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Resource use efficiency on paddy farms in Mau district of eastern Uttar Pradesh

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Abstract
The present study aims to analyze the resource use efficiency, marginal value productivity of variable resources, constraint and suggestion in paddy production entitled "Economics of paddy production and its processing in district Mau of Eastern Uttar Pradesh". The data pertained to agriculture year 2015-2016. The study was conducted in five villages of Ghosi block in Mau district taking a random sample of 100 farmers. The primary data were collected by survey method through personal interview by pretested structured interview schedule. The Cobb-Douglas production function was applied to measure the efficiency of various resources used in the production of paddy. To find out the resources use efficiency of five variables namely, seed, fertilizer, irrigation, tractor and human labour was considered. Return to scale in respect to various resources on marginal, small and medium farms were found 0.862059, 0.949245, and 0.906866 respectively. The cultivation of paddy was characterized by decreasing returns to scale on each farm situation. Therefore, increasing all the factors by one per cent simultaneously results in increase of the returns by less than one per cent on each farm situation. The value of MVP of seed, manure, fertilizer, tractor cost and human labour were found both positive and negative. The positive value of M.V.P. (Marginal Value Productivity) to factor cost indicates that there is further scope to increase the investment on these inputs(seed, manure & fertilizer) on marginal,(seed, manure & fertilizer, irrigation and tractor power) on small and (seed, manure & fertilizer, irrigation and human labour) on medium . All factors realize more return than the costs must increase optimally. The different constraints faced by farmers in the production of paddy were found as technical, labour, managerial, irrigation and financial problem respectively.

Keywords: resource use efficiency, MVP, constraint and suggestions in paddy production

Introduction
Rice is the most important cereal food crop of India. Globally paddy is grown in more than 155 million hectare area with a production of about 596 million tones. Maximum area under rice is in Asia, About 90 per cent of all rice grown in the world is produced and consumed in the Asian region. India and China together hold about half of the world's paddy area and more than 60 per cent people are dependent on rice. Vavilov (1926) suggested that India and Burma should be regarded as the centre of origin of cultivated rice. Paddy, being the staple food for more than 70 per cent of our national population and source of livelihood for 120 to 150 million rural households, is backbone of the Indian Agriculture.

Paddy is used in several preparations and there has much commercial and industrial importance's. Besides grains the by-products of paddy are used for various purposes. Rice bran is used as cattle and poultry feed. Rice husk can be used in manufacturing of insulation materials, cement, card board, as a litter in poultry keeping and rice straw mixed with other materials is used to produce porcelain, glass and pottery. Rice is also used in manufacturing of paper pulp and livestock bedding, so many others uses. Paddy straw is used as litter and allow during winter season. Husk is used as fuel, soil conditioner, packaging material etc.

Paddy is grown on an area of 164.72 million hectares with an annual production of 745.71 million tonnes in the world with the productivity of 45.279 quintal per ha. during 2013 (Anonymous 2013). In the world, India ranks first in area but second in production after China. In India rice occupies an area of 43.95 million hectares with annual production 106.54 million tones with productivity of 24.249 quintal per ha. (Anonymous, 2009)**,** While area, production, and productivity in Uttar Pradesh were 5.98 million hectare, 14.63 million tonnes and 24.479 quintal per hectare respectively (Directorate of Economics and Statistics, Department of Agriculture and cooperation 2013-14).

In Mau district paddy is grown in 88319 hectare and production 190922 metric tons with 21.62 quintals per hectare. (Arth Avam Sankhyiki, 2012-13)

Methodology

Sampling technique

The purposive cum random sampling technique was used to select district, block, village and cultivators. The sampling technique was subdivided into following stages:

a. Selection of district
b. Selection of block
c. Selection of village
d. Selection of farmers

a) Selection of district
The study was purposively undertaken in Mau district in order to avoid operational inconvenience of the investigator.

b) Selection of block
At first, a list of all 09 blocks of Mau district of Uttar Pradesh along with acreage in paddy cultivation were prepared and arranged in descending order. The block namely "Ghosi" having highest area in paddy was selected purposively for this study.

c) Selection of village
A list of all the villages falling under Ghosi block was prepared and arranged in ascending order to the area covered under paddy crop and 5 villages were selected randomly from this list.

d) Selection of farmers
A separate list of paddy growers of five selected villages was prepared along with their size of holding and stratified into three categories i.e.

1. Marginal – (Below 1 ha)
2. Small – (1-2 ha)
3. Medium – (2-4 ha.)

From this list a sample of 100 respondents were drawn following the proportionate random selection for different categories.

Table 1: Village wise number of the selected farmers under different size group of farms

S No.	Name of the village	Size of Holding						Total	
		Marginal (below 1 ha)		Small (1-2 ha)		Medium (2-4 ha)			
		P	S	P	S	P	S	P	S
1.	Maidapur Samastpur	69	11	25	04	16	02	110	17
2.	Ariyaso	85	13	28	04	22	04	125	21
3.	Bhawanpur	69	11	31	05	18	03	118	19
4.	Tariyon	83	13	34	06	24	04	140	23
5.	Nadwal	78	12	32	05	20	03	130	20
Total		374	60	150	24	100	16	624	100

Note: - P= Population, S= Sample

Methods of enquiry

The primary data were collected by survey method through personal interview with use of pre-structured and pre-tested schedule, while secondary data were collected from Vikash Bhawan, Agriculture Department, Block head quarter, journals, reports, books and internet etc.

Period of enquiry

The data pertained to agriculture year 2015-2016.

Methods and techniques of analysis

i) Functional analysis

Production function analysis was carried out to examine the productivity and efficiency of different resources of the sample farms. Multiple regression analysis was done to examine the cost-benefit relationship and productivity of farms. Different types of production functions were explored, out of them only Cobb-Douglas production function was found best fit for analysis is:

$$Y = ax_1^{b1}.x_2^{b2} \ldots\ldots\ldots\ldots x_k^{bk}.e^{\mu}$$

Where,
Y = Dependent variable (output values in Rs. / ha.)
X_i = i^{th} independent variable (input values in Rs/ha)
X_1 = Seed (Rs/ha)
X_2 = Manure and fertilizer (Rs/ha)
X_3 = Irrigation (Rs/ha)
X_4 = Tractor (Rs/ha)
X_5 = Human labour (Rs/ha)
a = Constant
b_i = Production elasticity with respect to X_i
e = Error term or disturbance term
μ = error term

The values of the constant (a) and coefficient (b_i) in respect of independent variables in the function have been estimated by using the method of least squares.

ii) Estimation of Marginal Value Product:

The marginal value product of input was estimated by taking partial derivatives of returns with respect to the input concerned, at the geometric mean level of inputs.

$$MVPxj = \frac{bj\bar{y}}{\bar{X}j}$$

Where,
MVP_{Xj} = marginal value product of j^{th} input
Bi = Production elasticity with respect to Xj
y = Geometric mean of y (output values in Rs/ha)
Xj = Geometric mean of Xj (input values in Rs/ha)

Significance test of the sample regression coefficients:

Having estimated the elasticity coefficients it is desirable to ascertain the reliability of these estimated. The most commonly used't' test was applied to ascertain whether the sample production elasticity coefficient, b_j is significantly different from zero or not at some specified probability level.

$$\text{'t' calculated} = \frac{bj}{\text{S.E.of bj}}$$

Where
b_j = production elasticity of X_j
SE = standered error
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 significantly different from zero,'K' is number of independent factors and 'n' is sampled size.

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

Where,
SSR = sum of square due to regression
$\sum e^2$ = sum of squares of error term

Resource use efficiency
The Cobb – Douglas production function was applied to find out the efficiency of various resources used in the production of paddy.
The value of elasticity of production, standard error, co - efficient of multiple determination and return to scale for paddy production on different size group of farms are presented in Table (2). The high value of R^2 of the fitted function indicated that sufficient and large proportion of the total variation in the depended variable is explained by the input included in the function. The table further indicated that five variables viz. seed, manure & fertilizer, irrigation, farm power machinery and human labour jointly explained 86.20, 94.92 and 90.68 per cent variation accused in dependent variable on marginal, small and medium farms, respectively.
It is also revealed from the table that dependent variable was statistically significant at 1and 5 per cent level of probability in all size groups of farms.

Marginal value productivity
In case of all the categories of farms and all five variables, the positive value of M.V.P. to factor costs Table-3 indicates that there is further scope to increase the investment in (Seed, manure & fertilizer) on marginal farms and (Seed, manure & fertilizer, irrigation and tractor power) on small farms while (Seed, manure & fertilizer, irrigation and human labour) medium farms on all these factors to realize more return than the costs & for betterment of the farming community

Table 2: Resource use efficiency in paddy on different size group of sample farms**.**

Size group of sample farms	Production elasticity					Sum of elasticity	R^2
	X_1	X_2	X_3	X_4	X_5		
Marginal farmer (Below 1ha.)	0.194213** 0.041295	0.326071** 0.028126	0.106087* 0.039713	0.051431 0.067295	0.184257** 0.033161	0.8620511	0.943957
Small farmer (1-2ha.)	0.221423* 0.070794	0.301856** 0.043273	0.172189 0.153556	0.098918 0.124127	0.154859* 0.050278	0.949245	0.965708
Medium farmer (2-4 ha.)	0.173370** 0.125196	0.371665** 0.056998	0.138735 0.094567	0.0675386 8.434433	0.1477714* 0.05654	0.906866	0.950868

** Significant at 1 percent level
* Significant at 5 percent level
X_1 = Seed
X_2 = Manure and fertilizer
X_3 = Irrigation charges
X_4 = Farm power & machinery
X_5 = Human labour

Table 3: Marginal value productivity (MVP) of included factors in production process of paddy crop.

Size group of sample Farms	Marginal value productivity of input/ factors				
	X_1	X_2	X_3	X_4	X_5
Marginal farmer (below 1ha.)	2.06935	1.88868	0.98432	0.37824	0.75240
Small farmer (1-2ha.)	2.62409	2.39770	2.37410	1.00683	0.96541
Medium farmer (2-4 ha.)	1.93997	2.80873	2.23560	0.95027	1.10976

Constraints and suggestions of production of paddy in study area
The main problem faced by the paddy growers of the study area is presented in table 4. The sample farmers had been suffering from number of problem. For the presentation, the problems were categorized in five major groups, which are as follows.

1. Technical problems
It is related to the knowledge of quality seeds, its rate and time of sowing. Required balance dose of fertilizer, name, quantity and method of application of herbicide etc.

2. Labour problem
It relates to the availability of sufficient number of labours during peak season of the farm work.

3. Managerial problem
It included the knowledge and experience regarding decision taking, timely arrangements of various inputs, irrigation facilities and disposal of produce at appropriate place and time.

4. Irrigation problems
The irrigation water was observed as the fourth major constraints that the availability was not assumed during the crop season. It is advised that the govt. should be ensure the availability of irrigation water to the different stage of crop and season to the farming community for betterment of farmers.

5. Financial problem
The arrangement of required fund at cheapest interest rate and appropriate time were included as financial problem.

Table 4: Constraints of paddy on different size group of sample farms

S. No.	Particulars	Marginal (below- 1ha.)	Small (1-2ha.)	Medium (2-4ha.)	Total	Ranks
1.	Technical problems	40 (66.66)	18(75.00)	5(31.25)	63(63.00)	I
2.	Labour problems	15 (25.00)	20(83.33)	14(87.50)	49(49.00)	II
3.	Managerial problems	38(63.33)	7(29.16)	--	45(45.00)	III

4.	Irrigation Problems	30(50.00)	6(25.00)	2(12.50)	38(38.00)	IV
5.	Financial problems	32(53.33)	3(12.5)	2(12.50)	37(37.00)	V
	Total farms	60(100)	24(100)	16(100)	100	

Suggestions

- Any agricultural knowledge and new technology farmers should call "Kisan Call Center" No. 18001801551 and Iffco Kisan Call Center" also provides the facilities for the farmer regarding knowledge on agriculture. Agencies involved in disseminating the improved scientific techniques should organize more practical training programmers in order to increase the knowledge and skill of paddy growers.
- Adoption of co-operative farming and formation of SHG may help to solve the labour problems of the producers.
- Different Government departments like Department of Agriculture, plant protection and irrigation should assure the timely and adequate supply of the inputs and irrigation water. Government should also ensure that the quality inputs are supplied to the farmer by different agencies.
- Awareness among the irrigation water in canal to be peek session of the irrigation on paddy crop. Effort should be made by the Government to develop the Chuck dam, irrigation channels and ridges.
- Through the Kisan Credit Cards and other financial schemes of the institutional credit have been proved helpful for the farmers. But to make it more efficient these facilities should be easier and liberal.

Conclusion

To find out the resources use efficiency five variable namely, seed, fertilizer, irrigation, tractor and human labour were considered. Return to scale on marginal, small and medium farms were found 0.862059, 0.949245, and 0.906866 respectively. The cultivation of paddy was characterized by decreasing returns to scale on each farm situation. Therefore, increasing all the factors by one per cent simultaneously results in increase of the returns by less than one per cent on each farm situation.

The positive value of M.V.P. (Marginal Value Productivity) to factor cost indicates that there is further scope to increase the investment on these marginal (Seed, manure & fertilizer), small (Seed, manure & fertilizer, irrigation & tractor power) and medium (Seed, manure & fertilizer, irrigation and human labour) all factors to realize more return than the costs.

The sample farmers had been suffering from a number of problems. For the presentation, the problems were categorized in four major groups, which are as follows: Technical problems, labour problems, irrigation problem, and financial problem respectively.

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