**Economic Analysis of Rapeseed -Mustard Crop in Prayagraj District of Uttar Pradesh, India**

**Abstract:**

In the present paper, an attempt has been made to examine Rapeseed-Mustard Crop production in different categories of the farmers. The study adopted a multistage purposive sampling method, incorporating purposive and random sampling technique was employed to select the study area including the district, block, villages and farmers. Specifically, chose the Baharia block was chosen from which, five villages were selected. Using proportionate allocation, then selected a total of 100 growers i.e. Marginal 48, Small 31 and Medium 21 were surveyed. Primary data were collected through personal interviews, using a pre-structured and pre-tested survey schedule or questionnaire. Total cultivated area of 110.04 hectares. The average farm size varies across categories: marginal farms (0.48 ha), small farms (1.45 ha), and medium farms (2.80 ha). Cropping Pattern: Paddy (29.44%), wheat (14.02%), mustard (11.21%), and moong (7.94%) are the major crops. The cropping pattern shows a significant variation in crop allocation across different farm sizes. The average cropping intensity is 194.55%, with marginal farms exhibiting the highest intensity at 222.92%. Per Farm Investment: The average investment per farm is Rs. 306,234.22, with marginal farms investing the least and medium farms the most. Investment distribution is primarily in buildings (76.91%), livestock (5.83%), and machinery (17.26%). Per Hectare Investment: The average investment per hectare is Rs. 324,262.70, with marginal farms investing the highest amount per hectare. Part B: Structure of Costs and Income. Costs of Cultivation of Rapeseed-Mustard: The highest costs are incurred by small farms (Rs. 29,464.90), followed by medium and marginal farms. Human labor, land rental value, and irrigation charges are significant components of the total cultivation cost. Per Hectare Costs and Income: Costs are categorized into six cost concepts: A1/A2, B1, B2, C1, C2, and C3, with overall averages of Rs. 12,193.65, Rs. 12,653.44, Rs. 20,153.44, Rs. 14,622.88, Rs. 22,122.88, and Rs. 24,335.17. The on an average output per hectare and Cost of production per quintal and per hectare. were 10.94 quintal and Rs. 2214.88, respectively. The basis costs for A1/A2, B1, B2, C1, C2 and C3 were recorded at 1:3.36, 1:3.22, 1:1.93, 1:2.71, 1:1.75, and 1:1.59, respectively, based on the average input-output ratio. Small farms had the greatest cost-to-output ratio 1:1.69, followed by medium1:1.37 and medium 1:1.60 farms respectively.

**Keywords:** *Farm Structure, Cropping Patterns, Cropping Intensity, Cost of Cultivation, and Profitability etc.*

**INTRODUCTION**

Rapeseed (*Brassica campestris*) and Mustard (*Brassica juncea*) are rabi season oilseed crops of India, significantly contributing to the nation’s oilseed output. These crops collectively known as rapeseed-mustard are extensively grown across 24 states. Rapeseed-mustard hold a critical role in cooking, frying, and as condiments especially in northern India. Additionally, the by-products like oil cake and green stems are valuable for cattle feed and as fertilizers. Among the seven major edible oilseed crops in India, rapeseed-mustard ranks second in production but leads in contributing to the country’s total oil supply, accounting for about 36%. The production of rapeseed-mustard has seen significant growth over the years, reaching 11.75 million tonnes in 2021-22. Major producing states include Rajasthan, Madhya Pradesh, Haryana, Uttar Pradesh, and West Bengal. Globally, in 2018-19, the area, production, and yield of rapeseed-mustard were 36.59 million hectares, 72.37 million tonnes, and 1980 kg/ha, respectively. India contributed significantly to global acreage and production. In 2022, India was the fifth-largest producer of mustard globally, with production at 115 lakh tonnes. State-wise, Rajasthan leads mustard production in India, followed by Madhya Pradesh, Haryana, and Uttar Pradesh. Despite significant production, there is limited research on the economic aspects of rapeseed-mustard farming, particularly in Uttar Pradesh (**Ahmad *et al.,* 2019**).

Rapeseed-mustard constitutes a crucial collection of crops cultivated across nearly 24 states in India. Among the seven edible oilseed crops grown nationwide, rapeseed-mustard holds the second position, trailing only behind soybean. However, regarding its contribution to the country’s total oil supply, rapeseed-mustard claims the top spot, accounting for approximately 36%. Over the past three decades, concerted efforts by the Government of India, the Indian Council of Agricultural Research (ICAR), state governments, and farmers have led to a substantial increase in rapeseed-mustard production, reaching a remarkable 11.75 million tonnes in the 2021-22 periods. The primary rapeseed-mustard growing states include Rajasthan, Madhya Pradesh, Haryana, Uttar Pradesh, West Bengal, Assam, and Chhattisgarh, with cultivation also prevalent in other states such as Punjab, Bihar, and Odisha (**Bareliya *et al.,* 2023**).

 In the 2018-19 period, the global area, production, and yield of rapeseed-mustard were estimated at 36.59 million hectares (mha), 72.37 million tonnes (mt), and 1980 kg/ha, respectively. India contributed 19.8% of the global acreage and 9.8% of the global production (USDA). Over the past eight years, productivity has seen a significant rise from 1840 kg/ha in 2010-11 to 1980 kg/ha in 2018-19, while production has increased from 61.64 mt in 2010-11 to 72.42 mt in 2018-19.**(ICAR-DRMR).**

Nepal leads global mustard production, significantly ahead of other countries. Russia, Canada, and Malaysia follow, with production ranging from 144 to 183 lakh tonnes. India is the fifth-largest producer with 115 lakh tonnes. The United States, Myanmar, China, Ukraine, and Kazakhstan have lower production levels, with Kazakhstan being the lowest among the top ten.Rajasthan is the top mustard-producing state, significantly ahead of others. The next top producers are Madhya Pradesh, Haryana, and Uttar Pradesh, with production levels between 16 and 18 lakh tonnes. Punjab and Odisha also significantly contribute to mustard production. Lower output levels are found in states like West Bengal, Assam, Bihar, and Chhattisgarh, with Chhattisgarh having the lowest values.The Central Organization for Oil Industry and Trade (COOIT) forecasts a significant increase of 29% in the country's mustard seed production, reaching 109.50 lakh tonnes during the rabi season of the 2021-22 crop year, up from the previous year's output of 85 lakh tonnes. In Uttar Pradesh, production is expected to rise from 13.5 lakh tonnes to 15 lakh tonnes (The Economic Times of India). The Rabi oilseed crop was planted on 2.71 million hectares in Uttar Pradesh in 2019-20, yielding 956.72 tonnes **(Kaur and Singh 2023)**.

This study aims to fill that gap by examining **“Economic Analysis of Rapeseed -Mustard Crop in Prayagraj District of Uttar Pradesh”** The objectives include studying farm structure and cropping patterns, cost of cultivation and profits. Despite the significant production of rapeseed-mustard, there is a paucity of research on its economic aspects, particularly in Uttar Pradesh and Prayagraj district. Therefore, this study aims to provide detailed insights into the economic dynamics of rapeseed-mustard crop production in Prayagraj District, Uttar Pradesh. The specific objectives are:

1. To study/ the farm structure, Cropping pattern and Cropping intensity on different size of sample Farms;
2. To work out the cost of cultivation and different profit measures on different size of sample farms.

**Methodology:**

1. **Sampling Technique:** Purposive cum random sampling design was used for the selection of district, tehsil, block, villages and respondents.
2. **Selection of the district**: Keeping in view the limitation of resources and time of the investigator district Prayagraj of Uttar Pradesh was selected purposively.
3. **Selection of tehsil**: A list of all the 8 tehsil in Prayagraj district was arranged in ascending order according to number of Rapeseed-mustard cultivators in the region. Phulpur tehsil was selected purposively from the bottom.
4. **Selection of block:** All the 23 blocks of Phulpur tehsil were again arranged in ascending order according to number of Rapeseed-mustard cultivators in the region and one block namely Baharia was selected purposively from the bottom.
5. **Selection of villages**: A list of all villages of selected bikapur block was prepared separately along with their area under sugarcane cultivation and five villages namely Benipur, Maliakapoora, Basrahi, Dadupur and Jamha were selected randomly.
6. **Selection of farmers**: A separate list of farmers growing Rapeseed-mustard of selected villages was prepared along with their holding size. Based on size of holding, farmers were classified into three group i.e.

 1. Marginal farmer below 1 ha

 2. Small farmer 1-2 ha and

 3. Medium farmer 2 ha &above

 Finally, 100 respondents were selected randomly through proportionate allocation to the population.

**Period of Study**: The data was collected for the Agricultural year 2022-2023.

**Method of enquiry**: For the interpretation of data the following analytical tools were used:

1. **Tabular Analysis:**

Tabular analysis was made to compare different aspects of analysis of costs and returns on different categories of the sample farms.

1. **Average:**

The simplest and the most important measures of average mean and weighted mean were applied. The formula of mean and W.A. is given below **(Ahmad *et al.,* 2018 and Ahmad *et al.,* 2019)**



Where,

 X= Value of variable

 N= Number of observation

$W.A.=\frac{∑Wi Xi}{∑Wi}$

Where,

 W.A. = Weighted Average

Wi = Weight of Xi

 Xi = Variable

(b) Percentage = Simple comparisons have been made on the basis of percentage.

**(iii) Measures of Cost Concepts:**

**Cost A1** = this gives the total cash expenses incurred by the grower. It includes the following items. **(Ahmad *et al.,* 2019)**

1. Cost of hired labour
2. Cost of bullock labour and tractor charges
3. Cost of planting materials
4. Cost of manures, fertilizers and plant protection chemicals
5. Irrigation charges
6. Interest on working capital
7. Land revenue
8. Depreciation on fixed capital

**Cost A2 =** Cost A1 + rent paid for leased land

**Cost B1 =** Cost A2 + interest on fixed capital + rental value of owned capital assets (Excluding Land)

**Cost B2 =**Cost B1 + Rental Value of owned land (Net land Revenue)

**Cost C1 =** Cost B1+ imputed value of family labour

**Cost C2** = Cost B2 **+** imputed value of family labour

**Cost C3** = Cost C2 + 10 per cent of the managerial cost

**(iv) Measures of Farm Profit:**

**Gross Income =** Yield in quintal × Price per quintal

**Net Income =** Gross Income – Cost C

**Farm Business Income =** Gross Income - Cost A2

 **or**

 Net Income + imputed value of family labour

**Family labour income =** Gross Income-Cost C

**Farm investment income =** Net Income + Rental value of owned land

 + Interest on fixed capital

**Benefit-cost ratio =** Cost C / Gross Income

**Cropping Intensity:**

Cropping intensity index refers to the changes in the cropping intensity of crop compared to a given base year. Cropping intensity is the number of times a crop is planted per year in a given agricultural area. It is the ratio of effective crop area harvested to the physical area.

 C. I. = x100

**Results and Discussion**

**Average size of holding of sample Farm:**

The study covers a sample of 100 farmers, which are divided in three size groups, namely marginal (below-1 ha), small (1-2 ha) and medium (2-4 ha). It is clear from the table No.1 that marginal farmers constitute the largest group in terms of number, with 57 farmers accounting for approximately 24.92% of the total cultivated area. However, their average land holding is modest at 0.48 hectares per farmer. In contrast, medium-sized farms, though fewer in number (15 farmers), collectively manage a substantial gross cultivated area of 41.94 hectares, averaging 2.80 hectares per farmer. Small-sized farms, represented by 28 farmers, fall between these two extremes in terms of both number and land holdings.

**Table No. 1 Average. size of holding.under different size group of sample farms. (ha.)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.N.** | **Size of farms** | **No.of. Farmers** | **Gross Cultivated area(ha)** | **Average/size of holdings** |
| **1.** | **Marginal** | 57 | 27.42(24.92) | 0.48 |
| **2.** | **Small** | 28 | 40.68(36.97) | 1.45 |
| **3.** | **Medium** | 15 | 41.94(38.11) | 2.80 |
| **Total** | 100 | 110.04(100.00) | 1.10\* |

**Cropping pattern:**

Cropping pattern.shows. that/ area used for each crop over the specified time frame for analyzing constraints and agricultural activities is typically one year. It shows the annual rotation and crop-growing order of farmers in a specific region. The/data/ presented in Table no.2 that, on average, the largest cropped area on the sample farms was comprised of (29.44%) paddy, followed by Wheat (14.02%), Mustard (11.21%), and Moong (7.94%).

The percentage of Small farmers total cultivated area that is devoted to mustard cultivation is higher Marginal (14.95%) than that of small (12.93%) and medium (7.16%) farmers.

**Table no. 2: Cropping pattern under/various. size group of farms. (area in ha.)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N.** | **Crops** | **The average.size. of sample farms.** | **Overall average** |
|  |  | Marginal | Small | Medium |
|  | **Kharif** |
|  | Paddy | 0.36**(33.64)** | 0.50**(19.01)** | 1.89**(35.59)** | 0.63**(29.44)** |
|  | Maize | 0.02**(1.87)** | 0.19**(7.22)** | 0.13**(2.45)** | 0.08**(3.74)** |
|  | Bajara | 0.01**(0.93)** | 0.16**(6.08)** | 0.04**(0.75)** | 0.06**(2.80)** |
|  | Cauliflower | 0.01**(0.93)** | 0.15**(5.70)** | 0.14**(2.64)** | 0.07**(3.27)** |
|  | **Total** | **0.40****(37.38)** | **1.00****(38.02)** | **2.20****(41.43)** | **0.84****(39.25)** |
|  | **Rabi** |
|  | Mustard | 0.16**(14.95)** | 0.34**(12.93)** | 0.38**(7.16)** | 0.24**(11.21)** |
|  | Wheat | 0.11**(10.28)** | 0.34**(12.93)** | 0.93**(17.51)** | 0.30**(14.02)** |
|  | Potato | 0.16**(14.95)** | 0.16**(6.08)** | 0.60**(11.30)** | 0.23**(10.75)** |
|  | Pea | 0.01**(0.93)** | 0.12**(4.56)** | 0.32**(6.03)** | 0.09**(4.21)** |
|  | Berseem | 0.02**(1.87)** | 0.09**(3.42)** | 0.05**(0.94)** | 0.04**(1.87)** |
|  | **Total** | 0.46**(42.99)** | 1.05**(39.92)** | 2.28**(42.94)** | 0.90**(42.06)** |
| C. | **Zaid** |
| 1. | Chari | 0.03**(2.80)** | 0.03**(1.14)** | 0.11**(2.07)** | 0.04**(1.87)** |
| 2. | Moong | 0.14**(13.08)** | 0.21**(7.98)** | 0.24**(4.52)** | 0.17**(7.94)** |
| 3. | Urd | 0.03**(2.8)** | 0.14**(5.32)** | 0.23**(4.33)** | 0.09**(4.21)** |
| 4. | Vegetables | 0.01**(0.93)** | 0.20**(7.60)** | 0.25**(4.71)** | 0.10**(4.67)** |
|  | **Total** | 0.21**(19.63)** | 0.58**(22.05)** | 0.83**(15.63)** | 0.41**(19.16)** |
|  | Gross cropped area (ha) | 1.07**(100.00)** | 2.63**(100.00)** | 5.31**(100.00)** | 2.14**(100.00)** |

**Cropping intensity:**

The cropping intensity of various farm size groups is presented in Table no. 3. The maximum cropping intensity was observed on marginal farms (222.92%), followed by small farms (181.38%) and medium farms (189.64%), respectively. The average cropping intensity across the sample farms was calculated to be (194.55%) percent. A negative correlation between cropping intensity and farm size group was identified.

**Table no. 3 Cropping/ intensity on various size group of sample farms.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.N.** | **Size of farms**  | **Farms** | **Net Cultivated area (ha)** | **Gross cultivated area (ha)** | **Cropping intensity** |
| **1.** | **Marginal** | 57 | 0.48 | 1.07 | 222.92 |
| **2.** | **Small** |  28 | 1.45 | 2.63 | 181.38 |
| **3.** | **Medium** | 15 | 2.80 | 5.31 | 189.64 |
|  | **Total/overall average** | **100** | **1.10** | **2.14** | **194.55\*** |

\*Indicate overall average percentage of cropping Intensity.

**Structure of costs and income includes a breakdown of expenses and revenue sources:**

The Table no.4 shows that the largest cultivation costs were incurred by small farms (Rs. 29464.90), medium (Rs. 26933.56), and Marginal farms (Rs. 21131.47). The sample farms' overall average cultivation expenses (Rs. 24335.17) indicate favorable correlation between farm size and costs.

Overall, human labor accounted for 19.25% of total costs of cultivation, followed by the rental value of owned land at 30.82%, irrigation charges at 7.39%, manure and fertilizer at 6.26%, machinery labor at 10.25 %, and interest on fixed capital at 2.56%. It was shown that while family labor exhibited a negative link with an increase in farm size, hired labor, machinery labor, seed, manure, and fertilizer, as well as irrigation, showed favorable relationships with an increase in farm size.

**Table no. 4 Costs of cultivation of Rapeseed-mustard crop on different size group of sample farms.**

|  |  |
| --- | --- |
| S.N | **Variable cost** |
| A. | **Operational cost** | **Marginal.** | **Small.** | **Medium.** | **Overall average.** |
| 1 | Family labour | 2295.34(10.86) | 2018.57(6.85) | 639.33(2.37) | 1969.44(8.09) |
| 2 | Hired labour | 1602.63(7.58) | 5382.85(18.27) | 1969.33(7.31) | 2716.10(11.16) |
| 3 | machinery labor | 1918.91(9.08) | 3255(11.05) | 3264.07(12.12) | 2494.79(10.25) |
|  | **Sub-total (A)** | **5816.88****(27.53)** | **10656.42****(36.17)** | **5872.73****(21.80)** | **7180.33****(29.51)** |
| B | **Material cost** |
| 1 | Seed | 965.61(4.57) | 1482.14(5.003) | 2040(7.57) | 1271.40(5.22) |
| 2 | Manures and fertilizer | 1108.68(5.25) | 1599.11(5.43) | 2960.00(10.99) | 1523.70(6.26) |
| 3 | Irrigation | 1593.4(7.54) | 1954.28(6.63) | 2290.67(8.50) | 1799.04(7.39) |
| 4 | Plant protection | 1160.35(5.49) | 2072.86(7.03) | 2398.67(8.91) | 1601.60(6.58) |
|  | **Sub-total (B)** | 4828.04(22.85) | 7108.39(24.12) | 9689.34(35.97) | 6195.73(25.46) |
|  | **Total Variable Cost (A+B)** | **10644.92****(50.37)** | **17764.81****(60.29)** | **15562.07****(57.78)** | **13376.06****(54.97)** |
| C | **Other cost** |
| 1 | Interest on working capital. | 450.15(2.13) | 874.39(2.97) | 816.11(3.03) | 623.83(2.56) |
| 2 | Depreciation | 156(0.74) | 186(0.63) | 148(0.55) | 163.20(0.67) |
| 3 | Land revenue | 0 | 0 | 0 | 0 |
| 4 | Interest on fixed capital. | 459.36(2.17) | 461.16(1.57) | 458.88(1.57) | 459.79(1.89) |
| 5 | Rental value of own land | 7500(35.49) | 7500(25.45) | 7500(25.45) | 7500(30.82) |
|  | **Sub-total (C)** | 8565.51(40.53) | 9021.55(30.62) | 8922.99(30.62) | 8746.82(35.94) |
|  | **Cost C2 total (A+B+C)** | **19210.43****(90.91)** | **26786.36****(90.91)** | **24485.06****(90.91)** | **22122.88****(90.91)** |
|  | 10% of C2\*for managerial work | 1921.04(9.09) | 2678.63(9.09) | 2448.51(9.09) | 2212.29(9.09) |
|  | **Cost C3- (C2 + C2\*10%)** | **21131.47****(100.00)** | **29464.99****(100.00)** | **26933.56****(100.00)** | **24335.17****(100.00)** |

**Table 5: The per-hectare costs and income from the production of Mustard crop on different costs concept (Rs.)**

|  |  |  |
| --- | --- | --- |
| **S.N.** | **Particular** | **Farm sample sizes** |
| **Marginal.** | **Small.** | **Medium.** | **Overall average.** |
| **1.** | **Cost A1/A2** | 8955.73 | 16806.63 | 15886.85 | 12193.65 |
| **2.** | **Cost B1.** | 9415.09 | 17267.79 | 16345.73 | 12653.44 |
| **3.** | **Cost B2.** | 16915.09 | 24767.79 | 23845.73 | 20153.44 |
| **4.** | **Cost C1.** | 11710.43 | 19286.36 | 16985.06 | 14622.88 |
| **5.** | **Cost C2** | 19210.43 | 26786.36 | 24485.06 | 22122.88 |
| **6.** | **Cost C3.** | 21131.47 | 29464.99 | 26933.56 | 24335.17 |
| **7** | **Gross Income** | **35840** | **40600** | **43190** | **38275.3** |
| 8. | **Net Income** | 16629.57 | 13813.64 | 18704.94 | 16152.42 |
| 9. | **Family Labour Income** | 18924.91 | 15832.21 | 19344.27 | 18121.86 |
| 10. | **Farm Investment Income** | 24588.93 | 21774.8 | 26663.82 | 24112.21 |
| 11. | **Farm Business Income** | 26884.27 | 23793.37 | 27303.15 | 26081.65 |
| 12. | **Costs of production** **(q)** | 2063.62 | 2540.09 | 2182.62 | 2214.88 |
| 13. | **Yield(1/ha)** | **10.24** | **11.6** | **12.34** | **10.94** |
|  | **14. Input-output relationship** |
| 14. | **On the basis ofA1/A2** | 1:4.001909 | 1:2.415714 | 1:2.718601 | 1:3.365278 |
| 15. | **On the basis of B1** | 1:3.806656 | 1:2.351199 | 1:2.642281 | 1:3.224472 |
| 16. | **On the basis B2** | 1:2.118819 | 1:1.639226 | 1:1.811226 | 1:1.938394 |
| 17. | **On the basis of C1** | 1:3.06052 | 1:2.105115 | 1:2.542823 | 1:2.715352 |
| 18. | **On the basis of C2** | 1:1.865653 | 1:1.515697 | 1:1.763933 | 1:1.752408 |
| 19. | **On the basis of C3** | 1:1.696049 | 1:1.377906 | 1:1.603575 | 1:1.593098 |

**(5) Conclusion:**

The study examined the average size of land holdings, cropping patterns and costs associated with different farm sizes among 100 sample farmers. Marginal farmers (below 1 ha) constitute the largest group, managing small plots averaging 0.48 ha. Medium-sized farms, though fewer, have significantly larger holdings averaging 2.80 ha. The cropping pattern reveals paddy as the dominant crop, with wheat, mustard, and moong following. Cropping intensity is highest among marginal farms at 222.92%.

Cost analysis shows small farms incur the highest cultivation expenses (Rs. 29,464.90), followed by medium and marginal farms. Human labour, land rental, and irrigation are major cost components, with a trend of increased use of hired labor and machinery as farm size grows. Medium farms achieve the highest net income (Rs. 18,704.94), while the input-output ratio highlights marginal farms' efficiency on a per-unit basis. Overall, there is a negative correlation between cropping intensity and farm size, with smaller farms demonstrating higher intensities and costs.

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