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ASSESSING THE TECHNICAL EFFICIENCY OF INPUT IN RICE PRODUCTION IN THOI LAI COMMUNE, CO DO DISTRICT, CAN THO CITY

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ABSTRACT

Row seeder is a labor saving technology and it was adopted quite well in the intensive rice area of Thoi Lai commune, Co Do District, Can Tho city, Vietnam. The adoption may expand in the future because it reduces technical inefficiency effects in rice production. The yield loss in $US equivalent due to technical inefficiency effects was lower in row seeding ($US 142) than those in broadcasting ($US 176). Technical inefficiency effects were influenced by education of household head. The higher education level of household head, the lesser technical inefficiency effects were offered. To enhance input efficiency, aside from training to increase farmers' knowledge of in using different technologies in process of rice production, upgrading education level for farmers also can accelerate effectiveness of effort from extension agents.

INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food of approximately half of the world's population (IRRI 1997). Asian countries contribute nearly 90% of the total global production, supporting 60% of the world's population. Aside from being a staple food and common source of livelihood, rice also plays a major role in almost all Asian cultures and civilization.

Vietnam, an S-shaped country with more than 80 million people, is one of the major rice-producing countries in Asia. It stretches from the mountainous north and the Red River Delta to a narrow central belt snaking down to the fertile southern Mekong Delta. It has a total agricultural land of 9.4 million ha, 45% of which is for rice cultivation. Around 70% of the total labor force in the country is in agriculture. Total rice production in 2002 was 34,063,500 metric tons, with an average yield of 4.5 t/ha (Cuc 2003). Vietnam has become one of major exporting rice countries due to its increase of rice crop intensity. Co Do District of Can Tho city is representative for intensive rice area with major cropping of triple rice due to favorable irrigation system. Farmers in this commune adopted of row seeding technique for crop establishment (14% of rice farming households according to People Council of Thoi Lai Commune, January, 2004). Yamada et al. (2003) reported that the income from row seeding adoption was higher than those in broadcasting meanwhile family labor input in row seeding was smaller than those in broadcasting. Thus, the objective of this paper is to assess the efficiency of inputs in rice production in case of using new technology as row seeder.

DATA COLLECTION AND ANALYSIS

Rice farmers in Thoi Lai commune were stratified into row-seeder practised farmers and row seeder non- practised farmers. A purposive selection of 105 rice fields with row seeding practised by farmers and 85 rice fields with broadcasting practised by farmers was employed to collect data on inputs and yield in dry season 2003-2004 through direct interview the farmers of the fields. Data on socio-economic characteristics of farmers were also collected. The structured questionnaire was used to collect the above mentioned data.

The frontier production function described by Coelli (1994) was used to determine the input factors influencing on the rice yield.

The model is as follow:

$Y_i = x_i\beta + (V_i - U_i)$,i=1,...,N,

where Y_i is the production (or the logarithm of the production: rice yield) of the i-th farmer;

x_i is a k×1 vector of inputs (i.e. fertilizer quantity per ha, pesticide input per ha, seed rate, and labor-days per hectare) of the i-th farmer;

β is an vector of unknown parameters;

the V_i are random variables which are assumed to be iid. $N(0,\sigma_V^2)$, and independent of the

U_i which are non-negative random variables which are assumed to account for technical inefficiency in production and are often assumed to be iid. $|N(0,\sigma_U^2)|$.

To measure technical inefficiency, the model is as follow:

Technical inefficiency= $f(Z_i)$
Where:
i= from 1 to 3
Z_1= Education
Z_2= Experience in farming
Z_3= Household size

To assess the factors affecting technical inefficiency, a multiple regression analysis was employed. The model employed was: $Y = X\beta + e$ where,

Y is the dependent variable (technical inefficiency in percentage)

X is the matrix of independent variables (crop establishment method – dummy variable, age of head, years in rice farming, education of household head, household size, household income, rice income, income from male working as hired labor, income from female working as hired labor, non-farm income, off-farm income)

β is the vector of parameters representing the partial effect of each of the independent variables; and

e is the error vector which represents the amount of variable unaccounted for by the independent variables. Elements of e are assumed to have zero mean, constant variance, σ^2, and to be uncorrelated.

The level of significance (α) was set at 5 percent.

RESULTS AND DISCUSSION

Socio-economic characteristics of farmers

Farmers and their spouses are in middle age and have engaged in rice farming from 19 to 22 years. Farmers' education at the study site was low. Household heads (mainly husbands) reached grade 6 in school meanwhile the spouses (mainly wives) only completed 4 to 5 years in schooling. Household size was 5 in average. They cultivated rice in small land area (around 1 ha). However, rice income from farmers who applied row seeding for crop establishment was higher than those from farmer who practiced broadcasting. Farmers who used row seeding also obtained higher household income, and non-farm and off-farm income than farmers who practiced broadcasting (table 1).

Rice yield and technical efficiency effects in rice production. Rice yield in dry season (Winter-Spring) in row seeding was improved compared with broadcasting. Farmers practicing row seeding used less fertilizer quantity than farmers did broadcasting. They also saved seeds and labors (table 2).

Table 3a and 3b indicate that though rice farmers accessed to the new technique of row seeding, their inputs in fertilizer, pesticide and seed rate did not increased rice yield. Farmers' education, experience and household size did not influence on rice yield. This was similar as in the case of farmers who practiced broadcasting. These imply that farmers learned to use new technology but they have not known how to invest in efficient way to increase rice yield. Rice production is a process, thus the technician or extension workers should have talent and skill in transfer of technology to farmers. They also should teach farmers to know the inter-relation among technologies applied in the process of rice production.

Table 1. Socio-economic of rice farmers

Socio-economic characteristic	Row seeding	Broadcasting
Age of household head	45	45
Age of spouse	43	41
Experience (years in rice farming of household head)	22	19
Education of head	6	6
Education of spouse	5	4
Household size	5	5
Rice land area (ha)	1,046	1,051
Rice income per year (1000 VN dong)	36229	26974
Household income (1000 VN dong)	49153	34920
Non-farm income (1000 VN dong)	2354	1580
Off – farm income (1000 VN dong)	1455	1211

Table 2. Yield and Inputs in rice production (Winter-Spring season 2003-2004)

Item	Row seeding	Broadcasting
Yield (tons/ha)	6.62	5.86
Fertilizer quantity (kg/ha)	349	391
Pesticide cost per ha (1000 VN dong)	600	591
Seed rate (kg/ha)	131	210
Labor-days/ha	156	123

Table 3a: Estimates parameter of frontier production function (dependent variable is Ln yield per ha) (2003-2004 Winter-Spring season)

Variable	Row seeding		Broadcasting	
	Coefficient	Standard error	Coefficient	Standard error
Constant	2.8312*	0.5633	2.6296*	0.9446
Ln fertilizer amount (kg/ha)	-0.0005	2.0452	-0.0289	0.0844
Ln pesticide cost (1000vn dong)	0.0341	0.0319	0.0848	0.0680
Ln Labor (person-days/ha)	-0.2116*	0.0945	-0.1339	0.1494
Ln seed rate (kg/ha)	0.0396	0.0233	-0.0749	0.0478
∂^2	0.1864	0.1117	2.6992	2.3712
δ	0.9822*	0.1372	0.9787*	0.0109

Significant level at 5%

Table 3b. Estimates parameter of frontier production function (dependent variable is Ln yield per ha) (2003-2004 Winter-Spring season)

Variable	Row seeding		Broadcasting	
	Coefficient	Standard error	Coefficient	Standard error
Constant	0.0634	0.4445	-9.7878	9.2367
Education of head	-0.0348	0.0292	-0.8667	0.8237
Experience (years in farming)	0.0052	0.0081	0.0013	0.0117
Household size	-0.0389	0.0465	1.2263	1.1065

Significant level at 5%

Technical inefficiency in row seeding was lower than those in broadcasting (table 4). Due to technical inefficiency, 1,366 kg rice per hectare was lost in row seeding and this was 1,516 kg rice per hectare in broadcasting. The yield loss in Vietnam dong equivalent was 2,323 thousand in row seeding and 2,757 thousand in broadcasting. If farmers can exclude the technical inefficiency effects they will obtain higher benefit in rice production.

Table 4. Estimated technical inefficiency and corresponding losses in returns (2003-2004 Winter-Spring season)

Variable	Row seeding	Broadcasting
Technical Inefficiency (1-mean of efficiency)	0.219	0.243
Yield loss (kg/ha)	1366	1516
Yield loss in VN dong equivalent (1000 VN dong)	2323	2757
Yield loss in $US equivalent	142	176

(VN dong value per kg is 17000) (mean yield= 6.24 t/ha)

Factors affecting Technical inefficiency effects

Education of household head significantly and negatively influenced technical inefficiency effects. This indicates that those household heads with higher education would reduce the technical inefficiency effects in rice production. Thus increasing education level for farmers is necessary to increase rice production efficiency.

Table 5. Technical inefficiency effects (dependent variable is % technical inefficiency) (2003-2004 Winter-Spring season)

Variable	Coefficients	Std. Error	T value
(Constant)	0.2305**	0.088139	2.615
Crop establishment (1= row seeding; 0= broadcasting)	0.012594	0.024847	0.507
Age of household head	0.001033	0.001947	0.530
Years in rice farming	-0.00008	0.001884	-0.040
Education of household head	-0.01094*	0.004421	-2.475
Household size	0.00465	0.007469	0.622
Household income (1000 VN dong)	-0.000001	0.000001	-1.040
Rice income (1000 VN dong)	0.000001	0.000002	0.557
Income from male off- farm work in rice	0.00002	0.000054	0.453
Income from female off- farm work in rice	0.00005	0.000055	0.833
Non-farm income	0.000005	0.000003	1.584
Off- farm income	-0.00002	0.000054	-0.454
F=1.656			

CONCLUSION

Row seeding is a labor saving technology and has been adopted in Thoi Lai commune of Co Do district, Can Tho city. The adoption may have expanded wider in the future within district as well as in other places. It also reduced technical inefficiency effects compared with broadcasting practice, especially in the farm with higher education of the head of the household. Rice production is a process, thus to enhance technical efficiency in rice production, farmers should be trained how to use input efficiently aside from learning new knowledge impeded in the new machinery tool.

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Đánh giá hiệu quả kỹ thuật đầu tư trong sản xuất lúa tại xã Thới Lai, Cờ Đỏ, Cần Thơ

Sạ hàng là một kỹ thuật tiết kiệm lao động và được nông dân tiếp nhận khá tốt ở vùng lúa thâm canh xã Thới Lai, huyện Cờ Đỏ, Cần Thơ, Việt Nam. Sự tiếp nhận này có thể gia tăng trong tương lai vì nó giảm tỷ lệ không hiệu quả của đầu tư trong sản xuất lúa trên đồng ruộng tự nhiên của nông dân. Do có một phần tỷ lệ không hiệu quả của đầu tư trong sản xuất nên nông dân phải mất đi một phần năng suất mà lẽ ra họ phải nhận được nếu tỷ lệ này bằng 0. Tuy nhiên, sự mất năng suất này qui ra tiền đô la Mỹ đối với nghiệm thức sạ hàng (142 USD) thấp hơn so với sạ lan (176 USD). Tỷ lệ không hiệu quả này ảnh hưởng bởi trình độ văn hoá của chủ hộ. Trình độ văn hoá của chủ hộ càng cao thì tỷ lệ không hiệu quả của đầu tư ít hơn. Để tăng cường hiệu quả đầu tư, ngoài tập huấn để tăng cường kiến thức cho nông dân trong việc áp dụng các kỹ thuật khác nhau trong quá trình sản xuất lúa, cần phải nâng cao trình độ văn hoá cho nông dân nhằm thúc đẩy hiệu quả trong công tác khuyến nông.