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Assess resource utilization efficiency in mustard cultivation on different size of sample farms

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Abstract

The study was conducted to determine 'Assess resource utilization efficiency in mustard cultivation on different sizes of sample farms in Jhansi district'. The study used 159 mustard growers from 300 farmer adopting different pollinator friendly practices. Descriptive and statistical tools including Cobb-Douglas production function were used to analyze data which were collected from structured interview schedule. The benefit cost ratio (1.24) indicates that mustard.

Production was profitable with productivity of 0.81 ton/ha the magnitude of regression coefficients of mustard implied that use of human labor, tractor, nutrient and irrigation, plant protection, machinery charge, manure & fertilizer costs had significant at 1% and 5% profitable levels. Positivity effect on grows return with estimated increasing return to scale. according to estimated allocative efficiency indicates, it is suggested to increases use of tractor, machinery charge, labor, seed, nutrients and irrigation, plant protection costs by about 80.85%, 83.83%, and 85.11% of the variation in the dependent variable for marginal, small and medium farms respectively. To be 0.837274, 0.997068, 0.851999 respectively.

The variables X1, X2, X3, X4, and X5, X6 represent seed, tractor charge, manure & fertilizer, irrigation, plant protection and human labor, respectively. The returns of the scale for marginal, small and medium farms were found.

Extension of Morden technologies with adjustment on resource use is to be encouraged for increase in productivity and profit from mustard production which indirectly promotes and ensures forage for pollinators.

Keywords: Cobb-douglas, R squared value, sum of elasticity marginal value of productivity

Introduction

In India, mustard is a significant crop both culturally and economically. The state of India is the largest producer of Rajasthan, Haryana, Punjab, Uttar Pradesh, Madhya Pradesh.

Mustard grows best in cool, temperate climates. It thrives in temperatures ranging from 15 °C to 25 °C. In India, mustard is primarily grown during the Rabi season(winter). Mustard prefers well- drained loamy soil it can tolerate a range of soil types, but the soil should be rich in organic matter and have a neutral to slightly alkaline Ph.

Mustard is the condiment made from the seeds of the mustard plant, which belongs to the Brassicaceae family. Its known as for its sharp, tangy flavor and comes in various forms, including yellow mustard, Dijon mustard and spicy brown mustard. The seed can be ground and mixed with liquids like vinegar or wine to create the condiment mustard is widely used in cooking, as a seasoning, or as a dressing

for sandwiches and salads. It also has long history of use in culinary traditions around world. Mustard seeds are rich nutrients like vitamins, minerals, and antioxidants. They are known for their potential anti- inflammatory and digestive benefits. However, mustard should be consumed in moderation as part of a balanced diet.

Materials and Methods

Used for the study – sampling techniques, data collection and analytical.

In the sampling technique, selection of district, selection of Block, Selection of Villages, selection of Farmers in the study area. Mauranipur block is selected for the study in Jhansi.

Cost A1: Total working capital+ Interest in working capital.

CostA2: 0

Cost B1: = cost A1/ A2 + interest on fixed capital.

Cost B2: = Cost B1 + Rental value of land.

Cost C1: = Cost B1 + family Labor.

Cost C2: Cost B2 + family Labor.

Cost C3: Cost C2 + 10% + of Marginal Cost.

Measure of farm profit

Gross Income: yield in quintal × Price per tonne

Net Income: Gross Income – Cost C3

Farm Business Income: Gross Income – Cost A2 or Net Income + imputed value of family labour

Family labour income: Gross Income – Cost C2

Farm investment income: Net Income + Rental value of owned land + Interest on fixed capital

Benefit – cost ratio: Cost c/ Gross Income

$$\text{COST OF PRODUCTION} = \frac{\text{COST OF CULTIVATION} \backslash H_a}{\text{QUANTITY OF MAIN PRODUCT} \backslash H_a}$$

Resource productivity in mustard crop was studied by fitting the Cobb-Douglas production function

$$Y = a b_1 X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^{\epsilon}$$

Where,

Y= Yield(kg)

X1= Phosphorus X2= Nitrogen (kg) X3= Man-Days X4= Irrigation (Rs.)

X5= plant protection& Interculture (Rs.) X6= Seeds (Rs.)

a= Constant terms

e= Error\ disturbance term

b1 to b6 = Elasticity coefficient of respective inputs or regression coefficients of factor input.

The Cobb- Douglas type of production function was converted in to long- linear form and the coefficient were estimated by using ordinary least squares (OLS) method.

The efficiency of various inputs was estimated by working out their marginal value productivity. The MVPs are computed by multiplying the regression coefficient of the respective coefficient of the respective coefficients of

resources (bi) with ratio of geometric mean of the gross returns (GM of y) to the geometric mean of the resources (GM of x), for example MVP xi will be

$$\text{MVP} = \frac{Y}{X_i} * b_i$$

Where,

Y = Geometric mean of output or yield

X= Geometric mean of ith independent variables bi = Partial regression of ith input

Results and Discussion

CACPs methodology for cost farming to estimate input use patterns and costs of mustard crop cultivation among sample farms of different categories.

Pattern of Input Use

Table 1 shows the input use pattern per hectare of the crops grown by the different farms categories of mauranipur block. Machinery cost was found highest in large farms followed by medium farms, small farms and marginal farms respectively.

The per hectare costs incurred for various input factors in mustard production are detailed in Table 1. According to this table, the highest cultivation costs were observed on medium farms (Rs.61128.77), followed by small farms (Rs.56866.20), and marginal farms (48322.45). the overall cost of cultivation of cultivation across the sample was Rs. 51,098.33, indicating a positive relationship with farm size.

On the average, the primary components of these costs were as follows: human labour accounted for 32.88%, rental value of owned land for 15.65%, irrigation charges for 7.13%, manure & fertilizer for 5.54%, tractor labour for 15.94%, and interest on fixed capital for 0.82% of the total cultivation costs. It was observed that hired labour, machinery labour, seed, and irrigation costs increased with farm size, whereas family labour decreased as farm size increased.

Table 1: The input use pattern per hectare of the crops grown

S. No	Particulars	Size group of farms			
		Marginal	Small	Medium	Overall average
1.	Human Labor	16024.54 (33.16)	18214.15 (32.03)	20045.97 (32.79)	16802.49 (32.88)
a.	Family Labor	12012.27 (24.85)	7107.07 (12.49)	6022.45 (9.85)	10541.19 (20.69)
b.	Hired Labor	4012.27 (8.30)	11107.15 (19.53)	14022.52 (22.93)	6261.21 (12.25)
2.	Tractor Charges	7939.85 (16.43)	8324.07 (14.63)	9456.01 (15.46)	8149.30 (15.94)
3.	Seed	3122.15 (6.46)	4576.89 (8.04)	4419.87 (7.23)	3515.34 (6.88)
4.	Manure and fertilizer	2278.01 (4.71)	2855.15 (5.02)	3245.30 (5.30)	2834.72 (5.54)
5.	Irrigation	3250.64 (6.72)	4576.40 (8.04)	4840.61 (7.91)	3645.63 (7.13)
	Plant Protection	2482.91 (5.13)	3311.97 (5.82)	3530.26 (5.75)	2734.69 (5.35)
6.	Total working capital	23085.83 (47.77)	34751.63 (61.11)	39514.57 (64.64)	26780.91 (52.41)
7.	Interest on working capital	923.4 (1.91)	1390.06 (2.44)	1580.58 (2.58)	1071.15 (2.09)
8.	Rental value of land	8000 (16.55)	8000 (14.06)	8000 (13.08)	8000 (15.65)
9.	Interest on fixed capital	408.00 (0.84)	447.85 (0.78)	454.01 (0.74)	419.24 (0.82)
10.	Sub total (16.55)	43929.5 (90.90) (13.08)	51696.55 (90.91) (15.65)	55571.61 (90.91)	46453.02 (90.90)
	Interest on fixed capital	408.00 (0.84)		454.01 (0.74)	419.24 (0.82)
	Subtotal	43929.5 (90.90)		55571.61 (90.91)	46453.02 (90.90)
	Managerial Cost @10% of sub-total	4392.95 (9.09)		5557.16 (9.09)	4195.12 (8.21)
		48322.45 (100)		61128.77 (100)	51098.33 (100)

Costs and Return

Table 2 shows the average costs for different categories as follows: A1/A2, costs averaged Rs. 27852.13, B1 costs averaged Rs. 38186.17, C1 costs averaged Rs. 46,727.94, and C2 costs averaged Rs. 51,373.25.

The average gross income was Rs.63947.01 and net income was Rs. 18734 among different farms size, medium farms reported the highest gross income at Rs. 77012.50, followed by small farms at Rs. 74901.50, and marginal farms at Rs. 67980. The highest net income was recorded on small farms at Rs.19157.55, followed by medium farms at Rs. 18483.09, with marginal farms having the lowest net income at Rs.15883.73.

On average, family labour income was Rs. 17987.36 farm business income was Rs. 25213.20, and farm investment income was Rs. 31714.68. family labour income highest on marginal farms, followed by small and medium farms, followed by small and marginal farms. Farm business income was highest on marginal farms.

The average cost of production per quintal and yield per hectare were esteemed at Rs. 3775.2 and 1538.11 quintals respectively. The input- output ratio based on costs A1/A2, B1, B2, C1, and C2 were recorded as 1:2.29, 1:2.26, 1:2.06, and 1:1.36 respectively. Based on cost C2, the input- output ratio was highest on marginal farms (1:1.53), followed by small (1:1.38) and medium farms (1: 1.98).

Table 2: The average costs for different categories

Sr. No.	Particulars	Size group of farms			Overall average
		Marginal	Small	Medium	
1.	Cost A1/A2	24009.23	36141.69	41095.15	27852.13
2.	Cost B1	24417.23	36141.69	41549.16	28186.72
3.	Cost B2	32417.23	44141.69	49549.16	36186.75
4.	Cost C1	36429.5	43248.76	47571.61	30943.17
5.	Cost C2	44429.5	51248.76	55571.61	46727.94
6.	Cost C3	48822.45	56418.41	61128.77	51373.25
7.	Yield q/ha.				
a.	Main Product	13.20	14.50	14.75	13.58
b.	By Product	16.03	16.01	21.25	16.49
8.	Gross Income	67980	74901.5	77012.5	63947.01
a.	Main Product	66000	72500	73750	67932.5
b.	By Product	1980	2401.5	3262.5	2175.51
9.	Net income	19157.55	18483.09	15883.73	18734
10.	Family Income	23550.5	23653.09	21440.89	17987.36
11.	Farm Business income	31958.5	31652.74	29894.9	31714.68
12.	Farm investment income	27565.55	26960.94	24342.74	25213.2
13.	Cost of production (q/ha.)	3736.54	3925.40	4178.22	3775.2
14.	Input-Output ratio				
a.	Based on cost A1	1:2.83	1:2.07	1:1.87	1:2.29
b.	Based on cost B1	1:2.78	1:2.07	1:1.85	1:2.26
c.	Based on cost B2	1:2.09	1:1.69	1:1.55	1:1.76
d.	Based on cost C1	1:1.86	1:1.73	1:1.61	1:2.06
e.	Based on cost C2	1:1.53	1:1.43	1:1.38	1:1.36
f.	Based on cost C3	1:1.39	1:1.32	1:1.25	1:1.24

Resource use efficiency

The table in question presents data on resource use efficiency, production elasticity and returns to scale for mustard crops of varying sizes. The high R- squared value of the fitted model suggests that the factors considered in the production process account for a substantial portion of the total variation in the dependent variable.

The combined impact of the five variables- seed, tractor and machinery charge, manure and fertilizer, irrigation, plant protection, and human labour – accounted for 80.85%,

83.83% and 85.11% of the variation in the dependent variable for marginal, small and medium sized farms, respectively.

For marginal farms, seed, tractor charges, manure and fertilizer, plant protection and human labour were statistically significant at the 1% and 5% levels, while seed, manure and fertilizer and irrigation were not statistically.

The returns to scale for marginal, small, and medium farms were 0.837, 0.997 and 0.852 respectively, all less than one. This indicates that mustard cultivation shows decreasing.

Table 3: Question presents data on resource

Size group of sample farms	Production Elasticity						Sum of Elasticity\ Return scale	R ²
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆		
Marginal	0.065589	0.419025	0.154687	0.221328	0.147532	0.17089	0.837274	0.853024
	2.021988	0.185601	0.124687	0.188188	0.132919	0.194341		
Small	0.021496	1.097579	0.02481	0.0683	0.01895	0.00994	0.997068	0.984361
	0.029292	0.210813	0.034164	0.204028	0.054217	0.017356		
Medium	0.038291	0.419594	0.257446	0.633511	0.47523	0.01161	0.851999	0.912197

Size group of farms	Marginal value of productivity					
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆
Marginal	10.81599	5.795488	3.272149	0.108606	0.687738	0.536
Small	10.48828	5.119923	3.161854	1.13746	0.593397	0.554
Medium	2.998411	2.043033	1.291447	0.116398	0.426936	0.126

Conclusion

In conclusion, mustard cultivation in India is economically vital, especially in states like Rajasthan, Haryana, and Punjab. The study highlights the input usage patterns and cost structures across different farm sizes, revealing that medium farms incur the highest costs but also generate substantial gross incomes. Resource use efficiency was notable, with inputs like seed and labor significantly impacting yields. The overall findings suggest that while mustard farming can be profitable, especially for small and marginal farms, efficiency improvements and careful cost management are essential for maximizing returns and sustaining livelihoods in the agricultural sector.

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