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Factors Affecting Production Rice Farming (*Oryza sativa*. L) in Biha Village Makimi District, Nabire Regency, Indonesia

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Abstract: Factors Affecting Production of Rice Farming (Oryza sativa L) in Biha Village, Makimi District, Nabire Regency. This study aims to determine the effect of land area factor, seed factor, fertilizer factor, drug factor and labor factor on rice farming production in Biha Village, Makimi District, Nabire Regency, using a survey method with a sample of 30 respondents randomly (simple random). random sampling), through the interview method using a previously prepared questionnaire. With multiple linear regression analysis to determine the effect of production factors on rice farming production, as well as F test and t test to determine the effect partial and simultan Simultaneously or together the linear regression model has a positive and very significant effect, as seen from the results of the calculated F value of 17.62 which is greater than the F table of 2.62 while the R2 value or determinant coefficient of 0.7859 indicates that the linear regression model according to where the variables of land area, seeds, fertilizers, medicines and labor have an influence on rice production of 78.59%, the remaining influence of 21.41% is an influence outside the model. For the F test, it was found that fertilizer had a significant effect on rice production, while land area, seeds, medicines and labor only affected rice production and had a positive effect.

Keywords: Multiple linear regression; Production factors; Rice production

Introduction

Rice (Oryza sativa L) is the most important food commodity for the Indonesian people, so that rice is often a strategic commodity and domestic rice production is a benchmark for food availability for Indonesia (Antriyandarti et al., 2023). As a strategic commodity, in carrying out their farming efforts, farmers expect that every rupiah spent will generate comparable income (Rozi et al., 2023; Tamburaka, 2021). However, the high or low income received by farmers depends on the cost of production (input) during the activity and the amount of production (output) produced. The lower the level of production, the lower the income obtained and vice versa, so that income is often a measure of success in running every farming business (Nugroho et al., 2023; Farida & Setiawan, 2022). The size of success in farming will be influenced by the amount of production produced by a farming business, while farming production will be influenced by the production factors (input) used by farmers in farming, production factors in rice farming consist of internal and external factors (Santoso et al., 2023). Internal factors are directly related to the farming business and the farmers themselves, including land, capital, labor and management. These internal factors are factors that can be controlled by the farmers themselves, while factors that cannot be controlled are external factors or factors outside the farming business and the farmers themselves that influence farming (Liu et al., 2018; Rohani et al., 2024), including natural factors, culture, price fluctuations and markets. In line with that, it is hoped that farmers have the ability to control internal factors and can adapt to external factors in running their

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farming businesses. Nabire Regency has a rice field area of 1.226 ha in 2020 with a dry grain production of 5.689.40 tons with a productivity of 4.64 tons/ha (Nguyen et al., 2024; Saleh & Suherman, 2021).

Therefore, it is very important to use production factors properly and appropriately, including land production factors, capital (seeds, fertilizers and medicines), use of appropriate labor and use of technology using agricultural tools and machinery (Qadir et al., 2024; Zhang et al., 2021). The use of production factors in rice farming is also expected to provide farmers with knowledge and skills through continuous agricultural extension activities (Aniagyei et al., 2024). Based on the background described above, the author is interested in conducting a study entitled "Factors Affecting Rice Farming Production (*Oryza sativa* L) in Biha Village (SP 1) Makimi District, Nabire Regency" (Chau & Ahamed, 2022). From the description of the background above, the problems in this study are as follows; Do land area factors, seed factors, fertilizer factors, drug factors and labor factors affect rice farming production in Biha Village, Makimi District, Nabire Regency?

In accordance with the problems formulated in this study, the objectives of the study are: to determine the effect of land area factors, seed factors, fertilizer factors, drug factors and labor factors on rice farming production in Biha Village, Makimi District, Nabire Regency (Bakri et al., 2021; Mulyadiana et al., 2018; Michelson et al., 2023). The uses of this research are as follows: As a reference in conducting research which is the responsibility to complete the final study for obtaining a bachelor's degree in the Agribusiness Study Program, Faculty of Agriculture and Animal Husbandry, USWIM Nabire; It is expected to be useful for writers and readers to increase knowledge about rice farming production, especially factors that influence production; It is expected to be a reference for rice farming organizers to increase their production; It is expected to be a consideration for policy makers in the region, especially in the agricultural sector, to increase production and farmer welfare (Ansari et al., 2023; Borda et al., 2023).

A hypothesis is a temporary answer to a research problem, until proven through the collected data (Sydow et al., 2025). According to Chigbu (2019), a hypothesis is a temporary answer to a research problem whose truth must be tested empirically. Based on the objectives of this study, the following statistical research hypothesis can be formulated: Ho: 0≠β, namely; It is suspected that there is a positive and significant influence between labor, capital, and land area on rice farming production in Biha Village, Makimi District, Nabire Regency. H1: 0=β, namely; It is suspected that there is no influence between labor, capital, and land area on rice farming production in Biha Village, Makimi District, Nabire Regency.

Method

Research Method

This research is designed based on the objectives to be achieved through a descriptive analysis approach, namely to determine the effect of production factors on rice production in Biha Village, Makimi District, Nabire Regency. With this research design, the research method used is a descriptive method with a quantitative analysis approach, namely a method that aims to solve existing problems at the present time by collecting data, compiling, managing, analyzing, describing and drawing conclusions.

Time and Place of Research

The research time lasted for three months starting from May to June 2021, and was located in Biha Village, Makimi District, Nabire Regency, the selection of this research location was deliberate (Purposive), because the research location is the second largest rice production center after Bumi Raya Village, West Nabire District, and already has adequate technical irrigation for rice farming.

Types and Sources of Data

The types of data collected in this study include qualitative data, namely data obtained descriptively in the form of oral or written information and quantitative data, namely data obtained in the form of numbers from rice farmers at the research location and related agencies in accordance with the objectives of this study. The data sources obtained are, Primary data, namely data obtained directly from rice farmers as research respondents and secondary data, namely supporting data obtained through documents or written reports and information from related agencies.

Population and Sample

Population is the entire object in the study at the location where the research is taking place, which is the population in this study are all rice farmers in Biha Village, Makimi District. The sample is a representative of the population taken randomly (random sample) which is expected to describe the population or be representative of the research object as a whole, determining the number of samples using the Slovin formula as follows:

$$n = N / (1 + N. (e) 2) \quad (1)$$

Where:
E: Sample size (number of samples)

N: Population size (number of populations)
E: Percentage of inaccuracy due to errors in sampling that can be tolerated is 15%

Based on the information obtained, there are 93 rice farmers in Biha Village, Makimi District, Nabire Regency, so based on the Slovin formula above, the number of samples obtained is 30 farmers. The number of 30 farmers as samples in the study was obtained by rounding off the calculated value, namely 30.09, so it was rounded to 30.

Data Collection Method

Data collection methods are divided into primary data and secondary data. Primary data collection is carried out through direct interviews with respondents through the instrument used, namely a list of questions (Questionnaire) that has been prepared before conducting the study. Secondary data is obtained from literature or from statistical data from villages, districts or from related agencies. This secondary data includes geographical location, land ownership, population, village facilities and infrastructure and other data as supporting data in this study.

Analysis Framework

To answer the problem or objective of this study, namely to determine the factors that influence rice production using multiple linear regression analysis with the formula:

$$\hat{Y} = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + e \quad (2)$$

Where:
Ŷ : Rice production
A : Constant
b1,.. b5 : Regression coefficient
X1 : Land area variable
X2 : Seed variable
X3 : Fertilizer variable
X4 : Medicine variable
X5 : Labor variable
E : Standard error

According to Shetty et al. (2020) and Pasha et al. (2021) to determine the closeness of the relationship between independent variables (x1, x2, x3, x4 and X5) with the dependent variable (Y1), the coefficient of determination (R2) is used. Meanwhile, to determine the magnitude of the influence of independent variables with the dependent variable in each multiple regression equation, the coefficient of determination (R2) is used with the following formula:

$$R^2 = \frac{JK\,(reg)}{\varepsilon\, Y_i} \quad (3)$$

Furthermore, to determine the influence of production factors on rice farming production both as a whole (simultaneously) and the influence of each factor (partial), the F statistical test is used, which basically shows whether all independent variables entered into the model have a joint influence on the dependent variable (Song & Ye, 2022; Yangchen et al., 2022). The F test is to see the influence of production factors of land, labor, seeds, fertilizers and drugs on production as a whole or simultaneously. With the formulation:

$$F_{hit} = \frac{R^2/k}{(1 - R^2)/(n - k - 1)} \quad (4)$$

Where:
R2 = determinant coefficient
k. = independent variable
n. = number of samples
with a significance level of 0.05 or a confidence level of 95%.
Hypothesis: H0; ai = 0
H1; ai ≠ 0, at least one of the ai ≠ 0.
With the provisions:

F_hit > F_tab, then accept H1 reject H0. This means that land, labor, seeds, fertilizers and pesticides (X1, X2, X3, X4, and X5) have a significant effect on rice production (Y) F_hit <F_tab, then reject H1 accept H0. This means that land, labor, seeds, fertilizers and pesticides (X1, X2, X3, X4, and X5) do not have a significant effect on rice production (Y). In addition to conducting proof with the F test, furthermore, to determine the influence of production factors partially on the production of paddy fields using the "t" test to test the influence of each independent variable on the dependent variable in each multiple linear equation, the formula used is as follows:

$$t_{hit} = \frac{a_i}{Sa_i} \quad (5)$$

Where:
ai = regression coefficient of variable Xi
Sai = standard error of variable Xi
with a significance level of 0.05 or a confidence level of 95%.
Hypothesis: H0; ai = 0
H1; ai ≠ 0

With the provisions:
t_hit > t_tab, then accept H1 reject H0. This means that land, labor, seeds, fertilizers and pesticides (X1, X2, X3, X4, and X5) have a significant effect on rice production

(Y). t_hit > t_tab, then reject H1 accept H0. This means that land, labor, seeds, fertilizers and pesticides (X1, X2, X3, X4, and X5) do not have a significant effect on rice production (Y).

Result and Discussion

The following is data on rice production in Nabire Regency in 2021 by district. Based on table 1, it can be seen that in 2020 rice production in Nabire Regency was 5.689.40 tons of dry grain from a land area of 1.226.00 ha with a productivity of 4.64 tons/ha. The largest production was produced in the West Nabire District, which was 3.830.40 tons with a land area of 798 ha, while the second place was in Makimi District with a land area of 275 ha with a production of 1,210.00 tons where the productivity was 4.40 tons/ha. Next are Uwapa, Wanggar, Yaro and Yaur Districts. Makimi District, Nabire Regency is one of the second largest rice production centers in Nabire Regency after West Nabire District, so it has promising prospects in the future if rice farming is carried out by paying attention to good farming methods with the implementation of seven farming methods and other supporting factors such as strengthening capital that can be obtained through partnership institutions, both credit (Malesu & Syrovátka, 2024; Surya et al., 2021; Gutiérrez Cano et al., 2023), provision of farming infrastructure and marketing, and local government policies that support rice farming activities because they already have adequate technical irrigation and irrigate several villages including Biha Village (SP 1) and Legari Jaya Village (SP 2).

Table 1. Harvested Area and Rice Production by District in Nabire Regency in 2020

District	Harvest Area (ha)	Production (ton)	Average Production (Productivity)
1	2	3	4
1. Uwapa	98.00	421.40	4.30
2. Menou	-	-	-
3. Dipa	-	-	-
4. Yaur	4.00	13.60	3.40
5. Teluk Umar	-	-	-
6. Wanggar	39.50	169.85	4.30
7. Nabire Barat	798.00	3.830.40	4.80
8. Nabire	-	-	-
9. Teluk Kimi	5.50	22.55	4.10
10. Napan	-	-	-
11. Makimi	275.00	1.210.00	4.40
12. Wapoga	-	-	-
13. Kepulauan Moora	-	-	-
14. Siriwo	-	-	-
15. Yaro	6.00	21.60	3.60
Amount	1.226.00	5.689.40	4.64

Rice Farming Production Factors

From the results of the multiple linear regression analysis (table 11), the value of the determinant coefficient or Residual Square (R2) was obtained as 0.786 or 78.6%. This value indicates that the influence of the independent variables, namely; land area, seeds, fertilizers, medicines and labor simultaneously or in combination (simultaneously) affects the production of rice farming (dependent variables) by 78.6%, and the remaining 21.4% is the influence from outside the multiple linear regression model or variables observed in this study.

Table 2. Determinant Coefficient Values and F Test Results Based on the Results of Multiple Linear Regression

Model	Degrees of freedom	Coefficient of Determinant (R^2)	F_{count}	$F._{tab\ 0.05}$	Inf
Regresi	5	0.786	17.62*	2.62	Have a real impact
Residual	24				
Total	29				

Furthermore, in table 2 above, the results of the F test calculation on the multiple linear regression model can be seen as 17.62 at a 95% confidence level or a significance level of 0.05, greater than Ftable, the Fcount value = 17.62 indicates that there is a very significant or real influence between the production factors of land area, seeds, fertilizers, medicines and labor on farm production simultaneously (Ginting et al., 2023; Niu et al., 2024), thus the linear regression model used is feasible and correct. To determine the influence of production factors partially or individually, the t-test is used and compared with the results of the t-count

analysis with the t-table value to determine how much influence the independent factor has on the dependent factor. The results of agricultural production, especially rice farming, will depend on the use of the production factors used, the main production factors are land, capital (seeds, fertilizers, and pesticides) and labor (Iskandar et al., 2022). From the results of the analysis of production factors that affect rice farming production, the following form of multiple linear regression equation is obtained.

Table 3. Results of Multiple Linear Regression Analysis using Excel Software, where Land, Seeds, Fertilizers, Medicines and Labor have an effect on Rice Farming Production in Biha Village, Makimi District

Variables (production factors)	Variable coefficient	tcount	t_{hitung}	Inf
Y = Production	154.76	0.887	1,701	-
X_1 =Land	265.12	0.567		Influential
X_2 = Seeds	8.39	1.702*		Have a real impact
X_3 = Fertilizer	0.37	0.558		Influential
X_4= Drugs	12.82	0.539		Influential
X_5 = Labor	5.71	0.808		Influential

From the data in table 12 above, it can be explained that the results of multiple linear regression (Y estimates) or it can be said that the form of the regression equation is as follows: $\bar{Y}$ = 154.76 + 265.12X1 + 8.39X2 + 0.37X3 + 12.82X4 + 5.71X5 + e. Based on the results of the multiple linear regression calculation, the regression equation is as above and it can be explained that the constant or intercept value of 154.76 is the estimated rice production at the beginning of the regression model where this value indicates that when all independent variables, namely land, seeds, fertilizers, medicines and labor are in a stationary state or have a fixed value (cateris paribus), then rice production is estimated at 154.76 kg, while the value of the regression coefficient of variable X1 or the coefficient of the land area variable of 265.12 indicates that if the addition of the land area variable by 1 unit or 1 ha will increase rice production by 265.12 kg of rice production assuming that other variables, namely seeds, fertilizers, medicines and labor are in a fixed or stationary state or ceteris paribus (Salam et al., 2024; Acintya et al., 2024; Ly et al., 2016).

The regression coefficient value for variable X2, namely the seed variable of 8.39 indicates that if there is an addition of one unit or 1 kg of seeds, it will increase rice production by 8.39 kg assuming that other variables are in a fixed state (cateris paribus). The coefficient value of variable X3 or fertilizer variable of 0.37 indicates that if there is an increase or addition of fertilizer by 1 unit or 1 kg, it will increase lowland rice production by 0.37 kg assuming that other variables in the regression model are fixed or stationary, this fertilizer variable has a fairly small value because it can be said to be attached to the land area variable where if the land area is larger, the addition of fertilizer is also greater and vice versa (Simon, 2011). For the coefficient value of variable X4 of 12.82 or the coefficient value of the drug variable of 12.82 kg indicates that if there is an increase or addition of drugs by 1 unit or 1 kg, it will increase production by 12.82 kg assuming that other variables are in a fixed state, and the coefficient of variable X5 or the coefficient of the labor variable of 5.71 indicates that if there is an increase in labor by 1 unit or 1 hok, it will increase rice production by 5.71 kg assuming that other variables are in a fixed state or are not moving (cateris paribus) (Nalley et al., 2022; Korsa et al., 2024).

The results of the regression analysis have a positive value so that all variables have a positive effect in the regression model. From the results of the multiple linear regression analysis (table 12) it shows that the positive influence of all variables/ non-fixed/ independent/ Xi on the fixed/ dependent/ Y variables simultaneously or together appears in the regression model where all coefficients of the multiple linear regression variables have positive values. Furthermore, to find out how big the level of confidence or the level of confidence in the influence of independent/non-fixed variables on production/fixed variables will be seen from the results of the t-test of each variable in the regression model, where the results of the analysis of the t-test value of each variable will be compared with the t-table value with a confidence level of 95% or a significant level of 0.05, from the results of the t-test in multiple linear regression analysis can be described as follows.

The results of the t-test or also called the t statistic for the land area variable of 0.56, this value is smaller than the t-table which is 1.70, indicating that the land area variable or variable X1 has a positive effect but because it has a value smaller than the t-table, as well as the t-test for the fertilizer variable of 0.55, the drug variable of 0.53 and the labor variable of 0.80, have positive values and have an effect on production (Gupta et al., 2025), but the effect is quite small. Meanwhile, the seed variable or variable X2 has a value greater than the t table, which is 1.70, which is greater than 0.70, so it can be said to have a positive influence and a real effect on the fixed variable, namely the rice production variable (Y) (Aprizkiyandari & Palupi, 2023; Maiti et al., 2024; Oktariani & Yanti, 2023).

Conclusion

Based on the results of the study and multiple linear regression analysis, the following conclusions were drawn; Simultaneously or together, the linear regression model has a positive and very real effect seen from the results of the calculated F value of 17.62 which is greater than the F table of 2.62, while the R2 value or determinant coefficient of 0.78 indicates that the multiple linear regression model is appropriate where the variables of land area, seeds, fertilizers, medicines and labor have an effect on rice production of 78.59%, the remaining effect of 21.41% is an effect outside the model; For the F test, the results showed that fertilizer had a significant effect on rice production, while land area, seeds, medicines and labor only had an effect on rice production and had a positive effect.

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Author Contributions
Conceptualization; S. S. S.; methodology.; S. M; validation; Y.; formal analysis; S. M.; investigation.; S. M.; resources; Y.; data curation: S. S. S.; writing—original draft preparation. S. S. S.; writing—review and editing: Y.; visualization: S. M. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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