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Resource use efficiency of selected summer crop in Chandrapur district

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Abstract
This study investigates the cost and returns of selected summer crop in Chandrapur district. The district was selected purposively by considering the potential area under summer crop cultivation. Total of 90 farmer were selected 30 farmers of summer paddy, 30 farmers of summer mung bean and 30 farmers of summer sesame were selected. The loglinear cobb – Douglas production function was used to analyse the data. The result revealed that summer mung, coefficient of determination (R^2) was 0.71 which means 71 per cent variation in yield explained by variables. In case of summer paddy coefficient of determination (R^2) was 0.87 which means 87 per cent variation in yield explained by variables. Similarly in case of sesame coefficient of determination (R^2) was 0.89 which means 89 per cent variation in yield explained by variables.

Keywords: Resource efficiency, cobb – douglas production models

1. Introduction
Summer crops are grown during the warmer month of the year. These crops are specifically chosen for their ability to thrive in high temperature and ample irrigation water. In summer paddy, mung bean and sesame were majorly grown by the farmer where the irrigation is available Paddy is the world's second most important cereal crop. Nearly 510 million metric tons of milled rice were produced worldwide. In crop year 2021, there were around 165.25 million hectares of rice cultivated area worldwide. China and India are considered as the main producers of rice worldwide. India was estimated to be the leading global producer of rice and to harvest about 45 million hectares of rice. India is ranked second with 108.5 million metric tons of rice consumed in the same period.

India is the major producer of green gram in the world, and it is grown in almost all the states. It is grown on about 40.38 lakh hectares with a total production of 31.5 lakh tonnes with a productivity of 783 kg/ha and contributes 11% to the total pulse production in the year 2021-22. According to 1st advance estimates during 2022-23, green gram was grown in 0.08 lakh hectares with a production of 0.04 lakh tonnes and productivity was 493 kg/ha.

India is one of the major producers and exporters of sesame in the world. The total area under sesame in 2021-2022 is 1627.04.The state west bengal is the largest producer of sesame in India i,e. (254.35, followed by Gujarat,Madhya Pradesh, Rajasthan and Uttar Pradesh. the production of sesame in India during the year 2021-2022 was estimated to be around 788.74 and productivity is 485 kg/ha. The major varieties of sesame grown in India are Black, Brown, and White. Sesame is an important crop in the Indian agriculture sector, providing income and employment opportunities to millions of farmers and farm laborers. It is used for oil extraction, as a condiment in food, and as an ingredient in bakery and confectionery products.

2. Objectives
To work out the resource use efficiency of selected summer crop

3. Methodology
The present study was undertaken in Chandrapur district of Vidarbha region. Three tahsils were selected namely Warora, Brahmapuri, and Sindewahi for mungbean, paddy and sesame respectively.

In each tahsils three villages and 10 irrigation available farmer were randomly selected from the list obtained from agriculture technology management agency (ATMA) office of Chandrapur district. Thus, total of 90 farmer were selected. The data were collected using pre tested schedule by interviewing the farmer. The data was analyse using the following loglinear cobb-douglas production function.

$\text{Log } Y = \log a + b_1 \log x_1 + b_2 \log x_3.\ b_7 \log x_7$

Where,
Y = Estimated yield of the crop in quintals
a = Intercept of production function
bi = Partial regression coefficients of the respective resource Variable (i = 1, 2, 3, ……,7)
X_1 = Human labour in man days
X_2 = Machine labour in hours
X_3 = Seed in kg
X_4 = Manures in quintals
X_5 = Fertilizer in kg
X_6 = Bullock labour in days
X_7 = Area under summer crop in hectare

3.1 Marginal Value Product (MVP)
The MVP of resource indicates the addition of gross value of farm production for a unit increase in the 'i'th resources with all resources fixed at their geometric mean levels. The MVP of various inputs was worked out by the following formula:

$$MVP - b\,\frac{Y}{X}\,P_y$$

Where, b = Regression coefficient of particular independent variable
X = Geometric mean of particular independent variable
Y = Geometric mean of dependent variable
P_y = Price of dependent variable

4. Results and Discussion

Table 1: Regression coefficient of Cobb-Douglas production function of mung

Sr. No	Variables	Mung	Mvp to price ratio
1	Constant (Intercept)	0.39	
2	Human Labour (X_1)	0.45*	0.88
3	Machine Hours (X_2)	0.04	0.01
4	Seed rate (X_3)	0.002	0.003
5	Manure (X_4)	0.03	0.05
6	Nitrogen (X_5)	0.75	1.39
7	Phosphorus (X_6)	-2.27*	-3.87
8	Potassium (X_7)	0.93	1.51
9	Bullock Labour (X_8)	0.75	0.375
10	R^2	0.71	
11	Estimate of Return to scale	0.68	

(Figures in parenthesis are standard error of regression coefficients.)
(*indicates significant at 10% level of significance.)

From the table it is observed that the value of coefficient of determination (R_2) was 0.71 it indicated that 70 per cent variation in mung yield was jointly explained by the variable under study. The result also indicated that the elasticity of production with respect to the input were 0.45, 0.04, 0.75, 2.27, 0.93, 0.75, 0.02, 0.03 for farm input human labour, machinery labour, nitrogen, phosphorus, potassium, bullock labour was found to be most important variable output of mung. The sum of partial elasticities (0.68) shows that the farmer were operating at the region of decreasing return to scale, which suggest that they are in stage third of the production function.

The MVP to factor cost ratio of the variables nitrogen and potassium were greater than unit input price, it implies underutilization of resources and this indicates scope for raising output efficiently by increasing the use of that particular resources, the variables human labour, manures, machines, phosphorus, bullock labour, and seed, were less than unity indicating these inputs were over utilised on the farm and such the output level cannot be increased by raising more of the resources.

Table 2: Regression coefficient of Cobb-Douglas production function of paddy

Sr. No	Variables	Paddy	MVP to price ratio
1	Intercept	0.39	
2	Human Labour (X_1)	-0.32	-0.37
3	Machine hours (X_2)	0.61	0.43
4	Seed rate (X_3)	0.131	0.15
5	Manure (X_4)	0.13	0.06
6	Nitrogen (X_5)	0.23**	0.32
7	Phsphorus (X_6)	0.34	0.42
8	Potassium (X_7)	-0.23	-0.28
9	R^2	0.87	
10	Estimate of return to scale	0.89	

(Figures in parenthesis are standard error of regression coefficients.)
(** indicates significant at 5% level of significance.)

From the table it is observed that the value of coefficient of determination (R_2) was 0.87. It indicated that 87 per cent variation in paddy yield was Jointly explained by the variable under study. The result also indicated that the elasticity of production with respect to the input were 0.39, 0.32, 0.13, 0.23, 0.34, 0.23, 0.13, 0.61 for farm input human labour, machinery labour, nitrogen, phosphorus, potassium, bullock labour was found to be most important variable output of mung. The sum of partial elasticities (0.89) shows that the farmer were operating at the region of decreasing return to scale, which suggest that they are in stage third of the production function.

The MVP to factor cost ratio of the variables seed rate, nitrogen phosphorus, potassium, hired labour, manures and machine hours were less than unity indicating these inputs were over utilised on the farm and such the output level cannot be increased by raising more of the resources.

Table 3: Regression coefficient of Cobb-Douglas production function of Sesame

Sr. No	Variables	Sesame	MVP To price ratio
1	Intercept	-1.04	
2	Human Labour(X_1)	0.09	0.0003
3	Bullock Labour (X_2)	-0.83**	0.02
4	Seed rate (X_3)	-0.26	0.002
5	Manure (X_4)	0.31	0.00
6	Nitrogen (X_5)	0.90	0.03
7	Phosphorus (X_6)	-0.50	0.01
8	Potassium (X_7)	0.87	0.03
9	R^2	0.89	
10	Estimate of return to scale	0.58	

(Figures in parenthesis are standard error of regression coefficients.)
(** indicates significant at 5% level of significance.)

From the table it is observed that the value of coefficient of determination (R_2) was 0.87 it indicated that 87 per cent variation in paddy yield was jointly explained by the variable under study. The result also indicated that the elasticity of production with respect to the input were 0.09,0.83, 0.90,0.50, 0.87, 0.23, 0.26,0.31 for farm input human labour, machinery labour, nitrogen, phosphorus, potassium, bullock labour was found to be most important variable output of mung. The sum of partial elasticities (0.58) shows that the farmer were operating at the region of decreasing return to scale, which suggest that they are in stage third of the production function.

The MVP to factor cost ratio, the variables human labour, nitrogen, bullock labour, phosphorus, potassium and manure were less than unity indicating these inputs were over utilized on the farm and such the output level cannot be increased by raising more of the resources.

5. Conclusion

The production resources in the study area were found not be efficiently utilized, hence not to optimum economic advantage, so to increase the production farmer should used the recommended does of inputs.

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