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Assessment of farm level resource utilization in different rice types across the major rice growing districts of Tripura

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Abstract
This study undertaken in the four major rice growing districts of Tripura, has examined the farm level resource utilization of paddy production. The primary data collected from rice farmers using the stratified random sampling were used in the present study. During the study it was found that, in case of both autumn and summer rice the coefficient of manures and fertilizers was highly significant across all the size of farms. Similarly, in autumn rice the coefficient of machine labour was found to be highly significant across all size groups of farms except semi medium size of farms.In autumn rice for all farms sample, the MPP for all the factor inputs except the human labour in small farms and area along with machine labour in semi medium size of farms were found to be positive.

Keywords: utilization, major rice

Introduction
Paddy is the world's most important food crop, serving as staple food for more than half of the world's population (Khush, 2005) [4]. It is one of the major agriculture crop in India grown under diverse ecological conditions, with varied phenology and yield (Nachimuthu, VV *et al* 2014) [3]. Paddy being the stable food for 2.4 billion people, it feeds more than 50 per cent of the world's population. The principal paddy producing countries of the world are China, India, Japan, Bangladesh, Thailand, Myanmar, Vietnam, Brazil, South Korea, Philippines and the United States. In India, rice is the most preferred staple food for about 65 per cent of the population. One-third of the world's paddy cultivation area, i.e., 83 million hectares, is in India. It is grown in almost all the states of India but concentrated mostly in the river valleys, deltas and low-lying coastal areas of north eastern and southern states of India. In the northern and western parts, temperature in winters is fairly low and therefore paddy is grown once a year during the months of May to November. It is to be noted that there is a vast diversity in the types of rice cultivated across India. Tripura, a state located in the south-west extreme corner of the north-eastern region of India. Economy of Tripura is basically agrarian. About 50.83 percent of its population depends on agriculture for livelihood. Rice is the major crop of the state which is cultivated in 91 per cent of the total cropped area (Directorate of Economics &Statistics, Government of Tripura). Traditionally, most of the indigenous population practised Jhum method (a type of slash-and-burn) of cultivation, where also rice comprises a major part along with other crops grown. Agriculture and allied activities has remained as the backbone of the State's economy. State's rural economy is entirely driven by this sector. About 52 per cent of total main workers are engaged in agriculture including 28 percent cultivators and 24 per cent agricultural labourers. Small and marginal farmers constitute 96 per cent of the total farmers in the state against all India 78 percent. Availability of cultivable land is one of the main constraints in the state. During 11th plan period 2007-2012, the annual average growth rate of agriculture and allied activities has increased to 6.4 per cent as against 3.9 per cent in 10th plan period. The contribution of agriculture and allied activities to the Gross State Domestic Product (GSDP) is about 22 per cent in the terminal year of 11th plan. Agriculture sector plays the key role in the State's economy. There exists a high degree of volatility in the world rice market because a small change in production or consumption brings a relatively large change in its total trade. The agricultural growth is affected by the various resources such as seeds, manures, fertilizers, irrigation facilities, labour, bullock labour, working capital, farm implements, machinery, crop protection inputs, etc. The rationality in the allocation of resources by the farmers is a crucial issue in agricultural production (Malgatti *et al*., 2017) [2]. Therefore study was carried out across the major rice growing districts of Tripura which focussed on resource use efficiency in rice productivity.

Material and Methods

To evaluate how efficiently the farmers of the district were using their resources, the marginal physical product (MPP) of an input was compared with its respective factor cost. An optimal use of that factor was indicated as the ratio approached unity. The value of ratio greater than unity meant that returns could be increased by using more of that resource and for value of that ratio less than unity indicated improper use of that resource.

The marginal physical product (marginal return of an input) of a particular resource represents the expected addition to the gross return caused by an addition of one unit of the resource, while other inputs are constant. The marginal value products of the factors were computed by multiplying the regression coefficient of the resources with the geometric mean of gross return to the geometric mean of each resource.

$$M.P.P.x_{1.j} = \frac{dy_{i.j}}{dx_{i.j}} = \frac{b_{i.j}\, Y_{i.j}}{x_{i.j}}$$

Results and Discussion

Resource use efficiency in different rice types

Autumn rice

The value of MPP ranged from 0.9896 to 0.0178 in semi medium farms. The MPP of human labour was found to be negative in small size group of farms (-0.0607) and in semi medium size farms machine labour and area were found to be negative, which indicated that addition of one unit of human labour would decrease the gross return. But the case was just reverse in marginal and semi medium size group of farms where addition of one unit of human labour would add to the gross return. The MPP of area ranged from -0.0379 in semi medium farms to 0.8222 in marginal farms. In case of machine labour, MPP was negative because of negative regression coefficient (-0.0283) of factor in semi medium size farms. The negative MPP indicated decrease in gross return with the addition of one more unit of that factor. In marginal and small farms addition of one unit of this input would have add rupees 0.23 and 0.52, respectively.

Table 1: Elasticity coefficient of strategic inputs of autumn rice in different size group of farm

Size of Firm	Variable	Regression coefficient	Standard Error	R^2	Observation
Marginal	Intercept	8.7744***	1.272	0.90	45
	Area (X1)	0.8222***	0.187		
	Man & Fer (X2)	0.1109*	0.046		
	H Lab (X3)	0.0652	0.136		
	M Lab (X4)	0.2304*	0.123		
Small	Intercept	3.9247	0.655	0.98	26
	Area (X1)	0.1086	0.116		
	Man & Fer (X2)	0.3692***	0.085		
	H Lab (X3)	-0.0607	0.071		
	M Lab (X4)	0.5274***	0.134		
Semi Medium	Intercept	6.9078	1.704	0.98	9
	Area (X1)	-0.0379	0.327		
	Man & Fer (X2)	0.0178	0.097		
	H Lab (X3)	0.9896*	0.380		
	M Lab (X4)	-0.0283	0.133		

*indicates 10% significance**indicates 5% significance***indicates 1% significance

In all farms sample MPP for all the factor inputs except human labour in small farms and area, machine labour in semi medium size of farms were found to be positive. As positive MPP indicated possibilities of further increase of the input, hence there is a scope for increasing gross return through additional expenditure of this input except the negative one in all farms.

Summer rice

The value of MPP ranged from 0.0001 to 0.8038 in small farms. The MPP of human labour and machine labour (-0.0309 and -0.0786 respectively) were found to be negative in marginal size group of farms. In semi medium size farms area and machine labour were found to be negative, which indicated that addition of one unit of area or machine labour would decrease gross return. The negative MPP indicated decrease in gross return with the addition of one more unit of that factor. In small farms addition one unit of this input would have add rupees 0.75 in machine labour. The MPP of area ranged from -0.3209 in semi medium farms to 0.8038 in small farms. In case of human labour, MPP was negative because of negative regression coefficient (-0.0309) of factor in marginal size group of farms. The negative MPP indicated decrease in gross return with the addition of one more unit of that factor.

Table 2: Elasticity coefficient of strategic inputs of summer rice in different size group of farm

Size of Firm	Variable	Regression coefficient	SE	R^2	Observation
Marginal	Intercept	8.9631***	1.991	0.92	56
	Area (X1)	0.6811**	0.246		
	Man & Fer (X2)	0.3501***	0.081		
	H Lab (X3)	-0.0309	0.219		
	M Lab (X4)	-0.0786	0.060		
Small	Intercept	3.1264***	0.492	0.97	40
	Area (X1)	0.8038***	0.086		
	Man & Fer (X2)	0.2254**	0.068		
	H Lab (X3)	0.0001	0.036		
	M Lab (X4)	0.7554***	0.097		
Semi Medium	Intercept	3.2046	3.445	0.90	20

	Area (X1)	-0.3209	0.364		
	Man & Fer (X2)	0.6748*	0.324		
	H Lab (X3)	0.7733*	0.323		
	M Lab (X4)	-0.2162	0.171		

*indicates 10% significance**indicates 5% significance***indicates 1% significance

In all farms sample MPP for all the factor inputs except human labour in marginal farm, area of semi medium farms and machine labour in marginal and semi medium size of farms were found to be positive. As positive MPP indicated possibilities of further increase of the input, hence there is a scope for increasing gross return through additional expenditure of this input except the negative one in all farms.

Winter rice

The value of MPP ranged from 0.0064 to 0.9694 in small farms. The MPP of area were found to be negative in all groups of farms. In semi medium size farm machine labour was found to be negative, which indicated that addition of one unit of area or machine labour would have decreased gross return. The negative MPP indicated decrease in gross return with the addition of one more unit of that factor. In marginal and small farms addition one unit of this input would add rupees 0.78 and 0.96, respectively. But the case in marginal and small size group of farms where addition of one unit of machine labour would have added to the gross return. The MPP of area ranged from -0.4861 in small farms to -0.0379 in semi medium farms. In case of machine labour, MPP was negative because of negative regression coefficient of factor in semi medium size group of farms. The negative MPP indicated decrease in gross return with the addition of one more unit of that factor.

Table 3: Elasticity coefficient of strategic inputs of winter rice in different size group of farm

Size of Firm	Variable	Regression coefficient	SE	R^2	No. of observation
Marginal	Intercept	2.9540***	0.955	0.83	100
	Area (X1)	-0.2221	0.196		
	Man & Fer (X2)	0.0546	0.048		
	H Lab (X3)	0.3201	0.195		
	M Lab (X4)	0.7806***	0.062		
Small	Intercept	1.5613	1.87	0.70	39
	Area (X1)	-0.4861*	0.285		
	Man & Fer (X2)	0.0064	0.099		
	H Lab (X3)	0.1128	0.152		
	M Lab (X4)	0.9694***	0.241		
Semi Medium	Intercept	6.9078***	1.348	0.86	19
	Area (X1)	-0.0379	0.307		
	Man & Fer (X2)	0.0178	0.076		
	H Lab (X3)	0.9896*	0.338		
	M Lab (X4)	-0.0283	0.137		

*indicates 10% significance**indicates 5% significance***indicates 1% significance

In all farms sample MPP for all the factor inputs except machine labour in semi medium farms and area in all farms is found to be positive. As positive MPP indicated possibilities of further increase of the input, hence there is a scope for increasing gross return through additional expenditure of this input except the negative one in all farms. Above results were found in harmony with Suresh and Reddy (2006) [1].

Conclusion

In autumn rice the value of coefficient of multiple determinations (R^2) ranged from 0.90 in marginal size group of farm to 0.98 in small and medium size group of farm which explained variation in the dependent variable by independent variables chosen in the equation in different size groups of farms. In summer rice the value of coefficient of multiple determination (R^2) ranged from 0.90 in semi medium size group of farm to 0.97 in small size group of farms. In winter rice the value of coefficient of multiple determinations (R^2) ranged from 0.70 in small size group of farm to 0.86 in semi medium size group of farms.

Among the strategic variables included in the model of autumn and summer rice the coefficient of manures and fertilizers was found to be highly significant in almost all the size of farms. Similarly, in autumn rice the coefficient of machine labours was also found to be highly significant in all size group of farms except semi medium size of farms. In autumn rice for all farms sample MPP for all the factor inputs except human labour in small farms and area, machine labour in semi medium size of farms were found to be positive. As positive MPP indicated possibilities of further increase of the input, hence there is a scope for increasing gross return through additional expenditure of this input except the negative one in all farms. In summer rice all farms sample MPP for all the factor inputs except human labour in marginal farm, area of semi medium farms and machine labour in marginal and semi medium size of farms were found to be positive. In winter rice in all farms sample MPP for all the factor inputs except machine labour in semi medium farm and area of all farms were found to be positive.

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