

Resource Use Efficiency in Rice Production

B. Nirmala¹

Introduction

Rice is one of the staple food crops in India occupying 43 million hectares with a production of 93 million tones. It is estimated that about 260 million tones (MT) of food grains are to be produced annually by the year 2030 to meet the food requirements of the growing population (Reddy A R and Sen C. 2004). It is projected that India needs to produce 115 mt of rice by the year 2020 to maintain the present level of self-sufficiency. The available evidence suggests that farmers in developing countries fail to exploit the full potential of a technology and or make allocative errors.

Resource use efficiency is the ability of the farmer to produce the maximum possible output that can be produced with the resources available with him. The inefficient use of farm resources undoubtedly affects the productivity of crops, resulting in an unfavorable cost/returns structure. To avoid such a situation, the existing resource use pattern on individual holdings needs to be organized through appropriate farm management decisions. Since a comprehensive and analytical investigation in the magnitude and causes of variation in the productivity of individual crops/farm unit is a pre-requisite for resource use planning, this study was undertaken to examine the existing resource use efficiency and its deviation from economic use of farm resources.

The objective of the study is to examine the resource use efficiency in rice production.

Methodology

The present study was conducted in Kaithal district of Haryana, where rice is the major kharif crop. Two blocks namely Rajound and Pundari were selected randomly. Further, two villages from each block were selected and from each village, twenty farmers were selected randomly. Thus in all, eighty farmers from four villages of two blocks of Kaithal district of Haryana were selected for the study. The data on various aspects of rice cultivation were collected through pre-structured questionnaires. The data thus collected was subjected to statistical analysis. The data pertains to kharif 2007.

¹Scientist (Agricultural Economics), Directorate of Rice Research, Hyderabad.

The Analytical Framework

The frontier production function is defined as the relationship that describes the maximum possible output for a given combination of inputs. (Ferguson 1966). The empirical production functions are Linear, Cobb-Douglas type Production Function (CD), Constant Elasticity of Substitution Production Function (CES), Lieontief Production Function (LPF) and Linear Programming Production Function (LPPF). The Cobb-Douglas type production function (CD) is convenient for the comparison of the partial elasticity coefficients. It is a multiplicative type and is non-linear in its general form. The marginal productivity of factors, marginal rate of substitution, factor intensity and the efficiency of production can be calculated from the parameters in Cobb-Douglas type production (CD) function. Hence, to examine the factors affecting the resource productivity of rice, the Cobb-Douglas type production (CD) function of the following form was fitted:

$$Y = A \prod_{i=1}^{11} X_i^{b_i} e^u$$

Where

Y=Realized potential farm yield (t/ha)

X1=Seed (Kgs/ha)

X2= Manures (t/ha)

X3= Fertilizers (Kgs/ha)

X4= Plant protection chemicals (Rs./ha)

X5 = Irrigation costs (Rs./ha)

X6=Machine labour (Rs./ha)

X7= Human labour (Mandays /ha)

X8= Age of the farmer (Years)

X9=Experience in cultivation of rice (Years)

X10=Education (No. of Years of Schooling)

X11= Land (Hectares)

u= Random disturbance term

b1.....b11 = Regression coefficients

Marginal Value Productivity (MVP) of an input factor is defined as the change in output from a change in the input factor, keeping all other factors constant. Marginal Value Productivity (MVP) of a factor is measured from the following formula:

$$MVP(X_i) = b_i (Y / X_i)$$

Where,

Y=Geometric Mean level of yield of rice

X_i = Geometric Mean level of i th independent variable

b_i = The regression coefficient of i th independent variable

Results and Discussion

The estimated results of regression model for production elasticities of inputs in rice cultivation are given in Table No.1. It is evident from the table that the explanatory variables included in the model have shown greater variation in yields of rice.

Table 1. Production Elasticities of Inputs in Rice Cultivation

Item	Coefficients	Standard Error	t Stat
Intercept	11.0142	1.0866	10.1361
Seed	0.0433	0.0256	1.6923
Manures	0.4753 *	0.0969	4.9071
Fertilizers	0.0108 *	0.0029	3.7360
Pesticides	0.0015	0.0009	1.6643
Irrigation	0.0010	0.0011	0.8744
Machine labour	0.0001	0.0002	0.9258
Human labour	0.0497 *	0.0244	2.0378
Age	0.0095	0.0087	1.0897
Experience	0.0018	0.0089	0.2069
Education	0.0090	0.0231	0.3888
Land	0.0095	0.0220	0.4326
R ²	0.86		

The coefficient of multiple determination is 0.86 indicating 86 percent variation in mean yield of rice associated with variables included in the model. The regression coefficients of variables namely manures, fertilizers and human labour are significant at 5 per cent level. These positive and significant values indicate that there is scope for increasing production of rice by increasing the level of the aforesaid inputs holding all other inputs constant. The regression coefficients of seed, pesticides, irrigation, machine labour, age, experience and education of the farmer and the size of the land holding are

positive but are found to be non-significant. Among the significant variables, manure has a greater influence on yields of rice.

Resource use efficiency is the ratio of Marginal Value Product (MVP) of an input factor to the price of that input, that is Marginal Factor Cost (MFC). Optimum resource use efficiency of a particular input is obtained at a point where MVP and Factor Cost are equal ($MVP/MFC=1$). The inequality of Marginal Value Product (MVP) and Marginal Factor Cost (MFC) indicates the extent of inefficiency in resource use. If the ratio of MVP/MFC is greater than one and the regression coefficient is significant the resource input is said to be underutilized. Similarly, if the coefficients are negative and significant the input factor is said to be over utilized.

Table 2. Allocative Efficiency of Resources in Rice Cultivation

Variables	Geometric Mean	Elasticity of Output	MVP	MFC	Ratio of MVP to MFC
Seed	225.87	0.008	0.96	1	0.96
Manures	1129.97	0.259*	8.78	1	8.78
Fertilizers	2416.6	0.006*	0.18	1	0.18
Pesticides	2195.71	0.001	0.02	1	0.02
Irrigation	1002.91	0.001	0.05	1	0.05
Machine labour	4600.83	0.001	0.01	1	0.01
Human labour	3744.86	0.048*	2.15	1	2.15

It is observed from Table 2 that all the independent variables considered have positive coefficients and the ratios of MVP to MFC in respect of resource inputs namely manures and human labour are 8.78 and 2.15 respectively. These ratios indicate that, for every additional rupee spent on these variables, yield levels of rice could be increased by Rs.8.78 and 2.15 respectively. Further, it could be inferred that these resources are underutilized. On the contrary, the MVP to MFC ratio was less than unity for the other inputs included in the model thus suggesting for rational use of these inputs for enhanced resource use efficiency.

Conclusion

The marginal value product is greater than the factor costs in case of manures and human labour used in rice cultivation in the study area. It may be concluded from the analysis that the inputs namely manures and human labour are underutilized in rice cultivation. There is scope for more effective utilization of resources since there exists

unexploitable economic margin in the cultivation of rice. To increase the production and profitability from rice cultivation, suitable measures should be propounded. There is also an urgent need to offer a remunerative price to the rice growers. Efforts should be directed towards ensuring a wider adoption of modern methods of cultivation. Existing methods of market intelligence should be revitalized. These suggestions if implemented are expected to result in reducing the inefficiency in resource use in rice cultivation in the study area.

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