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Growth performance, profitability and marketing pattern of rapeseed-mustard in Chhattisgarh plain

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Abstract
The present study analyzes the economic viability and marketing structure of rapeseed-mustard cultivation in the Chhattisgarh Plain. A decadal trend revealed a marginally significant decline in the area under cultivation (CGR:-1.02%) and a non-significant drop in production and productivity, indicating stagnation in technological advancement. Cost analysis showed that Cost C3 averaged ₹ 31,686.44/ha, with hired labour and machinery being major inputs. Profitability was highest in Rajnandgaon, with gross income of ₹ 71,076.50/ha and a B:C ratio of 1:1.20. The marketable surplus was high across districts (94.72-95.67%), with processors as the dominant marketing intermediaries, handling 48.38% of produce. Among three identified marketing channels, the APMC route emerged as the most efficient, ensuring a 100% producer share in consumer rupee. These findings underscore the need for targeted policy support to enhance productivity and strengthen direct market linkages for rapeseed-mustard growers in the region.

Keywords: Rapeseed and mustard, compound growth rate, significant, non-significant, cost and return, profitability, marketable surplus and marketing pattern

1. Introduction
Rapeseed and mustard are vital oilseed crops cultivated extensively in India, particularly in the northern and central plains. Belonging to the Brassica genus, these crops are valued for their high oil content, adaptability to diverse agro-climatic conditions, and short growing duration, making them suitable for inclusion in various crop rotations. Traditionally, mustard has been deeply rooted in Indian agriculture, with its seeds and oil used for culinary, medicinal, and religious purposes.

In modern times, rapeseed-mustard has gained commercial significance due to the rising demand for edible oils, industrial lubricants, biodiesel, and animal feed derived from its oilcake. Mustard oil is an essential part of the Indian kitchen, especially in rural and eastern regions, due to its pungency, flavor, and perceived health benefits. Furthermore, the crop's residue and by-products hold traditional utility in rural households for fodder and fuel. Despite its importance, the area and productivity of rapeseed-mustard have shown fluctuating trends in recent years due to climatic challenges, market volatility, and limited technological adoption. Studying this crop is essential to understand its economic viability, marketing efficiency, and potential to enhance farmer income, especially in the Chhattisgarh Plain.

The present research aims to analyze the production economics, consumption patterns, and marketing structure of rapeseed-mustard, providing insights for policy intervention and sustainable oilseed development. In Chhattisgarh, rapeseed-mustard is cultivated on about 34,081 hectares, with the Chhattisgarh Plain contributing 13,391 hectares. Districts like Rajnandgaon, Kabirdham, and Bemetara offer suitable conditions for rapeseed and mustard cultivation. However, challenges such as declining acreage, stagnant productivity, and increasing input costs have raised concerns about the crop's economic sustainability in the region.

2. Materials and Methods
Chhattisgarh state comprises three agro-climatic zones: the Chhattisgarh Plain, the Bastar Plateau, and the Northern Hills. Among these, the Chhattisgarh Plain was purposively

selected for the present study due to its prominence in oilseed cultivation. Within this zone, the districts of Rajnandgaon, Kabirdham, and Bemetara were selected purposively based on the relatively larger area under oilseed crops. From each district, two blocks were randomly selected: Rajnandgaon and Dongargarh from Rajnandgaon district, Saharshpur-Lohara and Bodla from Kabirdham district, and Bemetara and Berla from Bemetara district. Subsequently, three villages from each block were selected randomly to fulfill the objectives of the study.

For the selection of respondents, a percentage proportionate sampling method was adopted, and a total of 50 farming households (representing 30% of the total rapeseed-mustard growers) were selected and analyzed. The smaller sample size was due to the limited number of active rapeseed-mustard growers, as the area under these crops has been declining annually by 0.016%.

3. Collection of Data

Primary data was collected through personal interview method with the help of pre-tested questionnaires. The secondary data was collected for the period of 10 year from 2012-13 to 2021-22 through different Government offices such as Government of Chhattisgarh Agriculture Development and Farmer Welfare and Bio-Technology Department (agriportal.cg.nic.in) , Directorate of Statistics Government of Chhattisgarh

3.1. Trend

$Y = a + bx$

Where
Y = dependent variables (Area, Production and Yield)
a = intercept
b = Regression co-efficient
x = period

3.2 Compound growth rate

$Y = abt$

Where,
Y = Area, Production and Yield
a = Intercept
b = Regression Coefficient of Y on Time t
CGR in (%) = (antilog b-1) * 100

3.3 Cost concepts and Income measures

Cost A_1

- Value of Permanent labour
- Value of hired human labour
- Value of owned bullock labour
- Value of hired bullock labour
- Value of owned machinery
- Hired machinery charges
- Value of owned fertilizers and manures
- Value of purchased fertilizers and manures
- Value of own farm produced seed
- Value of purchased seed
- Irrigation charges
- Cannel water charges
- Market value of pesticides, herbicides etc.
- Interest on working capital
- Depreciation on farm implements and farm buildings
- Land revenue and other taxes

Cost A_2 = Cost A_1 + Rent paid for Leased in Land.
Cost B_1 = Cost A_1 + Interest on value of Owned fixed Capital assets (excluding land)
Cost B_2 = Cost B_1 + Rental value of owned land
Cost C_1 = Cost B_1 + Imputed value of Family Labour.
Cost C_2 = Cost B_2 + Imputed value of Family labour.
Cost C_3 = Cost C_2 + 10 per cent of cost C_2 taking as managerial allowances.

3.4. Marketing Pattern

I. Marketable Surplus

MS = Total quantity produced-(Total quantity used for consumption + Seed for next growing session)

MS = P-(C+S)

Where,
MS = Marketable Surplus
P = Total Production
C = Family Consumption
S = Quantity Retains for Seeds

II. Price Spread

Price Spread = Price Received By the Farmer / Retail Price Paid By the Consumer ×100

4. Results and Discussion

4.1. Compound Growth Rate of Rapeseed and Mustard in Chhattisgarh Plain

An analysis of the Compound Growth Rate (CGR) for rapeseed and mustard over the past decade in the Chhattisgarh Plain revealed a gradual decline in area and production. The area under cultivation showed a negative CGR of-1.02 percent (p = 0.05721), indicating a marginally significant decline at the 10 percent level. This suggests a slow reduction in sown area, possibly due to crop diversification, market disincentives, or unfavorable agro-climatic conditions. Production declined at a CGR of-1.20 percent (p = 0.20531), while productivity remained almost stagnant with a CGR of-0.19 percent (p = 0.77921); both trends were statistically non-significant. These results suggest limited technological advancement or improvement in input use efficiency. Overall, the findings indicate a concerning trend that warrants policy attention to enhance the economic viability and productivity of rapeseed and mustard in the Chhattisgarh Plain. Similar result was found by Kumar *et al.* (2016) [2] with marginally significant decline in mustard area (-1.05 percent*) and non-significant changes in production (-1.10 percent) and productivity (-0.12 percent) in Western Uttar Pradesh during 2005-15.

Table 1: Compound Growth Rate of Rapeseed & Mustard in Chhattisgarh Plain

Year	Area (Hectare)	Production (Tonne)	Productivity (Tonne/Hectare)
2012-2013	13,711	6,142	0.45
2013-2014	13,093	6,551	0.50
2014-2015	14,373	7,094	0.49
2015-2016	14,851	7,470	0.50
2016-2017	12,727	5,469	0.43
2017-2018	12,893	5,311	0.41
2018-2019	11,563	5,206	0.45
2019-2020	11,421	3,940	0.34
2020-2021	10,149	5,257	0.52
2021-2022	13,391	6,865	0.51
CGR (percent)	-1.01677*	-1.20131 ^{NS}	-0.18644 ^{NS}
P-Value	0.05721	0.20531	0.77921

Note: *** denote significant at 1 percent level of significance, ** denote significant at 5 percent level of significance, *denote significant at 10 percent level of significance, NS = Not Significant

4.2 Cost Structure of Rapeseed-Mustard Cultivation in Chhattisgarh Plain

Table. 2 highlights the cost structure of rapeseed-mustard cultivation in the Chhattisgarh plain, with the overall Cost was estimated at ₹ 31,686.44/ha in C.G Plain. The major components included hired human labour (15.00%, ₹ 4,753.00/ha), machinery (8.47%, ₹ 2,682.61/ha), fertilizers and manures (8.15%, ₹ 2,582.94/ha), and seeds (5.83%, ₹ 1,846.60/ha). These costs formed Cost A1, contributing 47.06% (₹ 14,911.76/ha) of the total. Cost B1 (₹ 15,152.86/ha) included interest on fixed capital, while Cost B2 (₹ 25,152.86/ha) also accounted for the rental value of owned land. Adding the imputed value of family labour (₹ 3,653.00/ha), Cost C1 and C2 stood at ₹ 18,805.86/ha and ₹ 28,805.86/ha, respectively. Incorporating a 10% managerial charge, Cost C3 reached ₹ 31,686.44/ha and Cost A2 + FL was estimated at Rs 18,564.76/ha in C.G Plain.

Across districts, Rajnandgaon recorded the highest cost across all levels (A1 to C3), followed by Kabirdham, with Bemetara having the lowest. These findings suggest higher input intensity in Rajnandgaon, while Bemetara's lower costs may reflect reduced input use or cost efficiency and the Cost A2 + FL was highest in Rajnandgaon Rs 19,005.23/ha and lowest in Bemetara Rs 17,211.72/ha, with an average of Rs 18,564.76/ha for the Chhattisgarh Plain. similar result was reported by Yadav and Meena (2016) [11] they found that the Cost C3 for mustard cultivation in Rajasthan was Rs 32,100/ha. Cost A1 contributed 47.2 percent of total cost. Cost B2 and C2 were Rs 24,500/ha and Rs 28,700/ha respectively.

Table 2: Cost on different heads of Rapeseed-Mustard crop in Chhattisgarh plain (Rs./ha)

Particulars	Rajnandgaon (14)		Kabirdham (26)		Bemetara (10)		C.G Plain (50)	
	Rs./ha	Percent	Rs./ha	Percent	Rs./ha	Percent	Rs./ha	Percent
Cost A_1	15315.94	47.36	14985.24	47.14	13276.72	43.53	14911.76	47.06
Cost A_2	15315.94	47.36	14985.24	47.14	13276.72	43.53	14911.76	47.06
Cost B_1	15711.48	48.58	15376.32	48.37	13789.79	45.22	15152.86	47.82
Cost B_2	25711.48	79.50	25376.32	79.82	23789.79	78.01	25319.43	79.91
Cost C_1	19400.76	59.99	18901.32	59.45	17724.79	58.12	18805.86	59.35
Cost C_2	29400.76	90.91	28901.32	90.91	27724.79	90.91	28805.86	90.91
Cost C_3	32340.84	100.00	31791.45	100.00	30497.27	100.00	31686.44	100.00
Cost A_2 + FL	19,005.23	-	18,510.24	-	17,211.72	-	18,564.76	-

4.3 Measures of Farm Profit in Rapeseed-Mustard Cultivation in Chhattisgarh Plain

Table 3 presents profitability measures of rapeseed-mustard cultivation across different farm sizes in selected districts of the Chhattisgarh plain. The highest main product yield was observed in Rajnandgaon (13.25 qt/ha), followed by Kabirdham (12.33 qt/ha) and Bemetara (11.60 qt/ha), with an overall average of 12.44 qt/ha. By-product yield ranged from 8.70 qt/ha in Bemetara to 14.51 qt/ha in Rajnandgaon. Cost of cultivation was highest in Rajnandgaon (Rs. 32,340.84/ha), and lowest in Bemetara (Rs. 30,497.27/ha). The cost of production was lowest in Rajnandgaon (Rs. 2,441.70/qt). Gross and net incomes were also highest in Rajnandgaon at Rs. 71,076.50/ha and Rs. 38,735.66/ha, respectively. Input-output and B:C ratios were highest in Rajnandgaon (1:2.20 and 1:1.20), while overall averages stood at 1:1.70 and 1:0.70 in C.G Plain. These findings reflect that better returns were associated with higher input use. Similar result was reported by Meena and Chauhan (2015) [4] for mustard in Rajasthan, where large farms showed higher yields (12.80 qt/ha), net returns (₹ 35,000/ha), and B:C ratio (1:1.15) due to efficient input use and better market access.

Table 3: Yield, value of output and cost of production of Rapeseed-Mustard in Chhattisgarh plain

Particular	Rajnandgaon	Kabirdham	Bemetara	C.G Plain
	Rs./ha	Rs./ha	Rs./ha	Rs./ha
Yield main product (qt/ha)	13.25	12.33	11.60	12.44
Main product @ 5200 Rs/qt	68900.00	64100.40	60320.00	52238.37
By product (qt/ha)	14.51	9.25	8.70	10.61
By product (150Rs/qt)	2176.50	1387.50	1305.00	1591.45
Gross income (Rs./ha)	71076.50	65487.90	61625.00	53829.81
Cost of cultivation (Rs./ha)	32340.84	31791.45	30497.27	31686.44
Net income (Rs./ha)	38735.66	33696.45	31127.73	22143.37
Cost of production (Rs/qt)	2441.70	2579.01	2630.21	1780.34
Input : Output ratio	1:2.20	1:2.06	1:2.02	1:1.70
B:C ratio	1:1.20	1:1.06	1:1.02	1:0.70

4.4 Break-up of Total Cost and Returns over Different Cost Concepts in Rapeseed-Mustard Cultivation

Table 4 presents the cost structure of rapeseed-mustard cultivation across three districts in Chhattisgarh plain. The overall Cost A1 and A2 was ₹ 14,736.13/ha, Cost B1 ₹ 15,152.86/ha, Cost B2 ₹ 25,152.86/ha, Cost C1 ₹ 18,805.86/ha, Cost C2 ₹ 28,805.86/ha, Cost C3 ₹ 31,686.44/ha and cost A2 + FL was Rs 18564.76. Among districts, Cost C3 and cost A2 + FL was highest in Rajnandgaon (₹ 32,340.84/ha & Rs 19005.23/ha), followed by Kabirdham (₹ 31,791.45/ha & Rs 18510.24/ha) and lowest in Bemetara (₹ 30,497.27/ha & Rs 17211.72/ha).

As shown in Table 4, overall returns over various costs were: ₹ 39,093.68/ha over Cost A1/A2, ₹ 38,676.96/ha over B1, ₹ 28,676.96/ha over B2, ₹ 35,023.96/ha over C1, ₹ 25,023.96/ha over C2, and ₹ 22,143.37/ha over C3. The highest return over Cost C3 cost A2 + FL was recorded in Rajnandgaon (₹ 38,735.66/ha & Rs 52071.27/ha), followed by Kabirdham (₹ 33,696.45/ha & Rs 46977.66/ha) and Bemetara (₹ 31,127.73/ha & Rs 44413.28/ha), indicating better profitability in Rajnandgaon. similar results were also observed by Patel and Meena (2022) [5].

Table 4: Income obtained over different cost of rapeseed and Mustard crop in Chhattisgarh plain (Rs./ha)

Particulars	Rajnandgaon	Kabirdham	Bemetara	C.G Plain
Return over cost A_1	55760.56	50502.66	48348.28	39093.68
Return over cost A_2	55760.56	50502.66	48348.28	39093.68
Return over cost B_1	55365.03	50111.58	47835.21	38676.96
Return over cost B_2	45365.03	40111.58	37835.21	28676.96
Return over cost C_1	51675.74	46586.58	43900.21	35023.96
Return over cost C_2	41675.74	36586.58	33900.21	25023.96
Return over cost C_3	38735.66	33696.45	31127.73	22143.37
Return over cost A_2 + FL	52071.27	46977.66	44413.28	35265.05

4.5 Marketable Surplus of Rapeseed-Mustard in Chhattisgarh Plain

The average cultivated area per farm was highest in Rajnandgaon (0.84 ha), followed by Kabirdham (0.72 ha) and Bemetara (0.35 ha). Yield also followed a similar pattern, with 13.25 qt/ha in Rajnandgaon, 12.29 qt/ha in Kabirdham, and 11.60 qt/ha in Bemetara, resulting in an average production of 8.46 qt/farm across C.G. Plain. Seed retention ranged from 3.86% to 4.78%, while household consumption was negligible (0.02-0.05 qt). leading to a high marketable surplus: 95.67% in Rajnandgaon, 95.14% in Kabirdham, and 94.72% in Bemetara, with an overall surplus of 8.06 qt/farm (95.33%) in C.G. Plain.

Processors emerged as the dominant intermediaries across all districts, handling 48.38% (3.90 qt/farm) of mustard in C.G. Plain. Their share was highest in Kabirdham (51.67%), followed by Rajnandgaon (51.09%) and Bemetara (33.11%). APMC was the second most preferred outlet, receiving 29.33% of the surplus. Village traders, more prevalent in rural areas, had a significant role in Bemetara (36.89%), while in Rajnandgaon and Kabirdham, their share was 19.19% and 19.88% respectively. On average, village traders handled 1.80 qt/farm (22.29%) in the C.G. Plain. Similar result was found by Sharma *et al.* (2017) for marketable surplus of mustard was high across all farm sizes. Large farms marketed 1,075.9 qt (86.7%), medium farms 831.4 qt (88.8%), and small farms 186.8 qt (91.1%) of their total produce.

Table 5: Marketable surplus of Rapeseed-Mustard in Chhattisgarh Plain

	Particular	Rajnandgaon (14)		Kabirdham (26)		Bemetara (10)		C.G Plain (50)	
		qt/farm	Percent	qt/farm	Percent	qt/farm	Percent	qt/farm	Percent
1	Cultivated area (ha./Farm)	0.84		0.72		0.35		0.64	
2	Yield main product (qt/ha)	13.25		12.29		11.60		12.40	
3	Total quantity produce (qt/farm)	11.74		9.35		4.13		8.46	
4	Quantity retained for seed (qt/farm)	0.45	3.86	0.41	4.39	0.20	4.78	0.35	4.19
5	Consumption (qt/farm)	0.05	0.47	0.04	0.47	0.02	0.50	0.04	0.47
6	Total quantity utilized (qt/farm)	0.51	4.33	0.45	4.86	0.22	5.28	0.39	4.67
	Marketable surplus	11.24	95.67	8.89	95.14	3.91	94.72	8.06	95.33
	Quantity sold of Mustard through different intermediaries (In quintal per farm)								
	Particular	Rajnandgaon (14)		Kabirdham (26)		Bemetara (10)		C.G Plain (50)	
		qt/farm	Percent	qt/farm	Percent	qt/farm	Percent	qt/farm	Percent
1	Village trader	2.16	19.19	1.77	19.88	1.44	36.89	1.80	22.29
2	APMC	3.34	29.72	2.53	28.45	1.17	30.00	2.37	29.33
3	Processor	5.74	51.09	4.59	51.67	1.30	33.11	3.90	48.38
	Total Marketable surplus	11.24	100.00	8.89	100.00	3.91	100.00	8.06	100.00

4.6 Marketing Channels and Price Spread in Different Marketing Channels of Rapeseed-Mustard Crop

Three prominent marketing channels were identified:

1. Producer → Village Trader → Wholesaler → Processor
2. Producer → Commission Agent → Processor
3. Producer → APMC → Processor

In Channel-I (Producer → Village Trader → Wholesaler → Processor), the total marketing cost was ₹ 163.00/qt, with the producer receiving ₹ 5200.00 and the processor paying ₹ 5500.00. The producer's share in the consumer's rupee was 94.55%, affected by multiple intermediaries. In Channel-II (Producer → Commission Agent → Processor), a total marketing cost of ₹ 316.50/qt was recorded, primarily due to a 5% commission (₹ 262.50). Despite higher costs, the producer received ₹ 5250.00, equivalent to the consumer price, resulting in a 100% producer share. Channel-III (Producer → APMC → Processor) was the most efficient. The producer incurred a minimal cost of ₹ 62.50/qt for transportation, packing, and loading and received ₹ 5080.00, with no intermediaries involved—yielding a 100% share in the consumer's rupee. Similar result was reported by Sharma and Tiwari (2021) [6] that direct marketing channels for mustard in Rajasthan ensured higher producer share (up to 100%) and lower marketing costs, enhancing farmer profitability and multiple intermediaries led to higher price spread and reduced producer share.

Table 6: Total Marketing cost and Producer Share in percentage in consumer's Rupee in different channels of linseed in Chhattisgarh plain (Rs./qt)

S. No.	Particulars	Channel-I	Channel-II	Channel-III
1.	Price received by the producer	5200	5250	5080
2.	Price received by Processor/ Consumer price	5500.00	5250.00	5080
3.	Total Marketing cost	163.00	316.50	62.50
4.	Producer Share in percentage in consumer's Rupee	94.55	100.00	100.00

Table 7: Price received by different intermediary

S. No.	Particulars	Received price
1.	Village Trader	5350
2.	Wholesaler	5500
3.	APMC	5080

Table 8: Major constraints in production of rapeseed-mustard in Chhattisgarh Plain

S. No.	Particular	C.G Plain	
		Mean	Rank
1.	Lack of improved Varieties of Seed	72.86	1
2.	Unfavorable weather condition	58.51	2
3.	Pest & disease infestation.	48.59	3
4.	Lack of knowledge about latest production technology	38.71	4
5.	Problem of availability of labour during the crop season.	23.70	5

5. Conclusion

The study highlights critical insights into the cultivation economics and marketing of rapeseed-mustard in the Chhattisgarh Plain. The declining trend in area and production, along with stagnant productivity, indicates a need for renewed focus on agronomic improvements and technological interventions. While cultivation remains profitable—particularly in Rajnandgaon—high input costs and variability across districts suggest uneven access to resources and efficiencies. The substantial marketable surplus across farms reflects the crop's commercial importance. However, marketing remains dominated by intermediaries, with processors playing a key role. Among the three observed marketing channels, the APMC route proved most efficient, offering the highest producer share in the consumer price. Therefore, strengthening institutional

marketing support, improving input efficiency, and incentivizing productivity-enhancing practices are essential to ensure sustainable growth and profitability in rapeseed-mustard cultivation across the region.

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