ANALYSIS OF FACTORS AFFECTING THE ADOPTION RATE OF BIOFERTILIZERS BY FARMERS PARTNERING WITH PT AGRIKENCANA PERKASA

Miranti Rizki Mareta[1], Rahmawati Setiyani[2], Annisa Nugraheni Afridhianika[3]
[1,2,3], Agribusiness Departement, Faculty of Science and Technology, Universitas Duta Bangsa Surakarta
*Correspondence Email : mirantirizki23703@gmail.com

ABSTRACT

This study aims to analyze farmers' level of knowledge and perceptions regarding biofertilizers, the rate of biofertilizer adoption, and the factors influencing the rate of biofertilizer adoption among farmers partnered with PT Agrikencana Perkasa. The study employed a quantitative method using a survey approach. Data were collected through observation, interviews, questionnaires, and documentation. Data analysis was conducted using descriptive analysis and multiple linear regression. The variables analyzed included age, level of formal education, farming experience, the role of farmer groups, and the role of agricultural extension workers in the adoption of biofertilizers. The research results show that farmers' knowledge and perceptions of biofertilizers fall into the high category. The adoption rate of biofertilizers among farmers partnering with PT Agrikencana Perkasa is also relatively high, indicating that most farmers have accepted and implemented the use of biofertilizers in their farming activities. The results of the multiple linear regression analysis show that the roles of farmer groups and agricultural extension workers have a significant effect on the adoption rate of biofertilizers. Conversely, age, level of formal education, and farming experience do not significantly influence the adoption rate of biofertilizers. These findings suggest that institutional and extension factors play a greater role in promoting the adoption of biofertilizers than individual farmer characteristics.

KEYWORDS *biofertilizers, adoption rate, multiple linear regression, farmer groups, agricultural extension workers.*

This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International

INTRODUCTION

Indonesia is an agrarian country where the majority of the population relies on the agricultural sector for their livelihood therefore, increasing agricultural production and productivity is a key step toward supporting food security and improving farmers' well-being. In the cultivation process, fertilizer is one of the essential inputs farmers use to support crop growth and yield. Data on the allocation of subsidized fertilizer (in metric tons) from the Indonesian Ministry of Agriculture (2024) is presented in Table 1.

Jenis Pupuk	2021	2022	2023	2024	2025
Urea	700.692	694.054	732.742	773.647	735.139
NPK	440.686	390.996	420.099	640.510	613.267

Based on table 1, data on the allocation of subsidized chemical fertilizers show that usage remains quite high and tends to increase in certain years. The allocation of urea fertilizer was recorded at 700,692 metric tons in 2021, declining slightly to 694,054 metric tons in 2022, then increased to 732,742 metric tons in 2023 and reached 773,647 metric tons in 2024, before declining again to 735,139 metric tons in 2025. Meanwhile, the allocation of subsidized NPK fertilizer, which stood at 440,686 metric tons in 2021, decreased to 390,996 metric tons in 2022, then increased to 420,099 metric tons in 2023 and surged significantly to 640,510 metric tons in 2024, although it declined slightly to 613,267 metric tons in 2025. This situation indicates that farmers' dependence on chemical fertilizers remains quite high, despite year-to-year fluctuations (Indonesian Ministry of Agriculture, 2024). Increases in production and productivity are supported by the use of agricultural inputs, particularly fertilizers. In practice, many farmers still rely on chemical fertilizers such as urea and NPK to boost crop yields.

The continuous use of chemical fertilizers can reduce soil fertility, decrease organic matter content, suppress the activity of soil microorganisms, and cause water, soil, and air pollution. In addition, excessive use of chemical fertilizers can potentially lead to soil compaction and increase the resistance of certain pests and diseases. To support sustainable agriculture, a more environmentally friendly alternative is needed: biofertilizers. Biofertilizers can improve fertilizer use efficiency, enhance soil fertility, increase organic matter, and reduce dependence on chemical fertilizers, thereby helping to preserve the environment. Data on biofertilizer allocation from the Klaten Regency Food Security and Agriculture Office (2026) is presented in table 2.

No	Tahun	Luasan (Ha)	Kebutuhan (Liter)
1	2022	20.793,38	103.670,90
2	2023	25.734,48	119.958,62
3	2024	-	-
4	2025	4.083,4	20.417,0
5	2026	856,0	4.280,0

Based on Table 1.4, data on biofertilizer allocation from the Klaten Regency Food Security and Agriculture Office (2026) show that in 2022, biofertilizer demand was recorded at 103,670.90 liters for a land area of 20,793.38 hectares, then increased in 2023 to 119,958.62 liters for a land area of 25,734.48 hectares. However, there was no allocation data available for 2024, and in 2025, there was a significant decrease to 20,417.0 liters for a land area of 4,083.4 hectares. Another decline occurred in 2026, when the demand for biofertilizer was only 4,280.0 liters for a land area of 856.0 hectares.

PT Agrikencana Perkasa is a company engaged in the agricultural sector, producing organic fertilizers, livestock feed, and organic pesticides. The company has introduced biofertilizers as a more environmentally friendly alternative to support sustainable agriculture. However, the rate of biofertilizer use among farmers remains relatively low, as some farmers still prefer chemical fertilizers, which are considered more practical and have been in use for a long time. The low adoption rate of biofertilizers indicates that farmers do not always immediately embrace new innovations. Factors such as age, educational level, farming experience, as well as support from the company and extension services are believed to influence farmers' decisions to adopt biofertilizers. Given these conditions, this study examines the factors influencing the adoption rate of biofertilizers among farmers partnered with PT Agrikencana Perkasa. The research findings are expected to provide insights for increasing the use of biofertilizers and supporting the development of sustainable agriculture.

RESEARCH METHOD

This study was conducted from May to July 2026 at PT Agrikencana Perkasa in Klaten Regency. The location was selected through purposive sampling because the company produces biofertilizers and has partner farmers as users of its products. The study population consisted of 234 partner farmers, with a sample of 70 respondents determined using the Slovin formula and selected through purposive sampling. Data were collected through observation, interviews, and documentation, and then analyzed using multiple linear regression to examine the factors influencing the adoption rate of biofertilizers. Multiple linear regression analysis was used to analyze the effect of independent variables on the level of biofertilizer adoption using the following model:

$$Y = a + \beta 1X1 + \beta 2X2 + \beta 2X3 + \beta 2X4 + \beta 2X5 \cdots + \beta nXn + \in$$

Equation Description:
Y = dependent variable
a = constant β1, β2, ...,
βn= regression coefficients for each independent variable
X1, X2, ..., Xn= independent variables
∈= error (residual)

RESULT AND DISCUSSION

Characteristics Respondent

The characteristics of the respondents provide a general overview of the circumstances of the farmers who collaborate with PT Agrikencana Perkasa and participated in this study. In general, the characteristics of farmers can be examined from social and economic perspectives. Social aspects include age, educational level, farming experience, and the number of dependents, while economic aspects include land area, land tenure status, and agricultural production (Kalamento et al., 2021). The characteristic data can be found in table 3.

Characteristics	Dominant category	Percentage %
Age	61-70	40
Education	High school/vocational school	38,57
Length of time engaged in farming	21-30	37,14
Land area	0,5-1,0	32,86
Ownership status	Owner	48,57

Source: Processed primary data, 2026

The characteristics of the respondents were dominated by farmers aged 61–70 (40%), with a high school or vocational high school education (38.57%), and with 21–30 years of farming experience (37.14%). Most respondents cultivated plots ranging from 0.5 to 1.0 ha (32.86%) and were landowners (48.57%). This indicates that the majority of farmers have considerable experience, a secondary education, and the freedom to manage their farming operations because they cultivate their own land.

Test Multiple Linear Regression Analysis

Multiple linear regression is a statistical method used to analyze the relationship between a dependent variable and two or more independent variables, as well as to determine the effect of the independent variables on the dependent variable (Wahyuni, 2024).

Table 4. Regression Calculation

Coefficients						
		Unstandard Coefficients		Standardized Coefficients		
Model		B	Std Error	Beta	t	Sig
t	(Constant)	6.404	2.323		2.757	.008
	Age	.013	.029	.034	.446	.657
	Level of formal education	-.086	.180	-.036	-.476	.636
	Farming experience	-.006	.024	-.018	-.249	.804
	Role of farmer groups	.390	.054	.538	7.178	.000
	Role of agricultural extension workers	.356	.047	.547	7.537	

Source: Processed primary data, 2026

Based on the results of the regression output in table 3, the multiple linear regression equation is obtained as follows:

$Y = 6{,}404 + 0{,}013X_1 - 0{,}086X_2 - 0{,}006X_3 + 0{,}390X_4 + 0{,}356X_5$

Information:

Y = rate of biofertilizer adoption (dependent variable)

X_1= age

X_2= level of formal education

X_3= farming experience

X_4= role of farmer groups
X_5= role of agricultural extension workers

A constant value of 6.404 indicates that the level of biofertilizer adoption is predicted to be 6.404 when all independent variables are held constant. The variables of age (Sig. = 0.657), level of formal education (Sig. = 0.636), and farming experience (Sig. = 0.804) do not have a significant effect on the adoption rate of biofertilizers. These results are consistent with Majid et al. (2025), who stated that age, formal education, and farming experience do not affect the adoption of PGPR. The role of farmer groups (Sig. = 0.000) had a positive and significant effect on the adoption rate of biofertilizers. These results are consistent with Majid et al. (2025), who stated that the role of farmer groups influences the adoption of PGPR. The role of agricultural extension workers (Sig. = 0.000) also had a positive and significant effect on the adoption rate of biofertilizers. This finding is supported by Febrian et al. (2024), who stated that the better the role of extension workers, the higher the level of innovation adoption by farmers.

F-Test (Simultaneous)

The F-test is used to determine the combined effect of independent variables on the dependent variable and to assess the suitability of the regression model (Rifkhan, 2023).

Tabel 5. F-test Results

ANOVA					
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	474.794	5	94.959	26.621	.000
Residual	228.292	64	3.567		
Total	703.086	69			

Source: Processed primary data, 2026

Based on Table 4.20, the results of the F-test show a calculated F-value of 26.621 with a significance level of 0.000 (<0.05). These results indicate that the variables of age, level of formal education, farming experience, the role of farmer groups, and the role of agricultural extension workers simultaneously have a significant effect on the level of biofertilizer adoption; therefore, the regression model used is appropriate for explaining the relationships among the variables.

t-Test (Partial)

The t-test is used to determine the partial effect of each independent variable on the dependent variable (Rifkhan, 2023).

Table 6. t-Test Results

Coefficients					
	Unstandardized B	**Coefficients Std. Error**	**Standardized Coefficients Beta**	**t**	**Sig.**
(Constant)	6.404	2.323		2.757	.008
Age (X1)	.013	.029	.034	.446	.657
Level of formal education (X2)	-.086	.180	-.036	-.476	.636

Farming experience (X3)	-.006	.024	-.018	-.249	.804
Role of farmer groups (X4)	.390	.054	.538	7.178	.000
Role of agricultural extension workers (X5)	.356	.047	.547	7.537	.000

Source: Processed primary data, 2026

Based on table 6, the results of the t-test show that the variables of age (Sig. = 0.657), level of formal education (Sig. = 0.636), and farming experience (Sig. = 0.804) do not have a significant effect on the level of biofertilizer adoption because their significance values are greater than 0.05; therefore, H_0 is accepted and H_1 is rejected. Conversely, the variables of the role of farmer groups (Sig. = 0.000) and the role of agricultural extension workers (Sig. = 0.000) have a positive and significant effect on the rate of biofertilizer adoption because their significance values are less than 0.05; therefore, H_0 is rejected and H_1 is accepted.

Coefficient of Determination R^2

The coefficient of determination is used to determine the extent to which the independent variable explains the variation in the dependent variable.

Table 7. Results of the Coefficient of Determination Test

Model Summary			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.822	.675	.650	1.889

Source: Processed primary data, 2026

Based on Table 7, the results of the t-test show that the variables of age (Sig. = 0.657), level of formal education (Sig. = 0.636), and farming experience (Sig. = 0.804) do not have a significant effect on the level of biofertilizer adoption because their significance values are greater than 0.05; therefore, H_0 is accepted and H_1 is rejected. Conversely, the variables of the role of farmer groups (Sig. = 0.000) and the role of agricultural extension workers (Sig. = 0.000) have a positive and significant effect on the rate of biofertilizer adoption because their significance values are less than 0.05; therefore, H_0 is rejected and H_1 is accepted.

CONCLUSION

The results of the multiple linear regression analysis indicate that the factors influencing the adoption rate of biofertilizers among farmers partnered with PT Agrikencana Perkasa are the role of farmer groups and the role of agricultural extension workers. Both variables have a significant effect on the adoption rate of biofertilizers because they play a role in disseminating information, increasing knowledge, providing guidance, and motivating farmers to adopt agricultural innovations. Meanwhile, the variables of age, level of formal education, and farming experience do not have a significant effect on the adoption rate of biofertilizers. These findings indicate that the success of biofertilizer adoption is more

influenced by institutional support and extension services than by the individual characteristics of farmers.

REFERENCES

Febrian, L. W. G., Ratri, W. S., & Mawardi, N. K. (2024). The Role of Agricultural Extension Workers in the Adoption of Biosaka by Farmer Groups in Kapanewon Karangmojo, Gunungkidul Regency. Agritas Scientific Journal, 9(2), 83–94.

Kalamento, A., Bempah, I., & Saleh, Y. (2021). Characteristics and Income of Corn Farmers in Sigaso Village, Atinggola Subdistrict, North Gorontalo Regency. Agrinesia, 5(2).

Klaten Regency Food Security and Agriculture Agency. (2026). Biofertilizer Allocation Data. April 20, 2026.

Majid, T. S. P., Sukadi, & Astuti, Rr. S. (2025). Analysis of Factors Influencing the Adoption Rate of Plant Growth-Promoting Rhizobacteria (PGPR) by Rice Farmers. Jurnal Ilmiah Sosio Agribis (JISA) ISSN, 25, 11–23.

Ministry of Agriculture of the Republic of Indonesia. (2024). Data on Subsidized Fertilizer Allocations (Metric Tons). Accessed on February 24, 2026, at 1:15 p.m.

Rifkhan. (2023). Guidelines for Research Methodology Using Panel Data and Questionnaires (Abdul, Ed.). Adab Publishing, CV Adanu Abimata.

Wahyuni. (2024). Linear Regression and the Least Squares Method (ed. Santoso). Meraki Pustaka.