The Role of Using Production Factors and Efficiency Rice Farming of Inpago Unsoed 1 Varieties in Banyumas, Central Java

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Abstract. Consumption of rice follows the trend of population growth. Indonesia always imports rice to sufficient this consumption. Land area for rice plants is decreasing due to various reasons, including rice fields used as housing, the younger generation is not interested in farming, the productivity of rice is decreasing and others. To overcome the reduction in paddy fields and reduced rice productivity, it has been found that the Inpago Unsoed 1 rice variety can be cultivated in both paddy and dry land. Inpago Unsoed 1 is an upland rice variety that is fluffier, fragrant and has high productivity (7.2 tonnes per hectare). The research objectives were 1) knowing the costs and income of Impago Unsoed 1, 2) estimating the effect of production factors on the product, 3) the efficiency of using production factors in Impago Unsoed 1. The research method was survey method, research location was Banyumas Regency, Determination of respondents using simple random sampling. Methods of data analysis to determine the amount of costs and revenues using cost and income analysis. Meanwhile, to determine the role of production factors on the product, using the Cobb Douglas production function. The results showed that the cost of farming Inpago Unsoed 1 was lower than the revenue, which resulted in positive income. The role of additional production factors, such as land area and labor, will increase rice productivity. However, the addition of seed production factors and insecticides does not increase rice productivity. Several factors of fertilizer production also show a role in increasing rice productivity.

1. Introduction

Fulfilling food needs, especially those from rice, has always been a problem for the Indonesian government. In 2017, Indonesia's per capita rice consumption reached 114.6 kg / year. Every year Indonesia has to import rice, and in 2018 Indonesia imports a large amount of 2.2 million tons (January 2018 - November 2018), equivalent to US $ 1.02 billion. A sizeable foreign exchange expenditure. Statistical data from BPS [1], during January 2018 to December 2018 the total estimated rice production was 32.42 tonnes, while the total rice consumption was 29.57 tonnes, meaning there was a surplus of 2.85 million tonnes. The explanation from BPS does not explain the details of what is meant by rice consumption, because rice is not only used for consumption as a staple food, but is also used for industry and is lost during the depreciation process. So there is a possibility that there will be no surplus.

Banyumas Regency is a district in Central Java which has quite a large area of lowland rice and dry land. Paddy rice harvested area in 2017 is 67,176 ha, production 382,635 kg with productivity 5.7 kg / ha. The harvest area in 2018 has decreased, to 66,209.70 ha, production of 368,301.40 kg with productivity of 5.56 kg / ha. In Banyumas Regency, many farmers have planted Inpago Unsoed 1 rice, such as in Sokaraja District, Kaliori, Jatilawang, Karangsalam. Farmers sell their crops which are sold in the form of grain.

Farmers in cultivating rice plants are oriented towards income or profit. Most of the paddy fields owned by farmers have a narrow area, ranging from 0.07 ha to 1 ha. With this wide land area, farmers must cultivate their rice plants efficiently, in order to produce the optimal number of products and maximum profits. Technical efficiency is determined by management ability as measured by experience, age, formal education, non-formal education and capital. Meanwhile, price or allocative efficiency is based on the ability of farmers to manage capital and market information (especially product prices and production factor prices). In reality in the field, this is still a problem for lowland rice farmers, such as the problem of input prices which tend to always increase, product prices that are difficult to predict and limited capital. Therefore, to overcome these problems, rice farmers must be good at regulating and combining production factors in such a way that they can produce optimal products and maximum profits.

The Inpago Unsoed 1 rice variety is a discovery that can help the government in overcoming the problem of food security. Inpago was discovered by Prof. Dr. Ir. Suwarto, MS and Prof. Ir. Totok Agung D., Ph.D. 110 days of plant life. Potential yield of 7.2 tonnes / ha of GKG. Fluffier texture slightly to brown planthopper biotype 1, susceptible to brown planthopper biotypes 2 and 3. Resistance to disease, resistant to blast disease 133. Tolerance to abiotic stress, mildly tolerant of dryness, tolerant to moderate to iron (Fe) poisoning. Good for planting in lowland to moderate dry land <700 m asl. Impago can also be planted in rice fields (Research and Development Ministry of Agriculture, 2018). In Banyumas Regency, there is a large area of dry land. Data from BPS Banyumas Regency (2018) states that the dry land area in Banyumas Regency reaches 551 ha of fields with a production of 2,645.5 kg / ha and a productivity of 4.8 ha. Rice varieties planted on dry land / fields are generally local upland rice varieties so that productivity is low and not fluffier. If managed properly, rice farming on dry land will result in high productivity, namely by replacing local upland seeds with Inpago Unsoed 1 rice seeds.

One of the benchmarks for the success of a farm which is often an indicator is the level of income. Usually, to achieve large income is always based on additional input in order to increase agricultural production so that income will also increase. The increase in farm income does not only depend on the increase in farm production, but also the success of farming in achieving maximum production at a certain input level. This achievement occurs when the farm is in a state of full efficiency (fully efficient). Achieving full efficiency conditions is very important because farmers often do not realize that they have not reached the state of full efficiency as they should. The inability of farmers to reach the level of full efficiency conditions is a lost income due to the difference between the actual production produced and the production at the full efficiency level (fully efficient). Increasing the efficiency of farmers in addition to increasing income, also plays a very important role in maintaining the competitiveness of agricultural products in the market. One way to measure the level of efficiency obtained by farmers in farming is the concept of efficiency. This efficiency concept consists of technical efficiency and allocative efficiency. One of the requirements of a farm is said to be efficient if technical efficiency has been achieved. In practice, small farmers in achieving efficiency and productivity are expected to face various problems, both technical aspects (technology), economic aspects (capital and market access), social institutions (weak institutional consolidation of farmer groups), as well as aspects of government policies that are not yet conducive to development. farming (Bahari, 2014). Efforts to increase production through technical efficiency are currently an important alternative, because it can increase the yield of potential output to farmers. Efforts to increase technical efficiency by using existing resources are expected (Firmana, 2016).

Efforts to increase rice production can be carried out in various ways, namely increasing the area of land (extensification), the presence of new technological breakthroughs by optimizing the existing land area (intensification), and increasing technical efficiency in terms of using existing resources [4]. The production function is defined as a technical specification that describes the relationship between input and output in the production process. Analytically, there is a difference between short-run and long-run production. Short-run production consists of variable input (quantity changes when output changes) and fixed input (fixed quantity even though output changes), while long-run production consists only of variable input [5].

According to Soekardono, et al. (2005), to determine the optimum level of production according to the concept of economic efficiency, it is not enough just to know the production function, but there are more conditions that must be known, namely the input-output price ratio. In order for profit to reach the maximum, the first derivative of the function must be zero, so that the marginal product value (NPM) of the production factors used must be equal to the unit price of the production factor (Px).

2. Methods

Determination of the research location was carried out purposively, namely Sokaraja and Kaliori Districts, Banyumas Regency, Central Java, with the consideration that the farmers were developing Impago Unsoed 1 rice farming.The research method used was survey and respondent determination by census method on 30 organic rice farmers. Research time: when the research was conducted in June 2020.

2.1. Method of Analysis

A model for estimating the estimated parameters of the Cobb-Douglas production function in the form of natural logarithms [5].

$\ln Y = \alpha o + \beta 1 \ln X1 + \beta 2 \ln X2 + \beta 3 \ln X3 + \beta 4 \ln X4 + \beta 5 \ln X5 + \beta 6 \ln X6 + \delta 1 D1 + \delta 2 D2 + \beta 7 \ln X7 + e$

Information:
Y = productivity of organic lowland rice (kg)
X1 = seed (kg)
X2 = labor (HOK)
X3 = urea fertilizer (kg)
X4 = KCl fertilizer (ltr)
X5 = Phonska fertilizer (kg)
X6 = SP36 fertilizer (kg)
X7 = land area
$\partial 0$ = intercept
$\beta 1, \beta 2, ..., \beta 7$. = regression coefficient

2.2. Goodnessfit Test

Before regression analysis is used for forecasting, the accuracy of the regression line must be tested first. The Goodness of Fit test includes the coefficient of determination (R2), the F test and the t test as follows:

The coefficient of determination (R2) is used to determine how much variation in the independent variable affects the variation in the dependent variable in percent units. A small value of R2 means that the ability of the independent variables to explain the variation of the dependent variable is very limited [6].

The coefficient of termination test
"R" ^ "2" = "SSR" / "SST"
SSR = sum of squares of regression
SST = total number of squares

a. The F test is used to determine the effect of production factors together on production results. The hypothesis used is:

H0 : b1 = b2 = b3 …..= bn= 0
Ha : b1,b2,b3...bn ≠ 0

If the probability value < α then H0 is rejected, meaning that the model can be used for further analysis and if the probability value> α then H0 is accepted, meaning that the model can be used for further analysis

b. The t test is used to determine the effect of input on output. Formulations:

H0 : b1 = b2 = b3 ….. = bn= 0

Ha : b1 = b2 = b3 ….. = bn ≠ 0

If the probability value < α then H0 is rejected, it means that the use of input Xi is partially significant. If the probability value> α then Ho is accepted, the input Xi is partially non significant.

Allocative efficiency (price) will be achieved if the marginal product value of a factor of production (MVPX) is equal to the marginal input cost (MICX) which is stated in the formula:

MVPXi = MICXi

MVPXi/(MIC Xi) = 1

Organic lowland rice farming will be analyzed using cross section data, so it uses short-term allocative efficiency analysis with the assumption of perfect competition. Because the Marginal Input Cost (MICx) is the same as the price of the input / production factor, the formula is as follows:

(bi.Y.PY)/PXi = 1

Information:

MVPXi = Marginal Value product i-th
PXi = Price of input i-th
bi = coeficient regression input i-th
Y = amount of production
Py = Price of product
Xi = input product i-th

Criteria of test:

If MVPXi/PXi < 1, hence the use of production factors is not efficient
If NPMXi/PXi = 1, then the use of production factors is efficient
If NPMXi/PXi > 1, hence the use of production factors is not efficient

A good production function or regression analysis model must meet the requirements of goodness of fit or the accuracy of the regression line. If it does not meet these requirements, it is suspected that there are deviations from the classical assumptions which include multicollinearity, heteroscedasticity and autocorrelation so that the model is not blue (Gujarati, 2006).

Multicollinearity test is used to determine whether there is a correlation between independent variables in the regression model. To test whether there is multi or not by calculating the VIF value, if the VIF value <10 means there is no multi-collinearity. The heteroscedasticity test is a test that assesses whether there is an inequality of variance from the residuals for all observations in the linear regression model. Heteroscedasticity test can be done using the Breusch-Pagan-Godfrey method. If the value is Pro. Chi Square> 5%, it can be concluded that the model has a constant variant. The autocorrelation test was not carried out because the research data used cross section data.

3. Result and Discussions

3.1. Profile of Respondents

Respondents of farmers who cultivate Impago Unsoed 1 rice in terms of age of the oldest respondent is 78 years old (1 respondent) and the youngest is 30 years, this shows that the age of the respondent farmer is in the productive age position. The highest education of the respondents was S1 and the lowest did not complete elementary school. The number of family members of the respondent has an average of 3 people, the highest is 5 people and the lowest is 1 person, and the average dependence of the respondent's family is 3 people.

Respondents in the study were lowland rice farmers who cultivated Impago Unsoed 1 rice. The average farm ownership was 0.35 hectares, with details of the largest ownership being 1 hectare and the narrowest being 0.07 hectares. The average use of labor is 241 HOK / hectare consisting of male and female workers. The number of seeds used by farmers was 25 kg / ha, and the inorganic fertilizers used included urea, SP36 and phonskha fertilizers as much as 442.88 kg / ha. There are several farmers who use it. Details of the use of production factors are presented in Table 1.

Table 1. The use of production factors and production per hectare from Impago Unsoed1 rice farming in Banyumas Regency, 2020.

No	Variable	amount
1	Seed (kg)	25,00
2	Labour (HOK)	241,25
3	Urea (kg)	159,05
4	Sp36 (kg)	89,06
5	Ponskha (kg)	149,67
6	Organic Fertilizer (kg)	442,88
7	Pesticid (kg)	5,01
8	Cost of production (Rp)	11.572.958
9	Product (kg)	4.944,29
10	Price (Rp)	4.944
11	Revenue (Rp)	21.350.476
12	Income (Rp)	9.777.518

Source : Survey, 2020

If seen from the farm area (0.35), the average farm cost is IDR 4,050,535. The products produced by the farm expansion (0.31 ha) have an average of 1,731 kg, the selling price of the product is IDR 4,647 / kg and the revenue is IDR 7,472,667. So that the net income obtained by organic farmers is Rp 3,422.13.

The productivity of farmers in rice farming using the Impago Unsoed 1 variety is quite high, 4,944 tons per hectare / planting season and an income of IDR 9,777,518 per hectare per planting season. Warisin's research [7], on rice farming intensively through the Integrated Crop Management (PTT) program, with all production factors assisted by the government in Kebasen, Banyumas Regency, productivity reaches 6,898 tons per hectare with an income of Rp. 11,395,148, - / ha. Research by Denis at all [8] shows that the net income of lowland rice farming in Sigi Regency is IDR 7,836,643.33 / ha / MT.

3.2. Factors Affecting Productivity

The factors that affect the productivity of the Impago Unsoed 1 variety of rice include land area, seeds, fertilizers, pesticides and labor, which are called the independent variables or the twelve variables. The results of the regression analysis of the factors that affect productivity are presented in Table 2.

Table 2. The results of regression analysis of the relationship between production factors and productivity of the Impago Unsoed 1 variety in Banyumas Regency, 2020

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.879398	1.054051	5.577905	0.0000
LOG(BENIH)	0.096757	0.137357	0.704422	0.4846
LOG(INSEKTISIDA)	-0.009489	0.028392	-0.334211	0.7397
LOG(KCL)	-0.002720	0.025316	-0.107427	0.9149
LOG(LUAS_LAHAN)	0.594833	0.140191	4.243010	0.0001
LOG(PENDIDIKAN)	0.011843	0.084020	0.140959	0.8885
LOG(PHONSKHA)	-0.015995	0.011732	-1.363422	0.1792
LOG(PUPUK_ORGANIK)	0.042301	0.012841	3.294275	0.0019
LOG(SP36)	0.023115	0.009102	2.539460	0.0145
LOG(TANGGUNGAN_KELUARGA)	0.068405	0.032903	2.078975	0.0431
LOG(TENAGA_KERJA)	0.226856	0.119162	1.903755	0.0631
LOG(UMUR)	0.305594	0.233482	1.308853	0.1969
LOG(UREA)	0.047780	0.020290	2.354814	0.0228

R-squared	0.924945	Mean dependent var	7.114471
F-statistic	48.26729	Durbin-Watson stat	2.639374
Prob(F-statistic)	0.000000		

The results of the regression analysis are in Table 2. It shows that the regression model that is built meets the requirements of goodness of fit, with R2 = 92.49 percent and F is significant at the 99 percent confidence level. The production factor of land area has a significant and positive effect on the productivity of Impago Unsoed 1 rice variety of 0.59 (inelastic), organic fertilizer of 0.04 (inelastic), SP36 of 0.02 (inelastic), urea of 0.04 (inelastic)) and workforce of 0.23 (inelastic), meaning that each additional 1 percent of the production factor will increase productivity by less than 1 percent. This shows that the use of the five factors of production is rational (area II). The results of the research [9], show the same results that land area, labor and urea fertilizer have a significant effect on lowland rice productivity in Karanganyar Regency. Production factors of seed, insecticide and KCl did not significantly affect productivity of Impago Unsoed 1. Family dependents had a significant effect on productivity, while age and education had no significant effect. Different results, research by Kusmantoro et al (2019), show that the use of seeds in organic rice farming has a significant effect on increasing rice productivity.

3.3. Efficient Use of Production Factors (Input)

Allocative efficiency is often referred to as price efficiency or price efficiency or efficiency in the use of inputs. Allocative analysis is useful for knowing whether the use of production factors / inputs on a farm is efficient or inefficient or inefficient. Allocative efficiency involves input prices and prices. Allocative efficiency analysis is only used for inputs that have a significant effect on the product (Kusmantoro et al, 2020). The results of the analysis of the efficiency of using production factors in the Impago Unsoed 1 variety of rice farming.

Table 3. The efficiency of using production factors in Impago Unsoed 1 rice farming

N0	Variable	Price of input (Rp)	Marginal Product Value	$(MPV_{Xi})/P_{Xi}$	Ttest
1.	Land area	886.250,00	13.766.786,05	6,90009	2,00**
2.	Labour	50.000	101.768,21	2,04	1,44*
3.	Organic Fertilizer	695	82.629.019,75	132.727,03	2,78**
4.	SP36	2.079	8.698.206,88	3.310,37	$0{,}000148^{ns}$
5	Urea		8.265.609	4.350,22	$0{,}00027^{ns}$

Source: Primary data analysis

Land use for the Impago Unsoed 1 variety in Banyumas Regency is efficient (marginal value of product = prices input). The result of the t test shows that it is significant, meaning that the hypothesis NPMXi / PXi = 1 is proven, meaning that the use of land area is efficient so that it produces maximum profit. The use of labor is also efficient, meaning that when input prices and output prices are fixed at the time of research, farmers are able to allocate the use of labor optimally so as to produce maximum profits. The use of organic fertilizers is also efficient, meaning that farmers are able to allocate the use of inputs optimally so as to produce maximum profits. This result is different from the research by Dewi et al. (2012), the results of her research show that the use of labor and organic fertilizers in lowland rice farming in Badung Regency is inefficient. In a research [9] on paddy rice farming in Karanganyar Regency, showed that labor and urea fertilizer were inefficient.

4. Conclusions

The use of urea and SP36 fertilizers was allocatively not efficient (not significant) at the 95% confidence level. At the price of rice (harvested dry grain) of IDR 4,647.00 / kg and a price of urea of IDR 1,972.00 / kg and a SP36 price of IDR 2,340.00 / kg the use of urea and SP36 fertilizers is not optimal, so it is not yet productive. maximum profit. So that in order to produce maximum profit, it is better for farmers to increase the use of urea and SP36 fertilizers until they are optimal (efficient).

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