International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Resource use efficiency of the Sample Farms in Paddy Cultivation in Azamgarh District of U.P

Rajeev Singh[1], Santosh Kumar Mishra[2], Pravin Shahu[3]

[1, 2, 3]Department of Agriculture Economics, N.D.U.A. & T. Kumarganj, Faizabad-224229, India

Abstract: ***This study was conducted in Martinganj block of district Azamgarh Uttar Pradesh. Following purposing random sampling techinique. 100 sample farmers were selected and interviewed for collection of data. Cobb –Douglas production function was fitted to found out resource use efficiency. Return to scale in all farm size was found more than unity (1.025 in marginal, 1.014 in small, 1.063 in medium, and 1.754 in large farm), indicates that production of paddy was characterized by increasing return to scale in case of all categories of farm, manure & fertilizer, irrigation charges, human labor and seed; the value of marginal value product (MVP) to factor cost were found positive indicating there is future scope for increasing in the investment to realize more return. In various problems, technical problem ranked first followed by management problem, agro- climatic problem and miscellaneous problem.***

Keywords: functional analysis, Cobb-Douglas production function, standard error, multiple determination (R2), Sum of elasticity return to scale.

1. Introduction

Paddy (oryza sativa L.) belongs to the Graminae family is ithe most important food crops of India and is likely to be continued as dominant food crop in future also. The highest percentage of people of the country is engaged in the processing and marketing of paddy. Besides rice consumption as food the byproduct of rice that i.e. paddy husk is also used for different purpose conventionally, husk is used as fuel, soil conditioner, packaging material animal feed and for insulation purpose. It is also used for manufacturing the building material and other chemicals, Rice barn is used for extraction of edible oil, industrial oil and animal feed. However, it has been recognized as a very useful source of proteins, carbohydrates anvitamins, paddy straw is one of the major sources of dry fodder in animal feed.

Rice provides a significant amount of foreign exchange every year. At world level, export of milled rice was 30536.67 thousand tonnes, at Asia level, 22034.35 thousand tonnes and at India level, 4736.87 thousand tonnes (2006-07). Rice production in Azamgarh district has higher scop for increasing the income and employment of the farmers in the area but no any economic study has so for conducted on Paddy cultivation. Keeping in view the importance of Paddy cultivation the study entitled "Economics of paddy cultivation in Azamgarh district of eastern U.P." has been proposed to conduct the study during 2010-12 in Azamgarh district with the following objectives:

1) To study the farm structure, cropping pattern and cropping intensity of sample farmers.
2) To work out the input –output relationship of sample farms.
3) To work out the resource use efficiency of the samples farms.
4) To find out the constraints in paddy cultivation and to suggest the suitable policy implications thereof.

2. Methodology

(1) *Sampling Design-*
Purposive random sampling technique was used to select the sample respondent. Azamgarh district of Uttar Pradesh and Martinganj block of district Azamgarh were selected purposely. A list of all the paddy growing villages of the selected block was prepared and arranged in descending order on the basis of maginitude of area under paddy and 5 villages were selected randomly from this list.

A list of all the paddy cultivators of each selected villages prepared along with their size of holding and was arranged in ascennding order. From this list 100 sample farmers (i.e. 39Marginal<1ha, 33Small, 19 Medium, 9 Large and above) were selected following the proportionate random sampling techinique

(2) *Method and Period of Enquiry*
The primary data were collected by survey method through personal interview on well structured and pre tested schedule for the Agricultural year 2011-2012.

(3) *Methods and Techniques of Analysis:*
The data collected from the sample cultivators were analyzed and estimated with certain statistical techniques.

Average
The simplest and important measures of average which have been used into statistical analysis was the weighted average. The formula used to estimate the average is:

$$W.A = \frac{\sum Wi\ Xi}{\sum Wi}$$

Where,
W.A. = Weighted average
X = Variable
W = Weights of X

3. Functional Analysis

To study the effect of various independent variables on the output, various forms of production function have been

dealt. However, Cobb-Douglas function was found more suitable to the data; therefore it was used for measuring resource use efficiency.

The mathematical form of Cobb-Douglas function is:
$Y = aX_1^{b1}. X_2^{b2} .X_3^{b3} .X_4^{b4} . e^u$

Where,
Y = per hector output (Rs.)
X_1 = Manure and fertilizer (Rs./ha)
X_2 = Total human labour (Rs. /ha)
X_3 = Seed (Rs. /ha)
X_4 = Irrigation (Rs. /ha)
a = Constant (intercept)
e^u = Error
b_1, b_2, b_3, and b_4 are production elasticity of the respective input variables.

Cobb-Douglas Production Function In Log Forms:

Log Y = log a + b_1 log x_1 + b_2 log x_2 + b_3 log x_3 + --------- + u log e
This formula was used for estimating the parameters of the function based on sample data.
The marginal value product of input were estimated by following formula.

$$MVP\ X_J = \frac{b_j \bar{Y}}{\bar{X}_j}$$

Where,
MVP = Marginal value product of j^{th} input.
b_j = Production elasticity with respect to X_j
Y = Geometric mean of the dependent variable Y
X_j = Geometric mean of the independent variable X
Having estimated the elasticity co-efficient, it is desirable to ascertain the reliability of these estimates. The most commonly used "t" test was applied to know, whether „b_j" is statistically significant from zero or not at some specified probability level. "t" cal. = b_j standard error of b_j if calculated "t" value is greater than the table value of "t" at specified probability level and n-k-1 degree of freedom b_j is said to be statistically different from zero.

F test was used to test the significance of the regression as a whole.

$$F = \frac{\text{Regression mean square}}{\text{Error mean square}} = \frac{\frac{SSR}{K}}{\frac{\sum e^2}{n-k-1}}$$

where,
SSR = sum of square due to regression
$\sum e^2$ = sum of squares of error term
M.V.P. of j^{th} input factor was tested by using formula.
t = MVPj / S.E of MVPj
S.E of MVPj = (X / Y) standard error of b_j

4. Result and Discussion

Resource Use Efficiency

The functional analysis was carried out to determine the efficiency of various resources (seed, manure & fertilizers, irrigation and human labour) used in the production of paddy. Cobb-Douglas production function was found best fit to data, and was applied for functional analysis of data. X1, X2, X3 and X4 symbolized for seed, manure & fertilizer, Irrigation and human labour cost, respectively.
X1, X2, X3 and X4 symbolized for seed, manure & fertilizer, irrigation and human labour cost respectively.
X = Human labour
X2 = Seed
X3 = Manure & fertilizer
X4 = Irrigation

Elasticity of Production

The estimated value of elasticity of production, standard error, co-efficient of multiple determination (R^2) and return to scale for paddy production by different size group of farms are given in Table – 4.1.13

Table–4.1.13. Reveals that co-efficient of multiple determination (R^2) on marginal, Small an and Medium large farms were 0.922, 0.824, 0.971, 0.976603 respectively.

In case of marginal and small size groups of farms factor like manure & fertilizer size (X2), Irrigation (X3) and human labour (X4) were found statistically significant at 5% probability level except seed (X1) Where as, in case of medium size group of farms only irrigation (X3) was found significant by responsive at 5% probability level and other factor were found non significant. As for as, large categories of farms are no concerned non of the included factor of production showed significant response.

Return to scale in case of marginal, small medium and large farms were 1.025, 1.014, 1.063 and 1.754, respectively. Return to scale in all four categories of farms was found more than unity. It indicates that production of paddy is characterized by increasing return to scale on the each farm situation.

Table: Cost of cultivation of paddy crop on different size of sample farms (Rs/ha)

Size group of farm	Production elasticity				Sum of elasticities return to scal	R2
	X1	X2	X3	X4		
Marginal	0.14077 (0.100132)	0.353247* (0.079003)	0.292267* (0,059575)	0.23842* (0.062468)	1.025	0.922
Small	0.132921 (0.132706)	0.222479* (0.103339)	0.463429* (0.116739)	0.195036* (0.079668)	1.014	0.824
Medium	0.057103 (0.038737)	0.095151 (0.100605)	0.882486* (0.242551)	0.02858 (0.049915)	1.063	0.971
Large	0.409855 (0.444904)	0.972747 (0.435074)	0.108708 (0.060019)	0.262806 (0.160287)	1.754	0.9766

Figure in parenthesis indicates standard error of respective variable
*** – significant at 1% level of probability.**
**** - significant at 5% level of probability.**

5. Marginal Value Productivity (MVP)

The MVP of different factors were per cent in Table 4.1.14 This table revels. That in case of small and large farms mvp for all included factors were found more than unity. Where as in case of marginal farms except seed mvp of all factors were more than unity while in case of medium size – group of farms. MVP of manure and fertilizer and irrigation factor were never then unity except seed and human labour. More than unity mvp value reflects that there is further scope of investment on these factors to realize optimum return. Less than unity value of mvp reveals that on these factors excessive investment was made.

Table- Marginal value productivity

Size group of farm	M V P			
	X1	X2	X3	X4
Marginal	0.701443	14.50329	3.843651	2.799936
Small	1.54753504	12.99901	6.2654462	3.3284674
Medium	0.744295	5.193834914	11.2934431	0.734962753
Large	5.23096991	34.80946127	1.30753422	7.0738199

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