | VII |

***Source*:** Field Survey

The analysis revealed that labour shortage and high wages emerged as the most severe production constraint with a Garrett score of 72, ranking first. This highlights the heavy dependence of castor cultivation on manual labour and the rising cost of hiring farm workers. The second major issue was adverse weather conditions (Garret score 62), indicating the vulnerability of castor to irregular rainfall and climatic extremes. Pest and disease incidence ranked third (Garret score 54), followed by high input costs (Garret score 47) and instability of yield (Garret score 40). Additional challenges included lack of technical guidance (Garret score 30) and lack of mechanization (Garret score 06), especially among smallholders, suggesting limited access to modern farming tools and advisory services.

## Conclusion
The present study highlights the economic viability and profitability of castor cultivation in Middle Gujarat, particularly in Ahmedabad and Vadodara districts. The average cost of cultivation (Cost $C_2$) was estimated at ₹ 76,359.18 per hectare, with net returns averaging ₹ 66,096.43 per hectare, indicating substantial profitability across all farm sizes. Larger farms recorded the highest net returns and input-output ratios, reflecting better resource utilization and economies of scale. In contrast, marginal farms faced relatively higher per-unit costs due to limited mechanization and lower productivity. The overall input-output ratio based on Cost $C_2$ stood at 1:1.86, reaffirming castor cultivation as a remunerative enterprise in the region.

Despite the economic gains, the study identified several critical production constraints, notably labour shortages and high wages, adverse weather conditions and pest and disease infestations. Addressing these challenges through improved mechanization, timely technical support and adaptive practices could further enhance the profitability and sustainability of castor farming. These findings underscore the need for targeted policy support and extension services to improve productivity and reduce vulnerability among small and marginal castor growers in Gujarat.

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