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Research Paper

Analysis of Allocative Efficiency of Production Factors for Rice Field Farming In Labanan Jaya Village, Teluk Bayur District, Berau Regency

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ABSTRACT
The aims of the study were to determine: (1) the effect of the use of production factors of seeds, fertilizers, pesticides and labor on the production of lowland rice; (2) efficient use of seed, fertilizer, pesticide and labor factors in lowland rice farming; (3) rice farmers' income; and (4) the feasibility of lowland rice farming in Labanan Jaya Village, Teluk Bayur District, Berau Regency
This research lasted for two months, starting from February to March 2021 in Labanan Jaya Village, Teluk Bayur District, Berau Regency.
Sampling was carried out using the Simple Random Sampling method. The data collected are primary and secondary data. Data analysis includes: production function analysis, farm cost analysis, revenue and income analysis, and R/C ratio analysis.
The results showed that: 1. The production factor that has a significant effect on the production of lowland rice in Labanan Jaya Village is the fertilizer production factor. 2. The allocative efficiency of the use of production factors shows an efficiency index greater than 1, which is 1.858, which means that the use of fertilizer at 360.28 kg.ha^{-1} is not efficient. In order for the use of fertilizer to be efficient, the amount of fertilizer must be increased by 309.19 kg.ha^{-1}. 3. The average income earned by farmers is Rp. 26,601,316, while the average total cost of production is Rp. 11,494,518, so the average income earned by farmers in Kampung Labanan Jaya is Rp. 15,106,798 mt^{-1}. 4. The value of the R/C ratio is 2.31. This shows that lowland rice farming in Labanan Jaya Village is feasible.

Keywords: *Allocative Efficiency, Farming, Paddy Rice*

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I. INTRODUCTION

Rice is a plant that is very useful and contains important meaning for human life because rice is a food ingredient that produces rice which is the main source of carbohydrates for the majority of the Indonesian population. Based on data from the Area Sample Framework Survey, East Kalimantan produced 253,818.37 tons of rice in 2019. This number has decreased when compared to rice production in 2018 which reached 262,773.88 tons. This is due to a decrease in productivity, rather than a decrease in harvested area. This condition is because harvested area data shows an increase from the previous 64,961.16 hectares in 2018 to 69,707.75 hectares in 2019. Meanwhile, productivity shows a decline from 4,045 tons ha-1 in 2018 to only 3,641 tons ha-1 in 2019 (BPS, 2020).

Berau Regency is one of the potential districts for agricultural development and is one of the rice centers in East Kalimantan (PROKAL.CO, 2019). Based on data from the Berau Regency Agriculture and Livestock Service, rice production in Berau Regency in 2019 was 10,768 tons. This number has decreased when compared to 2018 which reached 18,118 tons. In 2019 there was a decrease in planted area, from 5,128 ha in 2018 to 3,477 in 2019. The low productivity shows that farmers still have not allocated production factors efficiently.

As stated by Hanafie (2010), farmers generally measure the efficiency of their farming more from the point of view of the size of the production, not the low cost of producing these results. According to Soekardono (2005) in Mustadjab and Fahriyah (2018), when viewed from the concept of efficiency, the use of production factors is said to be efficient if it can generate maximum profit. One of the causes of low farm production is the inefficient use of production factors. This will affect the production and income obtained by farmers. T he importance of the concept of efficiency is to optimize the use of production factors in order to obtain maximum and sustainable production, so as to increase farmers' income.

The aims of the study were to determine: (1) the effect of the use of production factors of seeds, fertilizers, pesticides and labor on the production of lowland rice; (2) efficient use of seed, fertilizer, pesticide and labor factors in lowland rice farming; (3) rice farmers' income; and (4) the feasibility of lowland rice farming in Labanan Jaya Village, Teluk Bayur District, Berau Regency

II. RESEARCH METHODS

A. Time and Location of Research

This research lasted for two months, starting from February to March 2021 in Labanan Jaya Village, Teluk Bayur District, Berau Regency.

B. Data Collection Method

The data collected includes:

1. Primary data, namely data obtained from observations and direct interviews with respondents using questionnaires.
2. Secondary data, namely data obtained from libraries, internet media and agencies related to this research.

C. Sampling Method

Sampling was carried out using the Simple Random Sampling method. According to Umar (2003) in Wibowo (2012), the formula that can be used to determine the minimum sample size if the population size is known is the Slovin formula, which is as follows:

$$n = \frac{N}{1 + N(e^{1\,2})}$$

Notes:

N = Total population; n = Number of samples; e = The sampling error is set at 15%.

The results of these calculations show that the number taken from the total population of 257 farmers is 38 samples.

D. Data Analysis Method

1. Production Function Analysis

The analysis model used to determine the factors that affect lowland rice production is a multiple regression analysis model of the Cobb-Douglas function (Karmini, 2020) mathematically, the Cobb Douglas function is written in the form of an equation (Karmini, 2018) as follows :

$$y = Ax_1^{b1}x_2^{b2}x_3^{b3}x_4^{b4}e^{u}$$

To simplify the estimation calculation, the Cobb-Douglas function can be converted into a linear function by converting it into the form of the natural logarithm (ln) so that the function becomes (Sonia, Karyani, & Susanto, 2020):

$$Iny = InA + b_1 lnx_1 + b_2 In\, x_2 + b_3 In\, x_3 + b_4 lnx_4 + u$$

Where: y = lowland rice production (kg); x1 = number of seeds (kg); x2 = amount of fertilizer (kg); x3 = pesticide (liter); x4 = labor (HOK); A = intercept; b1 - b4 = Regression coefficient as well as elasticity of production; and u : Intruder Error

After obtaining the production function of lowland rice farming, statistical tests were carried out to determine the production factors that affect rice production. The statistical test consisted of the coefficient of determination (R2), simultaneous significance test (F-test), and partial significance test (t-test).

2. Allocative Efficiency Analysis

Allocative efficiency of production factors is determined by knowing the value of NPMx/Px or Ki (efficiency index) of each factor of production (Arta et al, 2014). The allocative efficiency index of each factor of production can be determined by the formula:

$$NPMxi = Pxi \text{ or } \frac{b.Y.Py}{X} = Pxi$$

The condition of price efficiency requires NPMxi to be equal to the price of production input X, or it can be written as follows (R, 2014):

$$\frac{NPMxi}{Pxi} \quad \frac{bi.Y.Py}{Xi.Px} = Ki$$

Where: NPMx = The value of the marginal product of the factors of production x; b = production elasticity xi; Y = Average production per production process (Kg); Py = unit price of lowland rice production (Rp); Xi = Average use of the first factor of production (Kg); Px = Price per unit factor of lowland rice production (Rp) and Ki = efficiency index

From the results of these tests will produce three possibilities, namely as follows:

a. $\frac{bi.Y.Py}{Xi.Px} = 1$ then the use of the i-th factor of production at the current price level already optimum or economically efficient

b. $\frac{bi.Y.Py}{Xi.Px} > 1$ then the use of the i-th factor of production at the prevailing price level not yet at a level or economically not yet efficient so as to be efficient then input X must be added

c. $\frac{bi.Y.Py}{Xi.Px} < 1$ then the use of the i-th factor of production at the prevailing price level has been exceeded or is economically inefficient so that reduced usage

Then to find out the optimal use of allocative input, the following formula is used (Wibowo, 2012):

$$Xi \text{ optimal} = \frac{biYPy}{P_X}$$

3. Farming Cost Analysis

The amount of production costs can be calculated using the following formula (Karmini, 2018):

TC = TFC + TVC

Notes: TC = total cost; TFC = *Total Fixed Cost; and* TVC = *Total Variable Cost*

4. Revenue and Revenue Analysis

To find out the total income obtained by rice farmers, it can be calculated using the following formula:

TR = Y . Py

Notes: TR = Total rice farming revenue (Rp); Py = Price per unit of paddy rice production ($Rp.Kg^{-1}$) and Y = Total paddy rice production (Kg)

Then to find out the amount of farmers' income can be calculated using the following formula (Sholeh, 2012):

n = TR - TC

Notes: n = Revenue (Rp); TR = total income; TC = total cost

5. Analisis R/C Ratio

R/C ratio analysis (Return Cost Ratio) is an analysis that compares the total revenue obtained by farmers with the total costs incurred by farmers to determine whether the farming is profitable or not (Noer dkk, 2018). The formula as follows:

$$R/C \text{ Ratio} = TR/TC$$

From the results of this analysis will produce three possibilities, namely:

a. R/C ratio > 1 means that farming has experienced profits so it is worth working on
b. R/C ratio = 1 This means that the farm does not experience a loss or profit (break even).
c. R/C ratio < 1 This means that farming has suffered losses so it is not feasible to cultivate.

III. RESULTS AND DISCUSSION

A. Overview of Research Sites

Labanan Jaya Village, is one of the villages located in Teluk Bayur District, Berau Regency, East Kalimantan Province. Labanan Jaya village has an area of about 14,380 ha. Most of the area is forest which is partly used as a mining area with an area of 9,400 ha (65.37%), while the rest is used for plantations covering an area of 2,579 ha (17.93%), upland/field covering an area of 850 ha (5.91%), rice fields covering an area of 600 ha (4.71%), residential and yard area of 785 ha (5.46%), the rest are public facilities, reservoirs/lakes and other uses.

The majority of the population in Labanan Jaya are men, namely 1,316 people (52.75%) and the number of women is 1,179 people (47.25%). The largest age group is the age group 0-14 years or the age of children, namely 673 people (26.97%), followed by the age group 35-44 years or the middle age group with 440 people (17.64%) and aged 25-34 years as many as 434 people (17.39%).

Most of the residents of Kampung Labanan Jaya have a livelihood as farmers, as many as 331 people (40.81%). It is also supported by the extent of agricultural land in the village, showing that the agricultural sector is still very potential in the village (Profile of Kampung Labanan Jaya, 2019).

B. Characteristics of Respondents

Based on the results of interviews with 38 farmers in Labanan Jaya Village, the following is a description of the characteristics of the respondents:

1. Respondent's Age

Most of the respondents are farmers aged 60-69 years, totaling 14 people (36.84%), aged 40-49 years totaling 10 people (26.32%), aged 50-59 years totaling 9 people (23.68%), aged 70-73 years amounted to 3 people (7.89%) and aged 32-39 years totaled 2 people (5,26%).

2. Respondent's Education

Education is one of the important factors that can affect the way farmers manage their farm products. Musa et al (2018), argue that generally education has an effect on the ways and patterns of thinking of farmers. From the results of the interview, it is known that most of the respondent farmers have education in SD (Elementery School) totaling 23 people (60.53%), SMP (Junior High School) totaling 13 people (34.21%) and SMA (Senior High School) being 2 people (5,26%).

3. Respondent's Land Area

In general, the wider the area of land cultivated, the higher the production produced and the income obtained per unit area (Rahim & Hastuti, 2007; Suratiyah, 2011). Based on the results of interviews, it can be seen that most of the respondent farmers have a land area of about 1 - 1.5 ha totaling 25 people (65.79%), 2-25 ha, totaling 5 people (13.16%) land area < 1 ha totaling 7 people (18.42%) and a land area of 4 ha totaling 1 person (2,63%).

4. Land Ownership

The status of agricultural land ownership shows the relationship between the agricultural land and the processor or owner (Karmini, 2020). Based on the results of interviews, it is known that 75% of farmers run their farms on their own land, while the other 25% run their businesses on borrowed land.

5. Farming Experience

Work experience is the length of time a person carries out certain tasks or jobs so that knowledge, skills or values are obtained that are integrated into self-potential (Indrawan, 2017). Based on the results of interviews, it is known that most of the respondent farmers have farming experience between 16-25 years, namely as many as 14 people (36.84%); farming experience between 6-15 years as many as 10 people (26.32%); farming experience between <5 years as many as 6 people (15.79%); farming experience between 26-35 years as many as 3 people or 7.89%

C. Analysis of the Use of Production Factors and Variable Regression Analysis

1. Multiple regression analysis

Multiple regression analysis was used to determine whether there was a significant effect of the independent variable on the dependent variable. The analytical model used to estimate the production function of lowland rice farming is the Cobb Douglas production function. Lowland rice production is used as the dependent variable (Y), while the independent variables are seeds (X1), fertilizer (X2), pesticides (X3) and labor (X4).

The results of multiple linear regression analysis on the production function of lowland rice farming in Labanan

Jaya Village, Teluk Bayur District, Berau Regency are as follows:
LnY = 4,559 + 0,261 LnX1 + 0,290 LnX2 + 0.015 LnX3 + 0.193 LnX4 + e^u 1.
R2 = 0,832; F-count = 40,908 F-tabel (0,05) = 2,65 Sig F = 0,000; t-tabel (0,05) = 2,03.

2. Analysis of Diversity Test (F Test)

F test analysis was used to determine the significant effect of the variables of seeds, fertilizers, pesticides and labor simultaneously or together on the production of lowland rice. Based on the calculation results, it is obtained that the value of Fcount (40.908) > Ftable value of 0.05 (2.65) which means that all independent variables in the form of seeds, fertilizers, pesticides and labor together affect the production of lowland rice in Labanan Jaya Village.

3. Analysis of the Coefficient of Determination (R^2)

Based on the results of the analysis, the coefficient of determination (R^2) is 0.832 or 83.2%, which means that the independent variables (seeds, fertilizers, pesticides and labor) have a major influence on the increase or decrease in lowland rice production in Labanan Jaya Village, while the remaining 17% is explained by other variables that are not used in this study.

4. Analysis of t test

T-test analysis is an analysis conducted to determine the significant effect of each independent variable partially (seeds, fertilizers, pesticides to labor) on the production of lowland rice in Kampung Labanan Jaya. The results of the t-test analysis showed that: (1) seeds did not have a significant effect; (2) fertilizer has a significant effect; (3) pesticides have no significant effect; and (4) labor has no significant effect on lowland rice production in Labanan Jaya.

D. Efficiency Analysis of Production Factors

The efficiency level of production factors in lowland rice farming activities in Labanan Jaya Village can be determined by testing allocative efficiency, namely calculating the ratio of the marginal product value of a factor of production (NPMx) to the price of the production factor (Px). Allocative efficiency analysis involves regression coefficient values derived from regression analysis using the Cobb-Douglas production function model. Based on the results of the regression analysis, it is known that not all independent variables have a significant effect on production. Of all the independent variables tested, there is only one factor that significantly influences the production of lowland rice in Labanan Jaya Village, namely the fertilizer factor. Allocative efficiency analysis is only used for inputs that have a significant effect on product/output, so the only factor of production that will be analyzed is fertilizer.

The results of the analysis of allocative efficiency on lowland rice production factors in Labanan Jaya Village can be seen in Tabel 1.

Tabel 1. Results of Allocative Efficiency Analysis of the Use of Production Factors Rice Field Farming in Labanan Jaya Village

Variabel	*Bi*	*(X)*	*(Px)*	*(Py)*	*(Y)*	*(NPMx)*	*(Ki)*	*Xi Optimal*
Pupuk	***0,290***	***360,28***	***10.333,33***	***7.815,79***	***3.055,70***	***6.917.830,09***	***1,858***	***669,47***

Notes: Bi = Fertilizer variable regression coefficient; Xi = Average fertilizer use (Kg); Px = Fertilizer unit price ($Rp.Kg^{-1}$); Py = Unit price of paddy rice production ($Rp.Kg^{-1}$); Y = Average paddy rice production (Kg); NPMx = Fertilizer variable Marginal Product Value; Ki = Efficiency Index; and Xi optimal = Optimal production average.

Based on the results of the analysis, it is known that the fertilizer production factor has an NPMx of 6,917,830.09, which means that the addition of 1 kg of fertilizer will increase income by Rp. 6,917,830.09. An efficiency index (Ki) greater than one indicates that the use of fertilizer production factors at the prevailing price level is not yet at the optimum level or economically not efficient, which means that the use of fertilizers in lowland rice farming has the potential to generate greater farm income so that the total fertilizer needs to be added.

Based on the results of the analysis of the optimal use of fertilizers for rice farming activities in Labanan Jaya Village is 669.47 kg.ha-1. The use of fertilizers in Labanan Jaya Village, Teluk Bayur District is 360.28 Kg.Ha-1, so to achieve the optimal amount of fertilizer use the amount of fertilizer that must be added is 309,19 $Kg.Ha^{-1}$.

E. Farming Cost Analysis

Farming cost analysis is an analysis used to determine the amount of costs incurred by lowland rice farmers when running their farming. The costs calculated in this study are the costs incurred by farmers in one planting season which include variable costs, namely the cost of using seeds, fertilizers, pesticides and labor and fixed costs, namely the cost of equipment depreciation. Details of farm production costs as presented in Table 2.

Tabel 2. Paddy Rice Production Cost in Labanan Jaya

No	Component	The amount of costs (Rp)	Percentage (%)
1	Seed	10,625,000.00	2.43
2	Fertilizer	40,801,250.00	9.34
3	Pesticide	50,093,050.00	11.47
4	Labor	314,859,375.00	72.08
5	Tool Depreciation	20,413,000.00	4.67
	Total	436,791,675.00	100.00

F. Revenue and Revenue Analysis

1. Revenue

Rice farming revenue is the result of multiplying the amount of production and the price per unit of production (kg). The amount of revenue is influenced by the amount of production and market prices. Farmers in Labanan Jaya usually sell their crops in the form of milled dry grain (GKG) and rice. The price of GKG is Rp 5.000 kg^{-1} while the price of rice is IDR 10,000 kg^{-1}. The average production of lowland rice in Labanan Jaya is 3,409 $kg.mt^{-1}$ or 3,055 kg.ha-1.mt^{-1} so that the average income obtained by respondent farmers from lowland rice farming is Rp. 26,601,316 mt^{-1} or Rp 24.269.737 $ha^{-1}.mt^{-1}$.

2. Income

Income is the result of the total income that has been reduced by the total costs incurred by farmers during one growing season. The amount of income is influenced by the amount of income and costs incurred by farmers during production in one growing season. The amount of income received by farmers in Labanan Jaya Village is presented in Table 3.

Tabel 3. Farmers' Income in Labanan Jaya Village

No	Component	Total costs (Rp)	Average (Rp)
1	Revenue	1.010.850.000	26.601.316
2	Total Production Cost	436.791.675	11.494.518
	Total Income	574.058.325	15.106.798

From the table, it can be seen that the acceptance of farmers' products in Labanan Jaya Village is Rp. 1,010,850,000 with an average income of Rp. 26,601,316, while the total cost of production is Rp. 436,791,675 with an average cost of Rp. 11,494,518, so that the income obtained by farmers is Rp. 574,058,325 with an average income of Rp 15.106.798.

The level of income generated or received by farmers is highly dependent on production costs during farming activities, the amount of production produced and the selling price (Margi & Balkis, 2016; Limintang, 2013). If the amount of production and selling price is high, the income obtained by farmers will be high and if the production cost is less than the income, the farmer will get a profit.

G. Feasibility Analysis of Farming (R/C Ratio)

R/C ratio analysis is an analysis used to determine the feasibility of farming by looking at the comparison between total revenue and total production costs. Based on the results of data analysis, it is known that the average income obtained by farmers is Rp. 26,601,316 and the average total production costs incurred

by farmers are Rp. 11,494,518, then the value of the R/C ratio obtained is 2.31 which means that means that every Rp. 1.00 spent will generate revenue of Rp. 2.31. This shows that the farming carried out by lowland rice farmers in Labanan Jaya Village is feasible because it is profitable.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

Based on the results of research and discussion, it can be concluded that:

1. The production factor that significantly influences the production of lowland rice in Labanan Jaya Village is the fertilizer production factor. The value of the regression coefficient on fertilizers has a positive sign and the magnitude is 0.290 indicating that the addition of the amount of fertilizer by 1% will increase the average production by 0.290%.
2. The results of the analysis of the allocative efficiency of the use of production factors show that the efficiency index is greater than one, which is 1.858, which means that the use of fertilizer at 360.28 $kg.ha^{-1}$ is not yet efficient. In order for the use of fertilizer to be efficient, the amount of fertilizer must be increased by 309,19 $kg.ha^{-1}$.
3. The average income earned by farmers is Rp. 26,601,316, while the average total cost of production is Rp. 11,494,518, so the average income earned by farmers in Kampung Labanan Jaya is Rp.15.106.798 mt^{-1}
4. The value of the R/C ratio is 2.31. This shows that lowland rice farming in Labanan Jaya Village is feasible because every IDR 1.00 spent will generate an income of Rp 2,31.

B. Suggestion

Based on the results of the research that has been done, the suggestions are as follows:

1. The less optimal use of fertilizers can be overcome by increasing the amount.
2. Using superior and certified seeds so that the production of lowland rice is increasing.
3. The need for continuous counseling and technical guidance.

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