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THE EFFECT OF PRODUCTION FACTORS ON RICE PRODUCTIVITY

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Abstract

This study aims to determine the effect of factors of production on rice productivity. The number of respondents in this research were 31 farmers who were taken randomly. This study used proportional parameter testing and multiple linear regression analysis using the Ordinary Least Square (OLS) method. This research has normal distribution, free from multicollinearity and heteroscedasticity problems multiple linear regression analysis can be performed. The results of the analysis show that the results of the R^2 test show that 83.9% of the variation in rice productivity can be explained by the five independent variables while the remaining 16.1% is explained by other factors not included in the model. The results of the F test show that the independent variables jointly affect rice productivity. The results of the t test showed that land area, seeds, labor, pesticides had a significant positive effect, while fertilizer had a significant negative effect on rice productivity.

Keywords: Productivity, rice, production factors, ordinary least square

A. Introduction

Indonesia is a country where the majority of the population works in the agricultural sector. The agricultural sector plays a very important role in the economy. One of the agricultural sectors that is of concern to the world is food security, Indonesia is listed as the fourth country in the world with food security (Lalo et al., 2020). South Sulawesi is one of the largest rice production centers and has the fourth highest national harvest area (BPS, 2018). The analysis results of (Susilowati, 2018) even revealed that South Sulawesi is the main rice producer and supplier for provinces with a rice deficit.

Paddy production in South Sulawesi shows that the development of superior agricultural commodities can improve the people's economy in the agricultural sector. By sector, the agricultural sector consists of the food crop agriculture sub-sector, the plantation sub-sector, the livestock sub-sector, the fisheries sub-sector, and the forestry sub-sector. Among all sub-sectors, the food crop sub-sector, especially rice, is a livelihood for the community. Farming activities cannot be separated from production activities (input) to produce a product (output) which will then be sold to the market. In the production process, rice production results depend on the production factors used according to Gasper, there are two things to consider in an alternative business, namely technical aspects and economic aspects (Jumiati, 2016).

Wajo Regency is one of the areas that has the potential to develop rice plants, almost the entire area is dominated by rice fields. In the last few years, data for 2016-2020 has shown a declining

trend in Wajo Regency's production, but on the other hand it still maintains the second leading position after Bpne Regency with a production value of 771.45 thousand tons in 2020.

Pammana District is one of the areas in Wajo Regency which is one of the largest rice producers. According to data from (BPS, 2020) in Pammana District, the rice planting area was 10,519 ha, the harvested area was 11,535 ha, the production was 58,898 tons and the productivity was 5.11 tons/ha, originating from 16 villages in the Lampulung district. One of the villages in Pammana District which has a fairly high production, namely Lampulung Village, with production reaching 6,851 tons with a planting area of 923 ha.

Agricultural production will not get maximum results if it is not supported by good production factors. Because with good production factors can streamline the time wasted. The use of good production factors can also provide good farming income for Indonesian agriculture. The factors of production include land area, fertilizers, labor, and pesticides. In addition to production factors, the rice planting schedule is also one of the things that really needs to be considered before planting rice. This planting schedule is often a concern and an obstacle for farmers in starting to plant because of climate change which is sometimes erratic so that it can cause farmers to fail to harvest.

B. Methodology

The research design is a survey research implemented in Lampulung Village, Pammana District, Wajo District, South Sulawesi. The research was conducted from March to May 2022. The population in this study were all farmers in Lampulung Village, Pammana District, Wajo Regency, totaling 618 people divided into 18 farmer groups. From this population, 5% of the population is taken so that the sample is 5% x 618 people = 31 people.

Data collection methods in this study are interviews and observation. The type of data used is primary data from direct interviews with respondents using research instruments and secondary data from the local government, BPS and related journals.

To determine the effect of production factors on rice productivity in Lampulung Village, Pammana District, Wajo Regency, using multiple linear regression analysis with eviews 12. The regression equation is as follows.

$$y = b0 + b_1x_1 + b_2x_2 + b_3x_{3+} + b_4x_4 + b_5x_5$$

Description:

Y = Rice Productivity (Tons/Ha)
b_o = Constant
b = Regression coefficient
X_1= Land Area (Ha)
X_2 = Seed (kg)
X_3 = Fertilizer (kg/ha)
X_4 = Labor (HOK)
X_5 = Pesticide (L)

To test the model using the Classical Assumption Test as follows.

1. Normality test
   Normality testing is done using Jarque Bera statistics. The regression model is normally distributed if Jarque Bera is greater than 0.05, and vice versa.
2. Heteroscedasticity Test
   Heteroscedasticity testing was carried out using the White Test. The regression model is said to be free of heteroscedasticity if the probability of Obs*R Square is greater than the significant level of 0.05.
3. Multicollinearity Test
   The multicollinearity test aims to determine whether there is a relationship between the independent variables and other independent variables. The regression model is said to

have no relationship between the independent variables, if the regression model has a value of less than 10.

4. Statistic test
   a. Coefficient of Determination (R2)
      The coefficient of determination is between 0 and 1. If R2 is close to 1, it can be said that the influence of the independent variable on the dependent variable is large. Means that the model used is good for explaining the influence of these variables.
   b. F Test on Multiple Linear Regression
      To obtain certainty that the resulting model can generally be used, a joint test is needed.
      H_0 : there is no significant effect between land area, seeds, fertilizers, labor and pesticides.
      H_1 : there is a significant influence between land area, seeds, fertilizers, labor and pesticides.
      In this case, the calculated F is compared to the F table with a confidence interval of 95% or = 5%.
   c. Individual Regression Test (t test)
      The process of testing the model part by part to be carried out with the t-test is carried out as follows:
      H_0 : there is no significant relationship between land area, seeds, fertilizers, labor and pesticides.
      H_1 : there is a significant influence between land area, seeds, fertilizers, labor and pesticides.
      In this case, t count (tk) is compared with a table with a confidence level of 95% or = 5% with the following conditions:
      If ttable < t count < t table, then the independent variables are removed from the multiple linear regression model.
      If t count = t table or t count = -t table, then these independent variables are not removed from the multiple linear regression model

C. Findings and Discussion

Classic assumption test

The classical assumption test shows that the regression model is normally distributed without any multicollinearity and heteroscedasticity problems. The regression model is normally distributed when Jarque Bera is greater than 0.05 and vice versa. The normality test is shown in Figure 1 below.

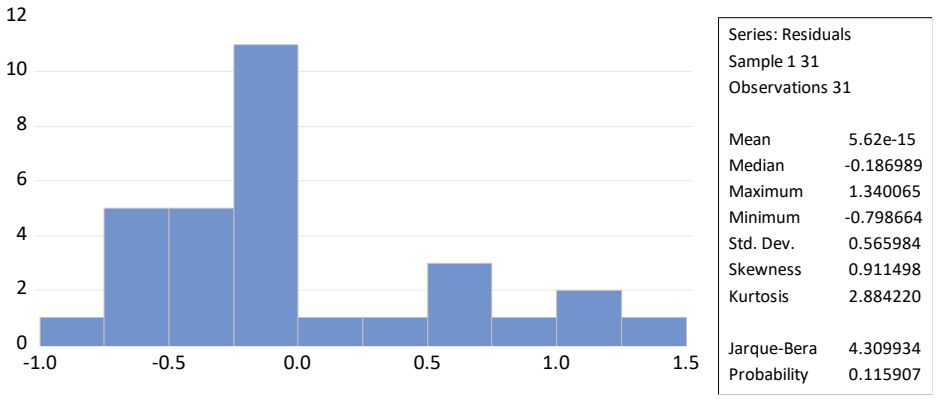

Figure 1. Normality Test of Factors Affecting Rice Productivity

Figure 1 shows that the Jarque-Bera value is 4.310 with a probability of 0.116, greater than 0.05 (95% confidence level). Which means the residual variable of the regression model of the factors of production is normally distributed on the productivity of lowland rice.

Heteroscedasticity testing was carried out using the White Test. The regression model is said to be free of heteroscedasticity if the probability of Obs*R Square is greater than the significant level of 0.05. The heteroscedasticity test can be seen in Table 1 below.

Table 1. Heteroscedasticity Test Results

F-statistics	117.1863	Prob. F	0.0000
Obs * R-Squared	30.77025	Prob. Chi-Square	0.0144

Source: Primary Data Analysis, 2022.

Table 1 shows that the residual variable is heteroscedasticity-free regression because the results show that the obs* R-squared significance is 30.77 greater than 0.05. Then the variables in the regression model used do not occur symptoms or are free from heteroscedasticity. The quantity that can be used to detect the presence of multicollinearity is the Variance Inflation Factor (VIP). If the VIP value is less than 10, it means that there is no relationship between the independent variables, and vice versa. The VIF value of the independent variables of land area, seeds, fertilizers, labor and pesticides is less than 10, so it can be interpreted that this regression model has no linear relationship, and there is no multicollinearity problem.

Statistic test

The statistical test in this study is using multiple linear analysis with a 95% confidence level α 0,05. The regression equation can be seen from the coefficient test table based on the output of Eviews 12 independent variables on the dependent variable can be seen in Table 3 below.

Table 3. Test Results Factors Affecting Lowland Rice Productivity in Lampulung Village, Pammana District, Wajo Regency, 2022

Variable	Coefficient	Prob.
C	-0.208470	0.7944
Land Area (X1)	21.11535*	0.0392
Seed (X2)	0.048773***	0.0000
Fertilizer (X3)	-0.120143***	0.0014
Labor (X4)	0.110960***	0.0000
Pesticides (X5)	2.492103***	0.0000
R-squared	0.838838	
Adjusted R-squared	0.806606	
F-Statistics	26.02477	
Probs (F-Statistics)	0.000000	

Description: *** = 99% Confidence Level
* = 95% Confidence Level

The statistical test used in this study is the determination test (R), F test and T test as follows.

a. Determination Test (R^2)

The determination test is carried out to prove how much influence the independent variables have on the dependent variable. The value of the coefficient of determination (R^2), productivity in Lampulung Village is 0.839, it can be said that the ability of the independent variable to influence the dependent variable is classified as very strong. So it can be concluded that the variable land area, seeds, fertilizers, labor, and pesticides have an effect of 83.9% on productivity while the remaining 16.1% is explained by other factors that are not included in the model.

b. F test

The statistical F test is a test conducted to determine the effect of the independent variables simultaneously on the dependent variable in a significant way or not. The t test is used to determine the effect of the independent variables partially on the dependent variable (Purnamasari et al., 2017).

The F test aims to determine whether the independent variables (X1, X2, X3, X4, and X5,) simultaneously affect the dependent variable (Y). In Table 13 the F test, the Fcount value of rice productivity in Lampulung Village is 0.807 and the significance value is 0.000. The F table value with a 95% level of confidence (α = 0.05) for df N1 = 5 and df N2 = 25 is 2.60. From the test results, it can be concluded that the value of Fcount > F table, then H0 is rejected, meaning that all independent variables which include land area, seeds, fertilizers, labor, pesticides jointly affect the dependent variable, namely rice productivity.

c. T test

The t-test aims to determine whether the regression model equation formed partially by the independent variables (X1, X2, X3, X4, and X5,) has a significant effect on the dependent variable (Y). The T test on rice productivity was carried out by comparing the Tcount value with the Ttable value, with a 95% confidence level (α = 0.05) with the degree of freedom (df) using the N-1 formula, the Ttable value was 2.06. Table 3 shows that Mathematically, the regression model between the rice productivity variable and the influencing production factor variables can be written in the following equation.

$$Y = -0.208 + 21.115\ x_1 + 0.049\ x_2 - 0.120\ x_3 + 0.111\ x_4 + 2.492\ x_5$$

Land Area (X1)

Table 3 shows that land area has a significant effect on lowland rice productivity with a 95% confidence level because the p-value of land area is 0.0392 which is smaller than α which is 0.05 (95% confidence level). The regression coefficient value is 21.115, which is positive, meaning that every 1 percent increase in the total area of land will increase rice productivity by 21.115 percent assuming other factors remain (constant). This matterin line with (Zarliani, 2020), which states that land area has a significant effect on farming productivity. At the 95% confidence level with a smaller p-value of 0.009αnamely 0.05 (95% confidence level). (Notarianto, 2011) in the journal (Onibala et al., 2017) explains that land is a factor of production that has a relatively large contributionto farming, making it difficult for land does not affect productivity.

Seed (X2)

In Table 3 it can be seen that seeds have a significant effect on rice productivity at the 99% confidence level because the p-value of seeds is 0.000 which is smaller thanαnamely 0.01 (99% confidence level). The regression coefficient value is 0.489, which is positive, meaning that every 1 percent increase in the number of seeds will increase productivity by 0.489 percent assuming other factors remain (constant). This is in line with (Purnamasari et al., 2017) research which states that seeds have a significant effect on soybean productivity at the 90% confidence level. This proves that seed is one of the factors that determine plant productivity.

Fertilizer (X3)

Table 3 shows that fertilizer has a significant effect on rice productivity at the 99% confidence level with a p-value of 0.001 which is less thanαnamely 0.01 (99% confidence level). the regression coefficient value is -0.120, a negative value, meaning that every 1 percent addition of fertilizer will reduce productivity by 0.120 percent. In Lampulung Village, most farmers choose to use urea fertilizer when compared to other fertilizers. Even though you have used a good fertilizer, the thing that must be considered is the dosage of fertilizer used. Because if farmers do not pay attention to the dosage of fertilizer it will have a negative impact on rice plants. This is in

line with research from (Anhar et al., 2016) which states that plants need to get fertilization at the right dose so that there is a balance of nutrients in the soil that will make the plants grow and develop properly and provide optimal results. (Onibala et al., 2017) which stated that the amount of urea used affects rice production.

Labor (X4)

The table shows that labor has a significant effect on rice productivity at the 99% confidence level with a smaller p-value of 0.000αnamely 0.01 (99% confidence level). The regression coefficient value is 0.111, which is positive, meaning that every 1 percent additional labor hour will increase productivity by 0.111 percent assuming other factors remain (constant). The labor used is both family labor and labor outside the family, namely labor for plowing, rice planting, fertilizing, spraying and harvesting. Labor has a very important role in rice farming, because without labor the farming will not run smoothly. This is in line with the opinion of (Naqias, 2012) which states that labor is one of the determining elements, especially for farming which is highly dependent on the season.

Pesticides (X5)

In Table 13 it can be seen that pesticides have a significant effect at the 99% confidence level with a pesticide p-value of 0.000 which is less thanαnamely 0.01 (99% confidence level). The regression coefficient value is 2.492, which is positive, meaning that every 1 percent addition of pesticides will increase productivity by 2.492 percent assuming other factors remain (constant). This is in line with research from (Purwono, 2007) which states that pesticides are needed by farmers to prevent and eradicate pests and diseases in plants for good growth and optimal yields.

D. Conclusion

Based on the results of multiple linear regression analysis, it shows that the variables of land area, seeds, fertilizers, labor and pesticides together have a significant effect on rice productivity. The results of the t test showed that the variables of land area, seeds, labor, and pesticides had a positive effect on the productivity of lowland rice. While the fertilizer variable has a negative effect on productivity.

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