Conference Paper

Efficiency Analysis of Production Factors Utilization in Upland Rice Farming

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Abstract

The research aimed to determine the factors that affect the production and the use of the factors that affect the production of upland rice farming. The research was conducted using a survey method in the Bluluk village, Bluluk district, Lamongan regency, Indonesia, from April to June 2012. Sampling was done by purposive sampling method on 38 farmer respondents. Based on the results of analysis, it was concluded that the production factors that have significant effects on upland rice farming were land, Urea fertilizer and herbicides. At current price levels, production factor of land have been efficient, whereas Urea fertilizer and herbicides are not efficient. Of the three factors of production, only land use school is potential to improve.

Keywords: efficiency; farming system; production factors; upland rice.

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1. Introduction

Food is a basic need of every human being, one of which is rice. Rice is a very important commodity in Indonesia because the staple food of 96 % of Indonesia's population is rice [1]. Despite the efforts of diversification has long promoted, up to now there is no other food that can replace the rice, so that the rice demand in Indonesia will always increase in line with the rate of increase of population growth. Increasing demand for rice will require the production and productivity of rice to be improved.

The effort to increase rice production is constrained by the growth of crop acre age and productivity has stagnated. At the same time, the average income of the population increased which boosted demand for rice as the end product of rice farming. At the same time, there are an increasing number of people who consume rice. Unbalance between production and consumption of national rice can cause serious problems, and to cover the shortage, importing rice is done. Imports of rice which are done continuously will reduce foreign exchange, farmers are deterred into farm as well as the loss of existing resources [2].

National rice production still focused on the irrigated rice paddy particularly in Java. Whereas the role of rice production of upland rice was very limited [3]. In 2010, the

productivity of irrigated rice paddy at national level was around 4.66 t · ha^{-1}, while the upland rice productivity was around 2.87 t · ha^{-1} [4]. Upland rice production in Peru could reach 7.2 t · ha^{-1} [5]. The result of intensive cropping pattern research showed that dry land could produce up to 10 t · ha^{-1}· yr^{-1} of grain equivalent, meaning that is not inferior to irrigated rice [6].

One way that can be done to overcome the reduced harvest area is to utilize dry land for upland rice cultivation. Indonesia has a dry land more than 55.6 × 106 ha, which until now has not been used optimally [7]. The development of upland rice in Indonesia is not as fast as the development of paddy rice, over a period of 37 yr upland rice productivity increased by only 1.56 t · ha^{-1} ie from 1.11 t · ha^{-1} to 2.67 t · ha^{-1}, while the increase in productivity of paddy rice reaches 3.18 t · ha^{-1} from 1.71 t · ha^{-1} to 4.89 t · ha^{-1} [8].

In farming system, aligned to the given input as small as possible to obtain the highest possible output. The production function can explain the relationship between the factors of production with production itself directly [9]. The farming system is categorized as effective when farmers or producers can allocate their resources as well as possible. The farming system is categorized as efficient if the use of resources can produce output that exceeds the input [10]. Definition of efficiency is very relative. Efficiency is defined as the use of the smallest input to get maximum production. Such a situation would happen if farmers are able to make an effort if the value of marginal product (VMP) for an equal input with input prices.

Production factors are all things that given to plants so that the plants are able to grow and produce well. Production factors are known by the term production inputs. Production factors are very decisive that production obtained is big or small. Production factors of land, capital to buy seeds, fertilizers, insecticides, labor, and management aspects are the most important of production factors. The relationship between the production factors (input) and production (output) is usually called the production function or relationship factors [11].

Problems of low rice production in upland rice farming system were due to (i) the use of production factors is not efficient, and (ii) limited ability of farmers to manage the production factors are owned.The research aimed to determine the factors that affect the production and idenitfy efficiency of the use of the factors that influence the production of upland rice farming.

2. Materials and Methods

The research was conducted using a survey method in the Bluluk village, Bluluk district, Lamongan regency, Indonesia from April to June 2012. Sampling was conducted by purposive sampling method on 38 farmer respondents. The data were analyzed qualitatively and quantitatively. Qualitative analysis was used to describe the circumstances related to the research problems that cannot be described quantitatively. Quantitative analysis was performed with the Cobb-Douglas function and analysis of efficient use of factors of production.

Mathematically, Cobb-Douglas equation can be written as follows:

$$Y = \alpha T^{\beta 1} TK^{\beta 2} K^{\beta 3} \quad (1)$$

where: Y = output (dependent variable)
T,TK,K = production factors (independent variable)
$\beta 1, \beta 2, \beta 3$ = parameters estimated value

Data processing to get a model of the function was performed with SPSS software. Parameter $\beta 1$ can be interpreted as elasticities of production for each production factors. So the elasticity of production for production factors T, TK, K, is expressed by the magnitude $\beta 1$, $\beta 2$, $\beta 3$. For example, if elasticity of the amount of production elasticity is if ε = 0.8 which means that if input (production factors) plus 10 %, it will raise output by 8 %.

The value of marginal product (VMP) for an input equal to the price of inputs, and can be written: VMPxi = Pxi. Where xi was input (or product), and P was price of input (price of product). In fact many VMPxi not always the same as Pxi. What often happens is as follows:

a. (VMPxi / Pxi) > 1 means the use of inputs x is not yet efficient, to achieve efficient, input x should be increased.

b. (VMPxi / Pxi) <1 means the use of inputs x is not yet efficient, to achieve efficient, efficient input x needs to be reduced [12].

3. Results and Discussion

3.1. Characteristics of Respondent Farmers

In farming, education level plays an important role.A farmer's background education will affect farmers in agribusiness management, in addition to its experience in making decision-making and or risk-taking. Armed with the proper education, the farmer's ability to absorb information would be better, including identifying new technologies and innovations in agriculture. This is in line with the research results of Budiono [13]

Education level	Number	Percentage (%)
Elementary school	18	47
Junior high school	12	32
Senior high school	7	18
College	1	3
Total	38	100
Source: Primary data processed		

Table 1: Percentage of respondents by level of formal education in the Bluluk village, Lamongan regency, Indonesia, in 2012.

Land area (ha)	Number of farmer	Percentage (%)
Less than 0.5 ha	22	58
Less than 1 ha	10	26
≥ 1 ha	6	16
Total	38	100
Source: Primary data processed		

Table 2: Percentage of respondents by land area used for upland rice farming in the Blulukvillage, Lamongan regency, Indonesia, in 2012.

which stated that the level of education of farmers will affect the rate of adoption of technology.

In the study area, the average education level of farmers was still low. Most of education level of the respondent farmers were elementary school: 47 %, junior high school: 32 %, senior high school: 18 % and college: 3 %. Based on the education factor, all the respondent farmers had already attended a formal education (Table 1). However, the ability of the respondent farmers to absorb information technology is still relatively low.

3.2. The Land Area of Respondent Farmers

In the area of research, upland rice farming was planted on forest land belonging to Perhutani. Upland rice grown under the stands of perennial crops namely: mahogany (*Swietenia macrophylla* King) and Mindi (*Melia azedarach* L.) under the age of 5 yr. Table 2 elucidated the percentage of land tenure which was used for upland rice farming.

3.3. Analysis of The Production Functions of Upland Rice Farming

Regression coefficient value in land area amounted to 0.401 with at-test value of 2.213 (Table 3) was higher than t-table 2.045. Statistically, it indicated that the land area that allocated significantly affect upland rice farming. This may imply that the use of land in a different area, have little possibility to produce the same amount of upland rice

Variable	Regression coefficient	Statistic-t	VIF
Constanta	2.387	4.078	
Land *	0.401	2.213	2.495
Seed	0.025	0.176	1.861
Urea *	0.391	2.067	2.383
SP-36	0.004	0.051	1.712
Phonska	0.058	1.331	1.473
Insecticide	0.028	0.270	1.399
Herbicide *	0.233	2.079	2.108
Labour	0.007	0.027	1.840
R^2 = 0.717		Asymtotic significance = 1	
Statistic-F = 9.169		DW-Statistic = 1.903	
Source : Primary data processed			

Table 3: Regression analysis of the production function of upland rice farming, Bluluk village, Lamongan regency, Indonesia, in 2012.

production. When using larger area are expected to generate greater production. The value of regression coefficient of 0.401 indicates that an increase inland area by 10 % would increase production by an average of 4.01 % assuming the other factors is constant.

Urea fertilizer used in the study showed significant effect on the production of upland rice. Regression coefficient values obtained amount to 0.391 with t-test value of 2.067 is greater than t-table 2.045. This may imply that the use of urea in different amount, had little possibility to produce the same upland rice production. When using urea in an amount more is expected to generate greater production. Increased urea by 10 % would increase production of upland rice by 3.91 %, assuming other production factors is constant.

The use of herbicides were allocated on upland rice farming in the study area shows the significant effect. The value of regression coefficient of 0.233 with t-test value of 2.079 is higher than t-table 2.045. This may imply that the use of herbicides in different amounts, have little possibility to produce the same amount of production. When the use of herbicides in larger quantities is expected to generate greater production. Increased allocation of herbicides by 10 % would increase production of upland rice by 2.33 %, assuming other factors in a constant state.

3.4. Analysis of The Efficiency of Upland Rice Farming

Efficiency of production factors was measured by assuming that the purpose of the farmer in doing farming was aimed to achieve maximum benefit, and farmers are able

Production Factors	Volume (Xi)	Regression Coefficient	Value (Pxi) IDR	Efficiency (VPMx/Px)	Xi optimal	t-value
Land	0.44 Ha	0.401	3 000 000	1.147	0.50 Ha	0.28
Urea	129.61 kg	0.391	1 800	6.261	811.48 kg	1.74
Herbicide	1.11 L	0.233	46 000	17.054	18.93 L	1.96
Source : primary data processed						
1 USD equal to IDR 13 109						
Table information : t-table (α = 0.05) = 2.045						

Table 4: Analysis Result of the efficiency of the production factors of upland rice farming,in growing season 2012, at Bluluk village, Bluluk district, Lamongan regency, Indonesia.

to combine the production factors to achieve optimal paddy output so that maximum benefit will be obtained.

The efficiency factor of production on upland rice farming can be determined by calculating the ratio of an input NPM with respective prices of production inputs. Based on the results of the analysis of the Cobb-Douglas production function, it is known that not all independent variables included in the model significantly affect the production of upland rice. Variable seed, fertilizer SP-36, Phonska fertilizers, insecticides and labor did not significantly affect upland rice production while land, Urea fertilizer and herbicides significantly.

From the calculation of the efficiency of the use of land allocation, efficiency values obtained amounted to 1.147 (Table 4), where the value is greater than 1. From the statistical test obtained t-value is smaller than t-table (t-value 0.28 < t-table 2.045), meaning that statistically, the value of efficiency equal to 1 so that the allocation of land in the study area average of 0.44 ha has been efficient. To achieve optimal revenues, additional allocation of arable land area could be increased to 0.5 ha (Table 4). Calculation value of VMPx/Px of the use of urea fertilizer production factor obtained by 6.261, meaning that the use of urea was highly efficient, as well as the use of herbicides is also very efficient.

4. Conclusions

Based on the results of the analysis, it was concluded that production factors significant in upland rice farming were land, Urea fertilizer and herbicides. The influence of the independent variable was equal to 71.7 % of the dependent variable ,and the remaining 28.3 % was explained by other variables not included in the estimation model. At the prevailing price level, the production factor of land had been stream-lined, whereas Urea fertilizer and herbicides were not efficient. Of the three factors of production that can still be improved was only land use.

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