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FARM SIZE AND RESOURCE USE RELATIONSHIP OF PADDY FARMS IN KERALA

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Agricultural production is influenced by several factors. Of these land, labour, capital and fertilizers are the most important. These resources have to be used in the most efficient manner to obtain the maximum production. The best method of measuring the nature of resource use in agricultural farms is by fitting a production function (Heady 1946). A production function is an algebraic equation expressing the relationship between the output factor and each of the input factors. A production function can be used as a guide to farmers in decision making. Among the various production functions used in experimental studies the Cobb-Douglas type of production function is considered to be the best (Heady and Dillon 1961). It allows diminishing marginal productivity and increasing or decreasing returns to scale. It assumes a constant elasticity of production over the entire ranges of inputs. The function is logarithmically linear and can be fitted by the method of least squares.

As no objective studies on the farm resources productivity had been done in Kerala, an attempt was made to study the nature of resource use among selected paddy farm sizes in Kerala State, the results of which are presented in this paper.

Material and Methods

The data for the present studies were collected from selected holdings in different districts of Kerala during the year 1969-70, using the stratified sampling method. From the collected schedules a random sample of fifty holdings which gave relevant data on the cultivation of paddy was selected. The farms were classified into 3 groups based on cropped area, as small (zero to 4.99 acres) medium (5 to 9.99 acres) and large (above 10 acres) (Subramaniam 1967). For each size of the farm, the input - output relationship was studied.

In these studies only 3 input factors namely land (x_1) labour (x.>) and manures and fertilizers (x_3) were considered. Land was measured in acres while the expenditure on labour and manures were recorded in rupees.

Marginal value of productivity of each input factor was estimated by taking the partial derivatives of returns with respect to the inputs concerned, calculated at the geometric mean levels of the inputs.

The function fitted was of the form:

$y = a x_1^{b_1} x_2^{b_2} x_3^{b_3}$

y = return in Rupees per acre

x_1 = cropped area in acres

x_2 = labour expenditure in Rupees

x_3 = manures and fertilizers in Rupees

a = constant

b_1, b_2, b_3 = elasticities of land, labour and fertilizers respectively.

The marginal value of productivity of each factors was obtained as:

M. V. P. = $\frac{\Delta y}{\Delta x_1} \cdot \frac{b_1 y}{x_1}$ - at the geometric mean levels.

Results and Discussion

The production functions for the three size groups of holdings are given below:—

Small: $y = 5.670\ x_1^{.0206}\ x_2^{.6932}\ x_3^{.2357}$

Coefficient of determination $R^2 = .3928$

Medium: $y = 255.8\ x_1^{.4395}\ x_2^{.0922}\ x_3^{.5478}$

$R^2 = .5210$

Large: $y = 27.86\ x_1^{.1534}\ x_2^{.0686}\ x_3^{.5377}$

$R^2 = .6217$

The coefficient of determination gives the fraction of variability in the dependent variable which can be attributed to the independent variables. Here the fraction of changes in gross output contributed by land, labour and fertilizer in the 3 sizes of groups of holdings were 0.39, 0.52 and 0.62 respectively.

The regression coefficients (Elasticities of Production) 'bi' with their standard errors and 't' values are presented in Table 1.

Table 1

Elasticities of Rice Production in Relation to Different Resources and Farm Sizes

Resources:	Land			Labour			Fertilizers		
Farm Sizes:	Small	Med.	Large	Small	Med.	Large	Small	Med.	Large
bi	.0206	.4395	.1534	.6932	.0922	.0686	.2357	.5478	.5377
S.E.ofbi	.2138	.3662	.1874	.3755	.3431	.1675	.2223	.2700	.1143
t	Zl	1.2001	Zl	1.8463	Zl	∠1	1.0607	2.0281	4.7877

The values of bi indicate the expected percentage change in the product in response to a one percent change in the input. bi indicates the percentage by which the output y would change if all the input factors $x_1, x_2, \ldots\ldots x_n$ were altered by one percent of their present quota. If bi is less than 1 decreasing returns to scale is anticipated In the present studies bi was less than 1 in all the three size groups indicating diminishing returns to scale.

Regression of lard turned out to be negative in the case of medium size farms whereas they were positive in the low and high groups of farms. A negative regression indicates a reduction in output with an increase in the concerned input. Thus, in the medium sized farms there was a reduction of 0.44 percent in the gross output per acre with an increase of one percent in the area of the land, but in the larger farms, if the land was increased by one percent there would be an addition of 0.15 percent to the total output.

Regression of labour was significant at 10 percent level for the small size group farms. It shows that a one percent increase in the amount spent for labour led to an increase of 0.69 percent in the total output keeping the other factors constant. The regressions in the other two categories of farm size groups were not significant.

The elasticity of manure was 0.2357 in the small size group of farms which was significant at 0.25 level. In the medium and larger farms the elasticities were significantly different from zero at 0 07 and 0.01 levels of significance. A one per cent increase in the expenditure on manures and fertilizers, keeping the other factors constant, increased the total output per acre by 0.23, 0.55 and 0.54 per cent respectively. The larger standard errors appeared to be due to the smallness of the sizes of the samples.

The marginal value of productivity of each input factor at the geometric mean levels of the other factors is given in Table 2.

Table 2

Marginal Value of Rice Productivity at Geometric mean Levels

Resource	SMALL		MEDIUM		LARGE	
	G. M. level of inputs.	Marginal value of products	G. M. level of inputs	Marginal value of products	G. M. level of products	Marginal value of products
X1 (Land in acres)	3.2	8.02	7.7	66.01	25.5	6.86
X2 (Labour in Rupees)	359.6	2.43	367.3	0.29	369.8	0.21
X3 (Manures in Rupees)	240.7	1.23	260.6	2.88	187 4	3.27

The marginal value of product indicates the returns which on the average can be expected bv adding one more unit of the input factor to the present quota. keeping the other factors constant at their G. M. level. From the Table it may be seen that there was an increase of 8.03 rupees in the output of the small farms corresponding to an increase of one acre in the present land size. For the large farms also the increase in land area was slightly profitable to the order of Rs. 6.00 per acre. But in the medium group there was a reduction of Rs. 66.00 with an increase of every one acre to the present size of holding.

Marginal values of products for labour were Rs. 2.42. Rs 0.29 and Rs. 0.21 respectively indicating that if the input of labour was increased by one rupee there would be an increase of Rs. 2.42 and 21 Ps. in the total output per acre respectively for the small and large farms whereas the medium size holdings showed a decrease of 29 Ps. per acre. Therefore there was greater scope of increasing labour in the small and large siza farms.

As regards the effect of manure in increasing profit from agricultural enterprises it may be seen that the marginal value of productivity of manure for the 3 groups were 1.23, 2.88 and 3.27 respectively. These figures indicate the possibility of getting larger outputs by additional use of manures and fertilizers. An increase of one rupee spent for buying manures and fertilizers added Rs. 1.23, 2.88 and 3.27 respectively to the total output provided the other factors remain constant at their G. M values. The response to fertilizers was greater in larger farms as compared to smaller ones. The large scale cultivators were more sensitive in the efficient use of manures and fertilizers with a view to increasing the gross output.

The geometric means of output per acre for the small medium and large groups of farms are given in Table 3.

Table 3

Geometric Means of Outputs of Rice Farms

Size of the farm	Range of Value in Rupees	Geometric mean of output per acre in Rupees
Small	522-2632	1259
Medium	755-2000	1161
Large	440-1882	1140

It may be seen that the mean output per acre was greater in smaller farms as compared to larger ones. Thus a possible negative correlation could be suspected between the size of the farm and the gross output per acre.

Summary

Studies were conducted on selected paddy farm sizes in Kerala State to measure the efficiency of resource use, by fitting the Cobb-Douglas type of production function. The results indicated a greater emphasis on the use of fertilizers and manures in cultivators' field. In small farms labour was a significant ingredient which accelerated production. The gross output per acre was found to decrease as the size of the farm increased.

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