The Allocative Efficiency Analysis in the Rice Farming Production

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ABSTRACT
The study aimed to analyze the effect of the application of production inputs on rice farming production and its allocative efficiency. The study was conducted in Bantaeng Regency. The primary data employed were collected from 36 farmers who owned 82 rice fields in total. The Cobb-Douglas Production Function (FPCD) Model and the Allocative Efficiency (AE) Analysis were applied for the data analysis. The FPCD model showed that there were five variables (land area, seeds, ZA fertilizer, NPK fertilizer, and labor) had positive and significant effects. Meanwhile, the result of EA Analysis showed that the variable of land area, seeds, and ZA fertilizer had not been efficient yet and the labor was not efficient. In increasing the rice farming production, the farmers are encouraged to cultivate more rice fields, apply for more certified seeds, ZA and NPK fertilizers, as well as reduce the number of labors used for production's efficiency.

Keywords: *Cobb-Douglas Function, Allocative Efficiency, Production Inputs, Rice Farming*

INTRODUCTION

Rice is one of the food crop commodities that are commonly cultivated by farmers in rural areas, because of its benefits as the staple food source for the Indonesian population. The population growth rate [which is not controlled in this country] will continue to increase the demand for rice (Hafizah *et al.,* 2020; Marwin *et al.*, 2021; Sumarsih *et al.,* 2020). Therefore, the deficit between rice production and demand will lead to food insecurity (Mashadi *et al.*, 2021). As a result of the deficit situation which occur sequentially will increase dependence on imported food, which further will weaken national food security (Sukerta *et al.*, 2018). As countermeasure effort to balance the rate of population growth, the government keep trying to increase the rice production (Lasmini *et al.*, 2016; Puspitasari, 2017).However, there are various factors that had become obstacles in the effort to increasing the rice production (Marwin *et al.*, 2021). Degradation of land and water resources, environmental damages, climate change and conversion of agricultural land to non-agricultural uses are the causes of the decline in rice production (Fauzan, 2020; Mulyani & Agus, 2017).

In the green revolution era, efforts to increase rice production have succeeded in achieving food self-sufficiency, especially for rice commodity. However, the implementation of agricultural intensification programs such as the use of high-yielding varieties, chemical fertilizers and pesticides in the long term has changed cropping patterns to be not environmental friendly (Sumarsih et al., 2020). These various problems encourage the need for more efficient rice farming system(Kartiasih & Setiawan, 2019), so that farmers are expected to have technical skills and knowledge in order to find and develop rice cultivation system to keep pace with the rate of rice demand (Pipih et al., 2020). Improvements in rice cultivation systems are expected to maximize the amount of production with less input allocation (Purwaningsih, 2017).

Bantaeng Regency is one of the areas in South Sulawesi with land area of 395.83 km^2. The area of paddy fields is 7,916.1 ha and non-paddy agricultural land is 24,722.3 ha (BPS Kabupaten Bantaeng, 2019). Harvested area, total production, and productivity of paddy fields in Bantaeng Regency in 2014–2018, are presented in Table 1.

Table 1
Figures of harvested area, production yield, and productivity of paddy fields in Bantaeng Regency

No.	Year	Harvested Area (ha)	Total Production (ton)	Productivity (kw/ha)
1	2014	15.007,00	89.311,00	59,51
2	2015	14.460,00	79.149,00	54,74
3	2016	15.848,00	100.765,00	63,58
4	2017	16.531,00	94.700,00	57,29
5	2018	17.931,20	91.159,12	50,84
Total		79.777,20	455.084,12	285,96
Average		15.955,44	91.016,82	57,19

Source: BPS Kabupaten Bantaeng (2019)

The area of paddy fields in Bantaeng Regency is relatively smaller than the area of non-paddy fields. The low paddy harvested area resulted in the decrease in rice production (Fitri et al., 2017). Table 1 shows a decline in paddy productivity in Bantaeng Regency in the last 2 (two) years. Meanwhile, in the same year, the harvested area increased. It can be seen that the paddy productivity level in this area, in 2016 had reached 63.58 kw/ha. Then it fell to 57.29 kw/ha and 50.84 kw/ha, respectively in 2017 and 2018. Meanwhile, in 2016 the harvested area of paddy cultivation was 15,848.00 ha. This figure increased in 2017 and 2018 with an area of 16,531.00 ha and 17,931.20 ha, respectively. Theoretically, low amount of farm production can be caused by not optimal use of production factors (Marwin et al., 2021).

The increasing cost of using production inputs that is not accompanied by an increase in the price of production results in decreasing farmers' income (Akite et al., 2022; Novitaningrum et al., 2019). Farmers' efforts to increase farming productivity and production still can be achieved by using production inputs efficiently, and at the same time it can provide benefits for farmers as well (Nurul C et al., 2018; Yuliana et al., 2017). Farming productivity can also be increased through increasing the quality of intensification by improving the application of seed technology (Abdi et al., 2019; Sholikah & Kadarmanto, 2020). In addition, efforts to optimize the use of paddy fields include choosing and using of superior seeds, effectively manage the land, proper management of irrigation water, application of balanced fertilization, and pest control activities (Pipih et al.,

2020). In this case, the role of farmers is very important in achieving farming efficiency (Soekartawi, 2016), and the effectiveness of increasing rice production is supported by the presence of agricultural extension workers through increasing skills, knowledge, innovation, and technology (Hermawan *et al.*, 2021; Sundari *et al.,* 2021)

Many studies have been conducted regarding the allocative efficiency of input application in the rice farming. However, the use of inputs varies by study area. Salam *et al.* (2019) found that productivity, selling price, and production costs of rice farming affected the income of rice farmers in Maros Regency, South Sulawesi Province, Indonesia. Musaba & Mukwalikuli (2019) used the Cobb-Douglas Function Model to estimate the effect of socio-economic variables on the rice production output of small farmers in Zambia. They found that land size, number of seeds, agricultural chemicals, labor, gender, access to extension services, and lines planting system were significant variables and were positively related to the rice production. Yuliana *et al.* (2017) in his study in Wirosari District, Grobogan Regency also revealed the same thing that amount of seed and amount of NPK fertilizer used variables affected the level of rice production. Meanwhile, the price of seeds used was not efficient and the use of NPK fertilizers was not yet efficient. Furthermore, Sukerta *et al.* (2018) in their study which was conducted in Subak Anyar Sidembunut, Bangli Regency revealed that the seed factor, phonska fertilizer, urea fertilizer did not affect the level of rice production. The use of seeds and urea fertilizer has not been efficient yet and labor is not efficient either.

Based on the results of previous studies as described in the previous paragraph, this study was intended to examine the effect of the application of production inputs and analyze the allocative efficiency on rice farming production in Bantaeng Regency.

METHODOLOGY

This study was conducted in Gantarangkeke Village, Gantarangkeke Sub-Regency, Bantaeng Regency. This location, deliberately, was selected with the consideration that because of this area is classified as an area that is quite potential for the development of food crops, including rice commodities. Field data collection took place in December 2021.

The data used in this research was quantitative-primary data, obtained from the results of structured interviews with selected respondent farmers. The primary data were collected from selected respondent farmers who cultivated rice crops in the last planting season in 2021. The respondents were selected by simple random sampling method from a population of 189 farmers in the study location. Then, from the total population, 36 farmers were taken as the samples. This figure was obtained from the results of the calculation of the Slovin Formula.

The first objective was analyzed using the Cobb-Douglas Production Function (FPCD) Model. The model fulfilled the BLUE assumptions. Charles W. Cobb and Paul H. Douglas are two American scientists who introduced the Cobb-Douglas Production Function Model (Gupta, 2016). This function is often used in econometrics (Hossain *et al.*, 2012) to describe a particular physical product that can be produced by two or more physical inputs (Entezari *et al.*, 2021). The FPCD model is a production function with two or more variables. One of the variables is called the estimator variable (Y) and the other variable is called the unexpected variable (X) (Purwaningsih, 2017). Meanwhile, the second objective was analyzed by Allocative Efficiency (AE) Analysis.

In this study, eight independent variables (Land Area, Seed, ZA Fertilizer, NPK Fertilizer, Regent Pesticide, Takeover 505 SL Pesticide, DMA 6 Pesticide, and Labor) were tested. Meanwhile, Rice Production as the dependent variable. Furthermore, with these variables, the FPCD Model

specifications were made as stated in Equation 1.

$$\text{Ln PP}_i = b_1\text{LnLL}_i + b_2\text{LnBN}_i + b_3\text{LnPZ}_i + b_4\text{LnPN}_i + b_5\text{LnPR}_i + b_6\text{LnPT}_i + b_7\text{LnPD}_i + b_8\text{LnTK}_i + e_i$$

(1)

Where **PP** is Rice Production (kilogram), **LL** is Land Area (hectar), **BN** is Seed (kilogram), **PZ** is ZA Fertilizer (kilogram), **PN** is NPK Fertilizer (kilogram), **PR** is Regent Pesticide (Litre), **PT** is Takeover 505 SL Pesticide (Litre), **PD** is DMA 6 Pesticide (Litre), **TK** is Labor (HOK, mandays), **a** is a constant, **b** is a regression coefficient, and **e** is another factor that is not observed.

AE Analysis approach is used to determine the level of production efficiency. Allocative efficiency is achieved when the ratio between the Marginal Product Value (NPM) of each input (X_i) is the same as the input price (P_x), as in Equation 2.

$$\frac{\text{NPMxi}}{\text{Pxi}} = 1, \text{ or } \text{xi} = \frac{\text{Py.bi.Yi}}{\text{Pxi}}$$

Where **NPM$_{xi}$** is the marginal product value of the i-th input, **P$_{xi}$** is the price per unit of the i-th input (Rp/unit), **P$_y$** is the price per unit of output (Rp/unit), **Y$_i$** is the average production (kilogram), **X$_i$** is the average usage i-th input (units), and **b$_i$** is the regression coefficient.

The results of the comparison between NPMxi and Pxi can be used as a basis for decision making in achieving allocative efficiency. It can be determined when to increase or decrease the use of production inputs, when:

$NPMxi/Pxi > 1$, this means that the application of input X is relatively small in number or not yet efficient, so it requires additional input.

$NPMxi/Pxi = 1$, it means that the input allocation has been efficient.

$NPMxi/Pxi < 1$, it means that the allocation of input X has exceeded the optimum limit or is inefficient, thus requiring a reduction in input.

RESULTS AND DISCUSSION
The Effect of The Application of Production Inputs

The FPCD Model shows the value of the Coefficient of Determination (R^2), as presented in Table 2, is 0.924. This figure can be interpreted that 92.4% of the variation in production results can be explained by the production inputs factors included in the model. While the remaining of 7.6% is explained by other factors that are not included in the model. The coefficient of determination in this study is a value that indicates the influence of land area, seed, ZA fertilizer, NPK fertilizer, regent pesticide, takeover 505 SL Pesticide, DMA 6 pesticide and labor on rice farming production simultaneously in the study location.

As previously explained and shown in the FPCD Model that the purpose of this study is to analyze the effect of Land Area (LL), Seed (BN), ZA Fertilizer (PZ), NPK Fertilizer (PN), Regent Pesticide (PR), Takeover 505 SL Pesticide (PT), DMA 6 Pesticide (PD), and Labor (TK) Variables on Rice Production (PP) Variable. The results of the regression analysis on the effect of the use of the above inputs on the rice production in the study location are presented in Table 2.

Table 2 shows two types of regression coefficients, unstandardized and standardized-beta coefficients. In this study, the FPCD model was constructed using the standardized-beta coefficient to simplify its interpretation of each individual independent variable. The simplification of this is due to that the beta coefficients have standard deviations as their units. It means that the strenght of the effects of each independent variable to the dependent variable can be easily compared to each other. The higher the absolute value of the standardized-beta coefficient, the stronger the effect.

Table 2
The results of the regression analysis on the effect of input application on rice farming production

	Coefficients[a]					
		Unstandardized Coefficients		Standardized Coefficients	t-value	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,451	0.578		7.704	0.000
	Ln_LL	0.293*	0.074	0.262	3.976	0.000*
	Ln_BN	40.286*	0.075	0.238*	3.829	0.000*
	Ln_PZ	0.168*	0.051	0.160*	3.284	0.002*
	Ln_PN	0.121*	0.052	0.122*	2.299	0.024*
	Ln_PR	0.054	0.037	0.071	1.450	0.151
	Ln_PT	0.045	0.034	0.058	1.349	0.182
	Ln_PD	0.122	0.062	0.132	1.961	0.054
	Ln_TK	0.465*	0.143	0.161*	3.259	0.002*

a. Dependent Variable: Ln_PP   F-Value = 110.561   R-square = 0.924
*Signification on the 95% confidence level   (Sig. = 0.000)   Adjusted R^2 = 0.915

The findings listed in Table 2 show that the variables of Land Area (LL), Seed (BN), ZA Fertilizer (PZ), NPK Fertilizer (PN), and Labor (TK) have a positive and significant effect on rice production at the 95% confidence level. Meanwhile, regent pesticide (PR), takeover 505 SL pesticide (PT), and DMA 6 pesticide (PD) had a positive effect, but the effect was not significant to rice production.

In Table 2 it can be seen that the Variable of Land Area has a significant positive effect on the rice production with a regression coefficient value of 0.262. This figure shows that in general the addition of land area in the study location can increase the rice production. Then, in detail it can be said that an increase in land area of one of its standard deviations will result in an expected in rice production of 0.262 of its atandard deviations, assuming other factors are constant. Furthermore, the variable of land area in the model is the most responsive and the most important input factor in increasing the amount of rice production because it has the largest in absolute value of its regression coefficient. These results are in line with the results of the previous studies at different locations and times.

Cendrawasih *et al*. (2019); Novitaningrum *et al*. (2019); Alhadi & Partini (2020) in their study also found that land area has a positive effect on rice production and is the most responsive factor in efforts to increase rice production. Then, another empirical fact, Saketa *et al*. (2018); Usman & Juliyani (2018) in their study revealed that land area affects the amount of rice production, so that the addition of arable land area is always accompanied by an increase in rice production. This implies that the land area factor should be a major concern for the government in order to boost rice production (Cendrawasih *et al*., 2019).

Furthermore, in Table 2 it can also be seen that the Seed Variable also has a significant positive effect on rice production with a regression coefficient of 0.238. The beta value of 0.238 indicates that an increase of one of its standard deviations of the seed will result in an expected in rice production of 0.238 of its standard deviations, assuming other factors are constant. In the model, the Seed Variable is the second important among the other independent variables on rice production. It means that the farmers in the study site should take for consideration the accuracy of seed

amount they use for increasing their rice production. The findings in this study are in line with the findings of Putra *et al.* (2018); Musaba & Mukwalikuli (2019); Novitaningrum *et al.* (2019); Kartiasih & Setiawan (2019); Marwin *et al.* (2021) which revealed that seeds have a positive effect on rice production. The results of the study of Puspitasari (2017) also revealed that the use of certified rice seeds resulted in higher production and profits, while farmers who used non-certified seeds obtained lower production and profits. Therefore, the use of a high quality seeds is one of the strategic choices and steps that can be applied to increase the productivity of rice farming (Abdi *et al.*, 2019).

Another moderate important independent variable in the model, as shown in Table 2, is Labor Variable. The beta-coefficient of the variable is 0.161, which indicates that an increase of one of its standard deviations of the labor will result in an expected in rice production of 0.161 of its standard deviations, if other input factors are constant. Based on the beta value of the Labor Variable we come to conlude that the farmers in the study site have a chance to increase their rice farming production by labor intensification, both family and hired labors. This finding is in line with the findings of Sukerta *et al.* (2018);Musaba & Mukwalikuli (2019); Khoerunisa *et al.* (2021); Marwin *et al.* (2021) which mentioned that the labor variable had a positive influence on rice production. Therefore, efficient labor management can help farmers in the study area to increase their rice farming production.

In this study, the application of ZA fertilizer and NPK fertilizer by the farmers who were tested for their effect on rice farming production also contributed significantly to a positive effect result. The beta-coefficient of ZA Fertilizer Variable is 0.160 (Table 2), assuming other factors constant. The coefficient value explains that increasing the use of ZA fertilizer by one of its standard deviations can contribute to an increase of rice production of 0.160 of its standard

deviations. The influence of the ZA fertilizer on the rice production has a litle bit less important comparing to the three previous independent variables explained above. This finding is relevant and supporting the findings of Musaba & Mukwalikuli (2019); Khairul & Lamusa (2021) who found out that fertilizer application was positively related to rice production. The last input factor that shows a significant positive effect is NPK fertilizer. The variable has a positive effect on rice production with a regression beta-coefficient of 0.122 (Table 2). If we compare to the other four independent variables which have a positive and significant effect on the rice production, the NPK Fertilizer variable has the smallest effect on the production. However, this result suggests that an increase of the use of NPK fertilizer by one of its standard deviations has an increase of 0.122 of its standard deviation in rice production. The result is in line with and supporting the findings of Yuliana *et al.* (2017); Salam *et al.* (2019); Khoerunisa *et al.* (2021); Marwin *et al.* (2021) which stated that the use of NPK fertilizer in the production inputs had a positive effect on rice production.

Based on the findings and foregone discussion, it can be said that the opportunity to increase rice farming production in the study area has potential to be improved. Therefore, it is deemed necessary to improve the management of rice farming in Gantarangkeke Village, Gantarangkeke Sub-regency, Bantaeng Regency. According to Musaba & Mukwalikuli (2019), farmers can increase rice production if they are assisted in accessing production inputs, given proper extension services and are encouraged to adopt better rice cultivation practices. Meanwhile, improvement in rice farming management is expected to encourage farmers to increase their income from rice farming and encourage rural economic growth in Indonesia (Salam *et al.*, 2019).

Allocative Efficiency of The Production Inputs

In this session, the results of the Allocative Efficiency (AE) Analysis of the application of rice farming inputs in the study area are presented, as shown in Table 3. The AE analysis of each input is measured by comparing the Marginal Product Value (NPM) of each input with the price of the input (Purwaningsih, 2017). The decision is based on the resulting ratio. If the result is greater than one, it is said to be "not efficient yet", equal to one means "efficient", and less than one is "not efficient". Before analyzing the allocative efficiency of each production input, the FPCD Model production efficiency is analyzed simultaneously by looking at the sum of the regression coefficients (bi), which is the production elasticity of each input (Khoerunisa *et al.*, 2021; Soekartawi, 1989). In Table 3 it can be seen that the total of regression coefficients for the FPCD Model is 1.204. These findings indicate that overall rice farming in Gantarangkeke Village is "not efficient". This situation is located in region 1 in the graph of the production function stages division, namely the area of increasing return to scale. Based on this, the farmers in the study locations are still possible to add inputs in order to increase the production of their rice farming.

Table 3
The Results of The Allocative Efficiency Analysis on The Application of Rice Farming Production Inputs

Variable	bi[a]	Average Y	P_Y	Xi	Pxi	PMxi	NPMxi	NPMxi/ Pxi	Optimum[c]
Land area (Ha)	0,262*	715,15	4.000	0,24	872.000	780,71	3.122.821,67	3,58[be]	0,86
Seed (Kg)	0,238*	715,15	4.000	8,13	13.000	20,94	83.742,04	6,44[be]	52,37
ZA fert. (Kg)	0,160*	715,15	4.000	23,12	1.700	4,95	19.796,54	11,65[be]	269,23
NPK fert. (Kg)	0,122*	715,15	4.000	19,11	2.400	4,57	18.262,33	7,6[be]	145,41
Regent pest. (L)	0,071	715,15	4.000	0,17	320.000	298,68	1.194.721,18	3,73[be]	0,63
Takeover 505 SL Pest. (L)	0,058	715,15	4.000	0,16	180.000	259,24	1.036.967,50	5,76[be]	0,92
DMA 6 Pest. (L)	0,132	715,15	4.000	0,19	180.000	496,84	1.987.364,21	11,04[be]	2,10
Labor (HOK)	0,161*	715,15	4.000	23,83	80.000	4,83	19.326,76	0,24[te]	98,64

Note: *positively affect and significant at 95% level;
a = total bi = 1,204
be = not efficient yet (*belum efisien*), te= not efficient (*tidak efisien*)
c = optimum value per hectare used

Furthermore, partially AE Analysis is performed on each input that has a positive and significant effect on Table 2. Based on Table 3, it is known that the Variables of Land Area, Seed, ZA Fertilizer, and NPK Fertilizer which have a positive and significant effect on rice production have proven to be "not efficient yet". These results are indicating that these variables need to be increased in order to achieve allocative efficiency. Meanwhile, the Labor Variable is "not efficient", which means that the allocation of labor in the study site is already excessive, so the number of workers must be reduced to increase rice farming production.

The ratio between the NPM of the production input of land area and the price of land rent per season per hectare is 3.58. This figure is greater than one. It means that the land area cultivated by the farmers, when this study was carried was 0.24 ha on average, was not efficient yet. Thus, it is still possible to increase the area of rice fields cultivated by farmers up to 0.86 ha in order to achieve optimal allocative efficiency to obtain higher rice production. These results are in line with the results of the study of Khoerunisa *et*

al., (2021); Putra *et al.*, (2018) which revealed that the use of land area in rice farming is not efficient yet, so it needs to be upgraded.

Table 3 also shows that from the AE Analysis of Seed Variable, the ratio between the NPM of the seed and the price of the seed itself is greater than one (6.44). This figure indicates that the use of seeds in rice farming managed by the respondent farmers is also "not efficient yet". Therefore, the farmers in the study area can increase the production of rice farming by increasing the seed amount they use. In Table 3, it is also realized that the optimum use of seeds at the prevailing price level at the study site at the time this study was conducted was 52.37 kg/ha. In addition, it is also known that when this study was conducted, the farmers' use of seed was on average 8.13 kg per parcel of land or 33.88 kg/ha. Therefore, in order to optimize the use of seeds, the farmers in the study locations can increase the use of seeds up to 52.37 kg/ha to increase their rice production. This finding are in line with the findings of Nurul C *et al.* (2018); Khairul & Lamusa (2021) which explained that in the rice farming at their study location shows the use of seed input is not yet efficient, so its use must be increased in order to achieve efficient conditions.

In this study, two types of fertilizers' application were tested, namely ZA fertilizer and NPK fertilizer. Both types of the fertilizers have a positive and significant effect on rice production (Table 3). The ratio between the NPM of ZA fertilizer and NPK fertilizer with each price is greater than one. The allocative efficiency of ZA fertilizer is 11.65. Meanwhile, the allocative efficiency for NPK fertilizer is 7.61. These two figures indicate that the use of these two fertilizers in the rice farming is also "not efficient yet". This result is in line with the findings of Khairul & Lamusa (2021) which revealed that the use of fertilizer inputs is not yet efficient, so it requires to be added more. Especially for the use of NPK fertilizers, our findings support the findings of Yuliana *et al.* (2017), which

showed that the efficiency value of using NPK fertilizer production factors was not efficient yet, so its use could still be increased. Furthermore, it is also known that the average use of ZA fertilizer by rice farmers in the study location when this study was conducted was 23.12 kg per parcel of rice field or 96.33 kg/ha. This amount of ZA fertilizer use is "not efficient yet". Therefore, the farmers in the study area can increase the use of ZA fertilizer to the optimum level, which is as much as 269.23 kg/ha (Table 3), to increase the production of their rice farming. Furthermore, in Table 3, it is also clear that the average use of NPK fertilizer used by farmers so far is 19.11 kg per parcel of land or 79.62 kg/ha. This amount is also "not efficient yet", so it is still possible for the farmers to increase the use of NPK fertilizer to the optimum amount of 145.41 kg/ha (Table 3), as an effort to increase the production of their rice farming.

Finally, in Table 3 it is also known that the ratio between the NPM of labor input and labor wages is 0.24. This figure is smaller than one, so the allocation of the number of labors are "not efficient". This finding is in line with the findings of Sukerta *et al.* (2018); Nurul C *et al.* (2018) which stated that the use of labor has exceeded the optimum or inefficient limits, so it needs to be reduced. Then, in Table 3 it is also known that the average use of labor in the study location is 23.83 HOK (mandays) per parcel of land or 99.29 HOK/ha. This amount still is "not efficient", so the farmers are advised to reduce the use of labor until it reaches the optimum level, which is 98.64 HOK/ha.

CONCLUSIONS

Based on the results of the data analysis described previously, it was concluded that the variables of land area, seed, ZA fertilizer, NPK fertilizer, regent pesticide, takeover 505 SL pesticide, DMA 6 pesticide, and labor which were tested on the FPCD Model simultaneously had a significant effect on rice production at the study site. Of the eight variables

mentioned above, there are five variables that have positive and significant effect on rice production, namely variable land area, seed, ZA fertilizer, NPK fertilizer, and labor. Meanwhile, the other three variables (regent pesticide, takeover 505 SL pesticide, and DMA 6 pesticide) had no significant effect on rice production. Then, all variables that have a positive and significant effect, their use has not reached allocative efficiency, except for the inefficient labor variable. The results of this study indicate that there is an opportunity for farmers to increase their rice production through improved management of rice farming. Farmers can increase their rice farming production through the increasing land area cultivated, application for more certified seeds, application for more ZA and NPK fertilizers. Therefore, it is recommended that the local government and agricultural extension workers assist farmers in expanding the cultivated area of rice farming, obtaining certified seeds, and procuring ZA fertilizers and NPK fertilizers on time. At the same time the use of labor needs to be reduced. Especially for agricultural extension workers in the study area, it is recommended that they provide continuous counseling to farmers about the importance of using high quality seeds, timely use of fertilizers, and appropriate doses of pesticides according to the needs of rice plants.

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