A STUDY ON 93TECHNICAL EFFICIENCY OF 93PADDY CULTIVATION IN WEST GARO HILLS DISTRICT OF MEGHALAYA

[1]Name of 1st Author - Bonali A Sangma, [2]Name of 2nd Author- Dr D.C. Kalita
[1]Designation of 1st Author- Research Scholar [2]Designation of 2nd Author- Professor,
[1]Name of Department of 1st Author-Department of Rural Development and Agricultural Production
[1]Name of organization of 1st Author North Eastern Hill University , City Tura Campus, West Garo Hills, Meghalaya, Country-India.

Abstract

The determination of Technical Efficiency is very crucial in analyzing the resource use efficiency of an agricultural product. A farmer attains technical efficiency when maximum production is yield by utilizing a minimum quantity of inputs. Therefore, in the present study, an attempt has been made to study the technical efficiency of paddy cultivation in the West Garo Hills district of Meghalaya. The data were collected from 200 paddy growers covering 20 villages. This study will enable the paddy growers to determine the optimal level of inputs utilization and thereby help in enhancing the yield and income. As per the findings, the different existing inputs used in paddy cultivation were land (X_1), seed (X_2), fertilizer (X_3), farmyard manure(X_4), pesticide(X_5), power tiller (X_6), bullock labour (X_7), labour (X_8) and marketing cost (X_9). The Cobb Douglas production function was used to test the efficiency of different production inputs. Hence the underutilized and the over-utilized inputs were determined using the production function analysis. The results reveals that Technical Efficiency or Elasticity Coefficient (Ep) shows a decreasing return to scale (Ep<1) of paddy productivity in all group size group of paddy growers in the study area.

Keywords : Resource use, Technical Efficiency, Cobb Douglas production function, Average Physical Product, Marginal Physical Product, Marginal Value Product, Marginal Factor Cost , Profitability ratio , Efficiency Gap and Divergence.

I. INTRODUCTION

Paddy is un-husked rice, which is one of the major food crops in the world as well in Asia. It is one of the most important food crop in India contributing to more than 40 per cent of total food grain production of the country. Rice plays a very key role in the Indian economy as it is the staple food for the two-third population of the country. Meghalaya is predominantly an agrarian economy and about 75 per cent of the population depends on agriculture for their livelihood. Among the districts of Meghalaya, the West Garo Hills district has maximum share of around 36.36 per cent of total rice production covering 35.98 per cent of cultivated rice area. However, in terms of productivity, it is lower than the national average. Therefore, an attempt has been made under this study to analyze the optimal level of inputs utilization. Further, it will help the paddy growers in maximizing the output from the efficient utilization of available inputs.

II.MATERIAL AND METHODS

The survey method of investigation was adopted for the work of data collection. A specially designed schedule structure has been used for getting the information on socioeconomic data, production, input utilization and related aspects. The study comprised of 200 samples of the paddy growers. Purposive sampling technique was adopted for the selection of sample paddy growers. The samples were collected from two blocks Viz., Tikrikilla and Selsela, covering 20 villages. The selected paddy growers were stratified into three size groups Viz., (Group I (1> -6 bigha), Group II (6.1-14 bigha) and Group III (14 and above bigha) base on the area under rice cultivation by using Cumulative Root Frequency Rule. The Cobb Douglas production function was used to analyse the data.

1.1 Determination of Technical Efficiency

The Cobb- Douglas production function was used to measure the technical efficiency of paddy growers. The general form of the Cobb-Douglas production function is as under:

Cobb-Douglas Production Function $Y = a_o x_i a_1$

Where Y=level of output

X_i= level of inputs

a_o,a_1 = constant represent efficiency parameter and the production elasticities of respective input variables

The elasticity of production(Ep) which is the percentage of change in output as a ratio of a percentage change in input was used to calculate the rate of return to scale which is a measure of a farm's success in producing maximum output from a set of input (Farrel, 1957). This is given as;

Ep = MPP/APP

Where, Ep = Elasticity of production

MPP = Marginal physical product (Change of output)

APP = Average physical product (Change of input)

Decision rules :

If, ∑Ep = 1: constant return to scale

∑Ep < 1: decreasing return to scale

∑Ep > 1: increasing return to scale

III. RESULTS AND DISCUSSION

Technical Efficiency of Resource Use

The Production Elasticity (Ep) or Technical Efficiency of paddy cultivation for inputs viz, land (X_1), seed (X_2), Fertilizer (X_3), FYM (X_4), pesticide(X_5),Power tiller (X_6),Bullock labour (X_7), Labour (X_8) and Marketing cost (X_9) were presented in table 1.1. Here in case of group I, II and III the sum of technical efficiency or elasticity coefficient (∑Ep<1) of input was 0.71, 0.70 and 0.57 respectively. Also, the sum of technical efficiency or elasticity coefficient of input for overall size group was 0.63. The result shows decreasing return to scale (∑Ep<1) for size groups I, II and III including overall. Which present that proportionate change of the output is less than proportionate change in input use for paddy cultivation. Thus the result indicates that a marginal increase in the amount of these inputs would not raise the total value of output proportionately. The coefficient of multiple determination (R^2) of the production function was 0.274 in group I, 0.245 in group II and 0.767 group III, the result shows that about 27.4,24.5 and 76.7 per cent of the variation in productivity of paddy in group I, II and III respectively, which were described by the independent variables. Similarly, about 51.6 per cent in the overall production of the paddy grower depends on these independent variables. Here in case of group I, II and III the sum of technical efficiency or elasticity coefficient (∑Ep<1) of input was 0.71, 0.70 and 0.57 respectively. Also, the sum of technical efficiency or elasticity coefficient of input for overall size group was 0.63. The result shows decreasing return to scale (∑Ep<1) for size groups I, II and III including overall. Which present that proportionate change of the output is less than proportionate change in input use for paddy cultivation. Thus the result indicates that a marginal increase in the amount of these inputs would not raise the total value of output proportionately.

Table -1.1 Technical Efficiency –Cobb Douglas production function analysis

Variables	Group I	Group II	Group III	Overall
	Technical Efficiency (Ep)	Technical Efficiency (Ep)	Technical Efficiency (Ep)	Technical Efficiency (Ep)
Constant	0.55	3.71	0.48	2.05
Land (X_1)	0.39	0.54	1.05	0.51
Seed (X_2)	-0.12	0.44	0.8	0.44
Fertilizer (X_3)	-0.005	-0.02	0.03	-0.01
FYM (X_4)	0.072	-0.67	0.09	-0.43
Pesticide (X_5)	0.05	-0.02	-0.09	0.02
Power tiller(X_6)	-0.04	0.18	-0.66	-0.14
Bullock(X_7)	-0.03	0.1	-0.43	-0.09
Labour(X_8)	0.25	0.31	-1.54	0.22
Marketing cost(X_9)	0.14	-0.17	1.33	0.12
Return to scales	0.71	0.70	0.57	0.63
R Square	0.274	0.245	0.767	0.516
No of observation	94	62	44	200

Significance at 5 % probability level

Technical Efficiency Parameters of Resource Use

The estimates of technical efficiency parameters of resources such as Average physical product (APP), Marginal physical product (MPP), and Marginal value product (MVP), Marginal Factor cost (MFC), Profitability ratio (MVP/MFC), Efficiency gap and Divergence were derived from the sample of paddy growers. The overall estimates of efficiency parameters of resource use in paddy cultivation are presented in table 1.2. The value of MPP represents that the paddy growers were technically more efficient in the use of land than all other resources for higher productivity of paddy. This shows that if additional hectares were available then there would be an increase in paddy productivity by 122.89 quintals to the paddy grower. Among the resource used, seed (X_2), FYM (X_4), Power Tiller (X_6) had the negative MPP values, this shows inefficiency in utilization of these resources. Further, the level of technology and prices of input, output, and efficiency of resource used were ascertain by equating the values of MVP to MFC of resources. When there is no significant difference between the MVP and MFC or the ratio of MVP to MFC or Profitability ratio is equal to unity (1), in that case, the resource is said to be optimally allocated.

Table 1.2 , represent that the profitability ratio was more than unity (1) for Fertilizer and FYM, whereas less then unity values were found in all other resources. This shows that Fertilizer and FYM were underutilized (>1) whereas all other inputs were over-utilized (<1). As above, to increase the profitability the paddy grower will have to efficiently utilize the inputs. The adjustment in the MVPs for optimal resource use purpose (per cent divergence), about 26.71 per cent increase in fertilizer (X_3) and 27.03 per cent increase in FYM (X_4) will be required , while land (X_1), Seed (X_2), pesticides (X_5), Power tiller (X_6), Bullock (X_7) Labour (X_8) and Marketing cost (X_9) where over-utilized which require 9.38, 473.29,270.84,63.65,230.27,701.45, 119.25 per cent reduction for optimal use in paddy production.

Table 1.2 Overall estimates of Efficiency Parameters for Economic use of resource in Paddy cultivation

Resource	Geometric mean	APP	MPP	MVP	MFC	Profitability ratio	Efficiency gap	Divergence
Land (X_1)	6.25	177.01	122.89	1106.05	1209.77	0.91	-103.72	-9.38
Seed (X_2)	64.46	17.85	-1.85	-16.63	-95.33	0.17	78.7	-473.29
Fertilizer (X_3)	16.11	4.46	0.51	4.61	3.38	1.36	1.23	26.71
FYM (X_4)	54.82	139.04	-0.5	-4.54	-3.31	1.37	-1.23	27.03
Pesticide (X_5)	3.15	88.86	7	62.97	233.5	0.27	-170.54	-270.84
Power tiller (X_6)	5.76	152.62	-28.75	-258.75	-423.43	0.61	164.68	-63.65
Bullock labour (X_7)	2.53	978.45	18.57	167.13	551.98	0.3	-384.85	-230.27
Labour(X_8)	25.79	731.11	0.35	3.14	25.17	0.12	-22.03	-701.45
Marketing cost (X_9)	7.22	207.75	4.98	44.86	98.35	0.46	-53.49	-119.25

IV. CONCLUSION

The study reveals that in case of group I, II and III the sum of Technical Efficiency or elasticity coefficient were in decreasing return to scale ($\sum Ep<1$) for all size group of paddy growers including overall. The coefficient of multiple determination (R^2) shows that about 27.4,24.5 and 76.7 per cent of the variation in productivity of paddy in group I, II and III respectively, The overall estimates of efficiency parameters of resource use in paddy represents that the paddy growers were technically more efficient in the use of land than all other resources and if additional hectares were available then there would be an increase in paddy productivity by 122.89 quintals to the paddy grower. Among the resource used, seed (X_2), FYM (X_4), Power Tiller (X_6) had the negative MPP values, this shows inefficiency utilization of these resources. Further, the input, output, and efficiency of resource used were ascertain by equating the values of MVP to MFC of resources. Also the profitability ratio was found more than unity (1) for Fertilizer and FYM, whereas less then unity values were found in all other resources. This shows that Fertilizer and FYM were underutilized (>1) whereas

all other inputs were over-utilized (<1). Therefore the study can be concluded that the paddy growers of the study area are not technically efficient in utilization of available inputs at present. Thus there is a scope of maximizing the output by the reallocation of these resources. Thus for economically efficient utilization, the paddy growers will have to reduce the amount of the over utilized inputs as reflected by the study and vice versa.

Reference:

[1] A. Suresh and T.R. Keshava Reddy.2006 .Resource-use Efficiency of Paddy Cultivation in Peechi Command Area of Thrissur District of Kerala: An Economic Analysis. Agricultural Economics Research Review. 19 pp 159-171

[2] A. Sani, A.A. Yakubu and H.M. Bello.2010, Resource-Use Efficiency in Rice Production Under Small Scale Irrigation in Bunkure Local Government Area of Kano State, Nigerian Journal of Basic and Applied Science.18(2),pp 292-296

[3] Annual Report 2016- 2017, Department of Agriculture Cooperation and farmers Welfare, Ministry of Agriculture and Farmers Welfare, www.agricoop.nic.in

[4] Devi and Ponnarsi .2009. An Economic Analysis of Modern Rice Production Technology and its Adoption Behaviour in Tamil Nadu, Agricultural Economics Research Review. 22, pp 341-347

[5] Hota Sanjib Kumar and Kshirod Kumar Pradhan. 2012. An Economic Analysis of Technical Efficiency in Rice Production: Data Envelopment Analysis (DEA), International Journal of Advanced Research in Science and Technology, 1(2) pp 109-119.

[6] Islam and kalita. 2016 Technical and Economic Efficiency of Resource Use in wetland cultivation, International Journals of Agricultural Sciences, 6 (2) pp 938- 948

[7] J. Anupama, R.P. Singh and Ranjit Kuma.2005. Technical Efficiency in Maize Production in Madhya Pradesh: Estimation and Implications. Agricultural Economics Research Review. 18, pp 305-315

[8] L. Geetarani Devi and Y. Chakrrabarty Singh. 2014 .Resource use and Technical Efficiency of Rice Production in Manipur. Economic Affairs,59, pp 823-835.

[9] M.K. Sekhon, Amrit Kaur Mahal, Manjeet Kaur and M.S. Sidhu..2010. Technical Efficiency in Crop Production: A Region-wise Analysis.Agricultural Economics Research Review .23, pp 367-374

[10] Pandey Narayan Akhilesh. 2009. Profitability and resource use efficiency of paddy production in Baster Block of Baster district Chhatisgarh. Department of Agricultural economics and Farm Management, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jalbalpur College of Agriculture, MP.

[11] R. Sanzidur .2002. Resource use efficiency with self-selectivity: an application of a switching regression framework to stochastic frontier models. School of Economics studies, University of Manchester, Manchester UK

[12] R.K. Sharma, S.K. Chauhan and Sonika Gupta. 2008 Technical Efficiency in North-Western Himalayan Region: A Study of Himachal Pradesh Agriculture. Agricultural Economics Research Review. 21, pp 82-90

[13] Rajeev Singh, Santosh Kumar Mishra and Pravin Shahu.2013. Resource use efficiency of the Sample Farms in Paddy Cultivation in Azamgarh District of U.P. International Journal of Science and Research. 4 (9) pp 2319-7064.

[14] Rangappa K.B. 2015. Resource Use Efficiency in Paddy Production under Different Sources of Irrigation in Shimoga District, Karnataka: An Analysis of Farm Level Data, Economics.4 (5), pp 155-157

[15] Suresh. A. 2013 Technical changes and efficiency of Rice production in India, A Malmquist total factor Productivity approach, Agriculture Economics Research Review. 26, pp 109-118