

Original Research Article

Rapeseed-Mustard Farming in Begusarai, Bihar, India. - A Holistic Exploration of Growth, Economic Viability, and Hindrances

ABSTRACT

The present study conducted a comprehensive analysis of the rapeseed-mustard sector's economic dynamics in India, with a focus on Bihar's Begusarai district. Despite a marginal decline in cultivation area, there was a noteworthy upswing in production and productivity. The average cost of cultivation per hectare was INR 63,873.1, while the gross income stood at INR 83,746.92, yielding a favorable return-to-cost ratio of 1:1.39, implying that rapeseed-mustard fetched an additional return of 39 paisa on each rupee spent. Primary constraints identified included the absence of high-quality seed varieties and elevated transportation expenses, both warranting attentions. To bolster the future of rapeseed-mustard, widespread dissemination of advanced farming techniques and the establishment of processing facilities among smallholders is recommended.

Keywords: Rapeseed-Mustard, CGR, Costs and Returns, Constraints, SRSWOR etc.

1. INTRODUCTION

India holds a top-ranking in the world not only in terms of rich diversity of oilseed crops but also in terms of area as well. Oilseeds occupy an important position in the Indian economy as they account for 14 per cent of the gross cropped area and contributing more than 4 per cent to the Gross National Product (GNP) as per Directorate of oilseed Development (DOD). India is the third largest rapeseed-mustard producer in the world after China and Canada with 16 per cent of world's total production. The area under rapeseed-mustard in the country was 6.23 million hectares, produced about 9.34 million tonnes with 1499 kg/ha productivity during the year 2018-19. Rapeseed-mustard and other oilseeds crops play a significant role in the agricultural economy of Bihar state. Bihar occupies 9th position in area and production of rapeseed- mustard in the country, with a growth rate of 7.34% during the eighties whereas Rajasthan state with top ranked. which accounted for 1.35 per cent of area and 1.17 per cent of production during the year 2018-19. It is the most important crops among oilseeds in terms of both area (0.08 million ha) and production (0.11 million tonnes) in Bihar. (DES, Government of Bihar Patna, 2018-19). Rapeseed-mustard crop is grown during *rabi* season as both irrigated and rain fed crop. The noteworthy situation in Bihar is that there has been wide fluctuation in

the mustard production, which is attributed to a number of factor such as the seasonal conditions, area under crop, level of inputs used, price of Rapeseed- mustard *etc.* Production of oilseeds and oils has not fluoresced with increasing demand for edible oils and due to this widening demand-supply gap has necessitated imports of edible oils. With competing demands on agricultural land from various crops and enterprises, the production of oilseeds can be increased only if productivity is improved significantly, and farmers get remunerative prices and assured market access. However, farmers face various constraints in oilseeds production. Unavailability of good Variety seeds, Severe Argo-ecological, technological, institutional, and socio-economic constraints also inhibit exploitation of the yield potential of crops and need to be addressed.

The area, yield and price of Rapeseed- mustard play a greater role in enhancing of Rapeseed- mustard. It is therefore, imperative to examine the relative contribution of area, yield and price of Rapeseed- mustard. India is deficit in oilseed production and wide gap between demand and supply. Keeping in view, Bihar is the state which has potential to contribute significant amount to fulfil the demand and supply gap and can reduce the dependency on imports. With the above facts, present study has been planned and conducted in Begusarai District of Bihar.

Objectives of the investigation:

1. To examine the growth in area, production and productivity of Rapeseed and mustard crop in Bihar.
2. To estimate the costs and returns of Rapeseed-Mustard production in study area.
3. To assess farmers level constraints and opportunities in cultivation of Rapeseed and mustard

2. RESEARCH METHODOLOGY

The study is based on both secondary and primary data. The required secondary data were collected from various published sources and government database while the primary data were collected from selected rapeseed-mustard growers with the help of pre-tested schedule by personal interview. Sample farmers were selected based on SRSWOR Technique. The study was conducted in twoblocks under Rapeseed-Mustard in Begusarai district of Bihar. Three villages from each block consisting of 20rapeseed-mustard growers from each village were selected randomly. Thus, the data were collected from 120farmers through a semi-structured interview schedule by using personal interview technique. The secondary data on area, production and productivity of rapeseed-mustard in Begusarai districts & Blocks were collected from District Statistical Office of the respective district. The data for Bihar state was collected from the Directorate of Economics and statistics, Govt. of Bihar for the

period of 1998 to 2020. Thereafter data were compiled, tabulated, analysed and interpreted as per objectives of the study.

2.1 Compound Growth Rate

To calculate the **compound growth rates** (CGR) of area, production and yield of rapeseed-mustard, the following exponential trend equation were used.

$$Y = ab^t$$

Where Y = the variable for which growth rate is calculated

t = time variable (1, 2, 3... n) in years

a = intercept,

b = the regression co-efficient of 'Y' on t .

The above exponential equation can be expressed in terms of log form as follows:

$$\text{Log}Y = \text{Log}a + t\text{Log}b$$

After that, the CAGR per cent can be expressed as: $(\text{Antilog } b - 1) \times 100$

The standard error of the growth rate was estimated and tested for its significance with 't' statistic.

Compound annual growth rate was computed for Begusarai district and Bihar state as a whole.

2.2 Economics of rapeseed-mustard cultivation:

Study has been worked out using the cost incurred per hectare of sample farmers and return over the associated cost was estimated by using the classification of costs based on "Sen Committee" (1979).

2.2.1 The classification of costs based on Dr. Sen's Committee report (1979) is as follows

- ✚ **Cost - A₁**: It included wages of hired human labor, cost of bullock labor, charges of hired machinery, cost of seed, value of organic manure and chemical fertilizers, Weedicide, Insecticides, value of plant protection components, interest on working capital, depreciation on farm machinery, implements, equipment, farm buildings, land revenue etc.

Note 1: To calculate depreciation under the straight-line method, simply divide the number of years of useful life into the depreciable balance (purchase price minus salvage value).

Depreciation = $(\text{Purchase Price} - \text{Salvage Value}) / \text{Years of Useful Life}$

Note 2: Interest on working capital estimated @ **3% Rate of Interest**

- ✚ **Cost - A₂**: It consists of Cost 'A₁' plus rent paid for leased in the land.
- ✚ **Cost - B₁**: Cost 'B₁' consists of cost 'A₁' or 'A₂' plus interest on fixed capital invested in the

business excluding the value of the land.

Note:Interest on fixed capital estimated @ **8%Rate of Interest**

- ✚ **Cost - B₂:** Cost 'B2' consists of Cost 'B1' plus the rental value of own land.
- ✚ **Cost - C₁:** Cost 'C1' consists of cost 'B1' plus imputed value of family labor.
- ✚ **Cost - C₂:** Cost 'C2' consists of Cost 'B2' plus imputed value of family labor.
- ✚ **Cost - C₃:** Cost C plus 10 % managerial cost of A

The above farm management cost concepts were used for calculating the cost of production per hectare of Rapeseed-Mustard crop.

2.2.2 Procedure for determining the value of the product

The value of the product was computed at the actual prices received by the respondents from the market agency during the study period.

- a. Gross Income:** It was evaluated as the value of sum total of main product and by product, calculated at current harvest prices.
- b. Net Income:** It was estimated as difference between gross income and total cost of cultivation.
- c. Returns to Cost Ratio:** It was evaluated as the ratio of gross income to the total cost of cultivation.

2.3 Constraints analysis:

Constraints faced by rapeseed-mustard growers related to production were prioritized by using Garrett Ranking Technique.

Garrett Ranking Method: In this method the farmers were asked to rank the given constraint according to the severity of the problem. In analysis, rank 1 means most important problem and rank 15 means least important problem. In the next stage rank assigned to each reason by each individual were converted into per cent position by using the formula:

$$\text{Percentage Position} = 100 (R_{ij} - 0.5) / N_j$$

Where, R_{ij} = rank given for i^{th} item by j^{th} individual

N_j = number of items ranked by j^{th} individual

The percentage position was then converted to Garrett Score using Garrett Ranking conversion table. The individual score then obtained were added and mean value were calculated and ranked in descending order.

3. RESULTS AND DISCUSSION

3.1 Compound annual growth rate (CGAR %) of area, production and productivity of rapeseed-mustard in the state of Bihar and selected district

The Compound annual growth rate of area production and productivity of rapeseed-mustard in Bihar during the decades of 1998-99 to 2008-09, 2008-09 to 2018-19 were worked out to compare the rate of growth in the selected district and the state of Bihar over periods and have been presented in Table 1.

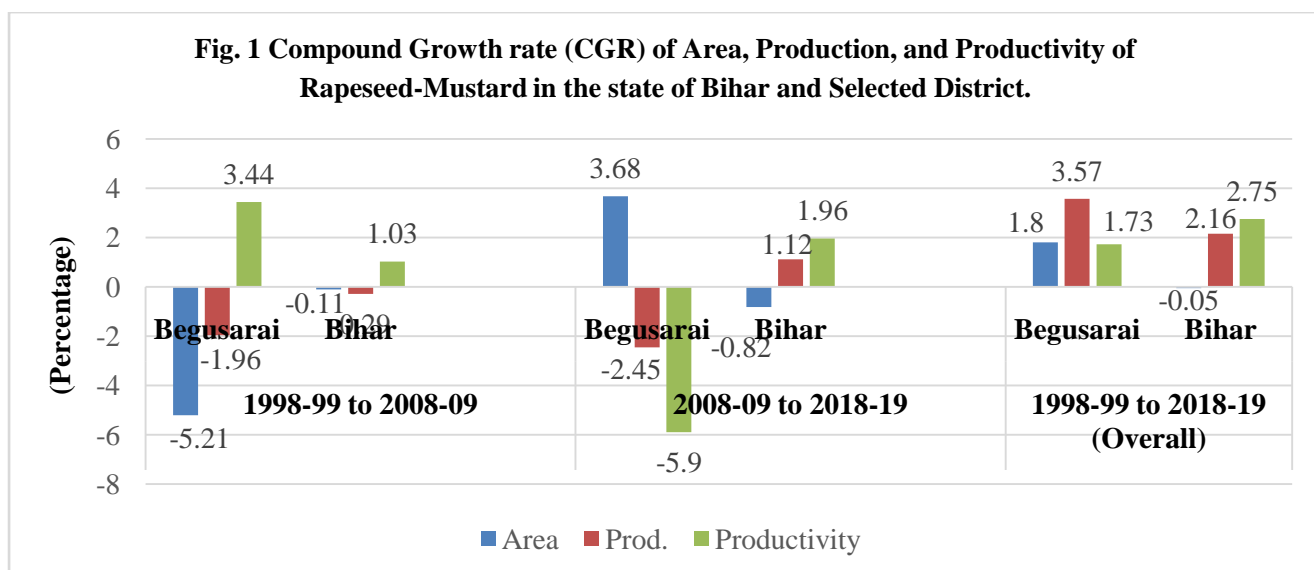
Table 1: Compound annual growth rate (CGAR %) of area, production and productivity of rapeseed-mustard in the state of Bihar and selected district

Sl. No.	Study Area	Time Period								
		Period 1 (1998-99 to 2008-09)			Period 2 (2008-09 to 2018-19)			Overall (1998-99 to 2018-19)		
		Area	Prod.	Productivity	Area	Prod.	Productivity	Area	Prod.	Productivity
1.	Begusarai	-5.21*	-1.79*	3.44	3.68	-2.25	-5.9	1.80**	3.57	1.73
2.	Bihar	-0.11*	0.91	1.03	-0.82**	1.12	1.96	-0.05*	2.71*	2.75

* Significant at 1 % Level of probability ** Significant at 5 % Level of probability

It was observed from the table that the area, production and productivity of rapeseed-mustard in Bihar showed compound growth rates of - 0.05, 2.16 and 2.75 percent respectively during the entire period i.e., 1998-99 to 2018-19 which were significant at 1 per cent level of probability. It clearly indicated that though there has been negative in the area growth but the production and productivity of rapeseed-mustard during this period was positive and significant in the state of Bihar. Districts wise analysis indicated that taking the entire period together i.e., 1998-99 to 2018-19 there was positive growth in the area that is 1.80 percent at 5 % level of probability in district of Begusarai. However, the growth in production and productivity of rapeseed-mustard was observed to be 3.57 and 1.73 per cent respectively. It is clearly indicated that there was a negative and non-significant growth in area and production of rapeseed-mustard during 1998-99 to 2008-09. It was probably due to either of the fact that farmers are not aware about new technologies or unavailability of HYV of seeds for cultivation of Rapeseed-Mustard crop during that period. Furthermore, during the sub period 2008-09 to 2018-19 area under Rapeseed-Mustard increased in the Begusarai district of Bihar. However, production and Productivity of Rapeseed-Mustard during this period registered negative and non-significant growth trend. The positive Growth in area under rapeseed-mustard in Begusarai District may be due to favourable weather condition and government efforts to expansion of area, production and productivity under oilseeds & Edible oil crops.

Therefore, the study indicated that compound growth rate of production and productivity of rapeseed-mustard in Bihar and Selected districts over period was positive in spite of decline or negative growth in area under Rapeseed-Mustard was observed over the period under study.



3.1 Estimated Coefficient, t-statistics and p-value in Exponential growth function

For the trends analysis of area, production and productivity, the Coefficient, t-statistics and p-value were estimated in exponential growth function. Table 2 indicated that the p value was worked out to find the significance level. The Area and production have shown significant in case of period-I in exponential growth function for Begusarai. For Bihar State, it was observed that the area and production has shown significant during entire period, while in case of period-I & period-II the area were significant in exponential growth function (Table 3).

Table 2: Estimated Coefficient, t-statistic and p-value in Exponential growth function (Begusarai district)

Variables	Period		
	Period 1	Period 2	Overall
Area			
a. Coefficient	-0.05	0.03	0.01
b. t-statistic	-4.48	1.30	1.84
c. p-value	0.001	0.22	0.08
Production			
a. Coefficient	-0.05	0.03	-0.01
b. t-statistic	-4.48	1.30	-0.55
c. p-value	0.001	0.22	0.58
Productivity			
a. Coefficient	-0.01	-0.02	0.01
b. t-statistic	-0.55	-0.80	1.39
c. p-value	0.58	0.43	0.17

Note: Period 1 (1998-99 to 2008-09); Period 2 (2008-09 to 2018-19); and Overall Period (1998-99 to 2018-19).

Table 3: Estimated Coefficient, t-statistic, and p-value in Exponential growth function (Bihar State)

Variables	Period		
	Period 1	Period 2	Overall

Area			
a. Coefficient	-0.001	-0.008	-0.0005
b. t-statistic	-3.34	-2.58	-3.74
c. p-value	0.008	0.02	0.001
Production			
a. Coefficient	-0.002	0.01	0.02
b. t-statistic	-0.21	0.63	3.50
c. p-value	0.83	0.53	0.002
Productivity			
a. Coefficient	0.01	0.01	0.02
b. t-statistic	0.92	1.18	5.10
c. p-value	0.38	0.26	6.29

Note:Period 1 (1998-99 to 2008-09); Period 2 (2008-09 to 2018-19); and Overall Period (1998-99 to 2018-19).

3.2 Cost of cultivation of Rapeseed Mustard in the study area

The per ha average total cost of cultivation of **rapeseed-mustard** was estimated as ₹ 63873 per ha on sample farms (n=120). The cost of cultivation was found to be highest for marginal & small farmers (₹ 71327 / ha) followed by semi medium (₹ 63328 /ha), semi-medium farmers (₹ 63214 / ha) and medium farmers (₹ 63214 /ha). The average total cost of cultivation included Variable Cost and Fixed Cost, while the variable cost included material cost and labour cost. The variable cost was estimated as ₹ 34657, covering 57.6 per cent of total cost. The manures & fertilizer (₹ 7382 per ha) and irrigation cost (₹ 3011 per ha) contributed 45.41 per cent and 18.52 per cent of the material cost. The highest labour cost (₹ 24893 per ha) was observed at marginal and small with 60.20 per cent of total Variable cost whereas 34.89 per cent of total cost of cultivation. Average yield on sample farms was obtained as 15.83 quintal per ha. The average price received by rapeseed-mustard farmers ranged between ₹ 5280 per quintal (marginal & small farmers) to ₹ 5977 per quintal (large farmers) with average price of ₹ 5287 per quintal. The gross income obtained by rapeseed-mustard farmers was lowest (₹ 80803 /ha) for marginal & small farmers, while semi-medium and medium farmers obtained a slightly higher income of ₹ 82204 and ₹ 83399 per ha, respectively. The large farmers received highest gross income of ₹ 96073 per ha, with an overall average was ₹ 83746 per ha. The return to cost ratio analysis was done on from cost A to Cost C₃. It varies from 1:1.20 to 1:1.3 in case of marginal & small farms, 1:2.24 to 1:1.29 on semi medium farms, 1:2.25 to 1:1.31 on medium and 1:2.71 to 1:1.57 on large size of farms. The large farmers obtained highest return to cost ratio of 1.57. The overall average of returns to costs ratio on the basis of various costs varies from 1:2.27 to 1:1.31.

Table 4: Costs of cultivation of Rapeseed-Mustard crop on different size group of sample farms in the study area (Rs/ha)

Particular	Size of sample farms (ha)				Overall average
	Marginal	Semi-	Medium	Large	

	&Small n=25	Medium n=49	n=33	n=13	N=120
I. Variable Cost					
1. Material Cost					
Seed	528.88	474.79	484.55	461.73	487.57
Manures and fertilizers	7556.72	7143.96	6953.70	6474.45	7382.22
Irrigation charge	3141.84	3030.53	2922.83	2916.5	3011.75
Plant protection	2215.94	2338.26	2624.67	3192.28	2515.16
Miscellaneous charges	1858.58	1650.94	1695.03	1548.83	1688.35
Interest on working capital(@3% Rate of Interest)	1151.71	1164.34	1161.98	1310.95	1171.38
Total Material Cost (1)	16453.67	15802.82	15842.76	15904.74	16256.43
2. Labour Cost					
Family Labour	6517.8	3166.2	2699.27	2487.38	3140.06
Hired Labour	18375.38	15462.44	15818.78	14386.4	15260.75
Total Human Labour Cost (2)	24893.18	18628.64	18518.05	16873.78	18400.81
Total Variable Cost (I=1+2)	41346.85 (57.96%)	34431.46 (54.36%)	34360.81 (54.35%)	32778..52 (5.00 %)	34657.24 (54.25 %)
II. Fixed Cost					
Land revenue	200.00	200.00	200.00	200.00	200.00
Depreciation	842.52	810.45	810.33	787.60	842.52
Interest on fixed capital(@ 8% Rate of Interest)	1859.03	1809.13	1803.11	1475.5	1827.95
Rental value of owned land	18500	18000	18000	18000	18250
Total Fixed Cost (II)	25939.43 (36.36%)	25227.78 (39.83%)	25152.4 (39.78%)	24673.34 (40.44%)	25519..95 (39.95%)
Total Cost (I+II)	67286.28	59659. 24	59513.21	57451.92	60177.19
Managerial Cost [@10 % of variable cost] (III)	4040.94 (5.66%)	3668.99 (5.79%)	3701.08 (5.85%)	3551.00 (5.82%)	3695.91 (5.78%)
Sum of Total Cost (I+II+III)	71327.22 (100%)	63328.23 (100%)	63214.29 (100%)	61002.92 (100%)	63873.10 (100%)

(Source: Compiled by the Authors)

Table 5 Costs and income from the production of rapeseed-mustard crop on various costs concept (Rs/ha)

S. No.	Particular	Size of sample farms				Overall average
		Marginal & Small n ₁ =25	Semi-Medium n ₂ =49	Medium n ₃ =33	Large n ₄ =13	
						N=120
1.	Cost A ₁ /A ₂	40409.45	36689.93	37010.83	35510.04	36959.18
	Cost B ₁	42268.48	38493.04	38813.94	36964.54	38787.13
2.	Cost B ₂	60768.48	56493.04	56813.94	54964.54	57037.13
	Cost C ₁	48786.28	41659.24	41513.21	39451.92	41927.19

3.	Cost C ₂	67286.28	59659.24	59513.21	57451.92	60177.19
4.	Cost C ₃	71327.22	63328.23	63214.29	61002.92	63873.10
5.	Gross income	80803.75	82204.5	83399.87	96073.5	83743.92
6.	Net income over Cost C ₂	13517.47	22545.26	23886.66	38621.58	23566.73
7.	Net income over Cost C ₃	9476.52	18876.26	20185.57	35070.57	19870.81
8.	Family labour income	10558.74	6835.19	6400.35	6038.38	6835.97
9.	Farm investment Income	9476.52	18876.26	20185.57	35070.57	19870.81
10.	Farm business income	40394.3	45514.57	46389.04	60563.46	46784.74
11.	Cost of production per (q)	4380.61	3763.98	3710.29	3550.79	3801.46
12.	Yield (q/ha)	15.36	15.85	16.04	16.18	15.83
Costs and Returns relationship						
13.	On the basis of A ₁ /A ₂	1:2.00	1:2.24	1:2.25	1:2.71	1:2.27
14.	On the basis of B ₁	1:1.91	1:2.14	1:2.15	1:2.60	1:2.16
15.	On the basis of B ₂	1:1.33	1:1.46	1:1.47	1:1.75	1:1.47
16.	On the basis of C ₁	1:1.66	1:1.97	1:2.01	1:2.44	1:2.0
17.	On the basis of C ₂	1:1.20	1:1.38	1:1.40	1:1.67	1:1.39
18.	On the basis of C ₃	1:1.3	1:1.29	1:1.31	1:1.57	1: 1.31

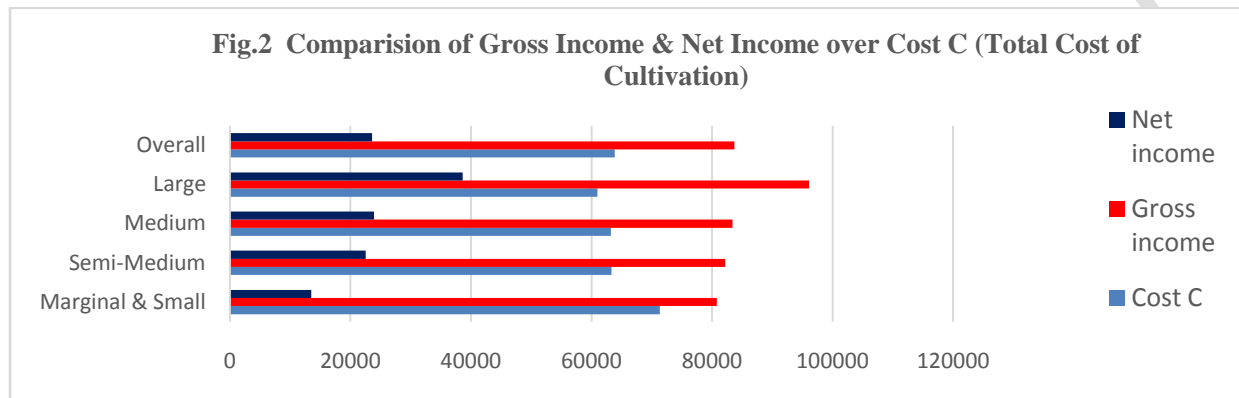
(Source: Compiled by the Authors)

Table 6: Costs and income from the production of Rapeseed-Mustard crop on various costs concept (₹ /ha)

S. No.	Particular	Size of sample farms				Overall average
		Marginal & Small	Semi-Medium	Medium	Large	
1	Cost C ₂	67286.28	59659.24	59513.21	57451.92	60177.19
2.	Cost C ₃	71327.22	63328.23	63214.29	61002.92	63873.10
3.	Gross income	80803.75	82204.5	83399.87	96073.5	83743.92
4.	Net income	13517.47	22545.26	23886.66	38621.58	23566.73
5.	Farm investment Income	9476.52	18876.26	20185.57	35070.57	19870.81
6.	Yield (q/ha)	15.36	15.85	16.04	16.18	15.83

7.	Cost of production per (q)	4380.61	3763.98	3710.29	3550.79	3801.46
Input output relationship						
8.	On the basis of C ₂	1:1.20	1:1.38	1:1.40	1:1.67	1:1.39
9.	On the basis of C ₃	1:1.3	1:1.29	1:1.31	1:1.57	1: 1.31

(Source: Compiled by the Authors)



3.3 Farmers level constraints and opportunities in cultivation of rapeseed-mustard

The constraints faced by the sample farmers across study area and among different categories offarmers were identified, ranked and presented in table 7. Major problems identified for rapeseed-mustard cultivation, the Lack of improved varieties of seed ranked first with Garrett scored 89.3 followed by High transportation cost due to small quantity with Garrett scored 76.58, Agro-ecological constraints with Garrett scored 72.06 had occupied the 3rd position.



The other problems associated with rapeseed-mustard production were High fluctuation in market prices, Lack of subsidy on inputs, and Lack of market information respectively.

Overall, can be summarised as, there is large opportunity for rapeseed-mustard cultivation in the study area having the huge potential to bridge the gap between demand and supply of rapeseed-mustard. The decreasing trends of area in a state may be due to their relative lower profitability

against competing crops like maize, wheat and soybean under the prevailing crop growing and marketing situations. Therefore, strategies for enhancing the productivity and profitability of rapeseed-mustard farmers should be prepared based on oilseed production system.

Table 7 Major Constraints faced by sample farmers in rapeseed-mustard cultivation

Sl.No	Farmers level constraints of rapeseed-mustard Growers	Overall (N= 120)	
		Garrett Score	Rank
1.	Lack of Improved varieties of seed	89.3	1
2.	High transportation cost due to small quantity	76.58	2
3.	Agro-ecological constraints	72.06	3
4.	High fluctuation in market prices	63.2	4
5.	Lack of Subsidy on inputs	53.27	5
6.	Lack of market information	49.92	6
7.	Labour Availability	49.62	7
8.	Long distance of regulated market	48.8	8
9.	Low market price	44.32	9
10.	Problems of Weed Management	38.75	10

4. Conclusion

Overall, the study observed that the scope of rapeseed-mustard in study area along with Bihar state is good and rapeseed-mustard having the potential to bridge the gap between demand and supply of edible oils. The study highlighted that even though the production and yield of rapeseed-mustard crops has increased per unit of area during the last 21 years, the overall increased in yield failed to boost the area under the crop. This failure probably may be due to the shifting of more fertile land under the crops that gave comparatively much higher return which ultimately put to marginal and less fertile land for rapeseed-mustard cultivation and other oilseed crops. However, there is a need to evolve a long run solution, stable new high-yielding, pest and disease resistance and quick maturing varieties of rapeseed-mustard which can compete with the high yielding varieties of staple food crops. The findings will be useful for rapeseed-mustard farmers in efficient use of resources to reduce the cost of cultivation of rapeseed-mustard. They will be able to identify proportion of input and labor used in its cultivation and will become more conscious about the various costs, particularly the indirect and imputed costs that are used during the production of rapeseed-mustard. The recent estimates of cost of cultivation will also provide information to stakeholders in deciding the prices of outputs. Over all it may be said that this study provides the feedback & valuable information to the different research institutions, departments, associated universities and various non-governmental organizations working in agricultural and allied departments to strengthen the research-extension farmer linkage by providing credible input on time to the farmer. Therefore, the technology should be targeted in these areas as cost effective or/ less costly than the competitive crop so that the farmers could get the net returns equivalent to that they get from the competitive crops especially from wheat. Only then, the farmers will go for cultivation of rapeseed-mustard.

5. Suggestions and Policy Implications:

- Introduce Improved High Yielding/oil content rapeseed-mustard variety.
- Focus should be more on area expansion, replace staple food crops with oilseeds crops.
- Inclusion of scientific package and practices
- Assured and timely supply of input will be a breakthrough to the farmers to counter Agro-ecological constraints.
- Dissemination of market information, weather related information to management of crops.

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