Jurnal Galung Tropika, 13 (1) April 2024, hlmn. 70 - 82 ISSN Online 2407-6279
DOI: https://doi.org/10.31850/jgt.v13i1.1166 ISSN Cetak 2302-4178

Processing Rice Land to Increase Rice Food Security in Semarang City (Location study Purwosari Village)

Pengolahan Lahan Padi Untuk Meningkatkan Ketahanan Pangan Beras di Kota Semarang (Studi lokasi Desa Purwosari)

Hendri Wibowo[*], Dewi Hastuti, Ahmad Abdul, Istanto, Rossi Prabowo, Endah Sukbekti, Shofia Nur Awami

[*)] Email korespondensi: wibowohendri9@gmail.com
Fakultas Pertanian, Universitas Wahid Hasyim, Jl. Menoreh Tengah X No. 22, Sampangan, Kec. Gajahmungkur, Kota Semarang, Jawa Tengah 50232

ABSTRACT

This research aims to understand the influence of five production factors, namely land area, urea fertilizer, NPK fertilizer, labor, and pesticides, on the amount of rice production in Purwosari Village, Semarang. The method used is a case study involving 61 rice farmers in the village. Data analysis was carried out using the Cobb-Douglas production function, production scale, and economic efficiency. The research results show that all production factors together have a very significant influence on the amount of rice production. However, when analyzed individually, only land area, urea fertilizer, and NPK fertilizer had a significant effect. Labor and pesticides did not show a significant effect on rice production. The scale of rice production in Purwosari shows an increasing trend. The economic efficiency of using production factors shows that the use of land, urea fertilizer, and NPK fertilizer has not reached optimal levels (NPM/BKM >1). On the other hand, the use of labor and pesticides is classified as inefficient (NPM/BKM <1). In conclusion, this research recommends increasing land use, urea fertilizer, and NPK fertilizer to increase rice production in Purwosari. On the other hand, the use of labor and pesticides needs to be optimized to achieve better efficiency.

Keywords: production factors; Cobb-Douglas; production scale; economic efficiency; rice production.

ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh lima faktor produksi yaitu luas lahan, pupuk urea, pupuk NPK, tenaga kerja, dan pestisida terhadap jumlah produksi padi di Desa Purwosari, Semarang. Metode yang digunakan adalah studi kasus yang melibatkan 61 orang petani padi di desa tersebut. Analisis data dilakukan dengan menggunakan fungsi produksi Cobb-Douglas, skala produksi, dan efisiensi ekonomi. Hasil penelitian menunjukkan bahwa seluruh faktor produksi secara bersama-sama mempunyai pengaruh yang sangat nyata terhadap jumlah produksi padi. Namun jika dianalisis secara individual, hanya luas lahan, pupuk urea, dan pupuk NPK yang berpengaruh nyata. Tenaga kerja dan pestisida tidak menunjukkan pengaruh yang signifikan terhadap produksi padi. Skala produksi padi di Purwosari menunjukkan tren peningkatan. Efisiensi ekonomi penggunaan faktor produksi menunjukkan penggunaan lahan, pupuk urea, dan pupuk NPK belum mencapai tingkat optimal (NPM/BKM >1). Sebaliknya penggunaan tenaga kerja dan pestisida tergolong tidak efisien (NPM/BKM <1). Kesimpulannya, penelitian ini merekomendasikan peningkatan penggunaan lahan, pupuk urea, dan pupuk NPK untuk meningkatkan produksi padi di Purwosari. Di sisi lain, penggunaan tenaga kerja dan pestisida perlu dioptimalkan untuk mencapai efisiensi yang lebih baik.

Kata kunci: faktor produksi; Cobb-Douglas; skala produksi; efisiensi ekonomi; produksi padi.

I. INTRODUCTION

Indonesia is an archipelagic country with an extensive land area, so the livelihood of most of the population is in the agricultural sector. Therefore, Indonesia is known as an agricultural country, which means a country that relies on the agricultural sector as a support for development as well as a source of livelihood for its population. Indonesia's position as an agricultural country certainly has great potential for developing agribusiness businesses in the current era of globalization. Developing the agricultural sector as the primary food sector in Indonesia is very important to Indonesia's development. It because more than 55% of Indonesia's population works and carries out activities in the agricultural sector and lives in rural areas (Notarianto, 2011).

The rice plant, or what is known in scientific language as Oryza sativa L, is a cultivated plant that is very important for humankind. Rice plants are the primary food source for almost half of the world's population. Indonesia is no exception; almost the entire population of Indonesia meets its food needs from rice plants. Thus, the rice plant is a plant that has important spiritual, cultural, economic, and political values for the Indonesian people because it affects the lives of many people. Indonesia is recorded as the country with the highest rice consumption in the world. At the Asian level, Indonesia beat four countries with the highest rice crops: Korea, Japan, Malaysia, and Thailand. The existence of this commodity as a staple food for almost all Indonesians must be maintained throughout the year (Ishaq et al., 2017).

Agricultural production factors such as land area, seeds, fertilizer, and labor can influence agricultural production. According to research by Notarianto (2011), land area is an essential means of production because land area is a medium for production. The larger the land area, the greater the production chances. Seeds play an essential role in the success of crop production. Apart from that, seeds are the first step to increasing production. Fertilizer is essential because providing appropriate and balanced fertilizer can increase production yields. Pesticides also play an essential role in influencing production levels. Until now, the use of pesticides has been considered the most effective in controlling pest and fungal attacks. Labor is essential in the production process because it carries out production. The more skilled the workforce, the more production can be.

Semarang City is the capital of Central Java Province, Indonesia. This city is also the fifth-largest metropolitan area in Indonesia after Jakarta, Surabaya, Bandung, and Medan. As one of the most developed cities on the island of Java, Semarang City has a population of around 1.7 million people. Semarang City also produces rice, with the total harvested area in hectares being 4,207.74 in 2019 and experiencing a decrease in 2020 amounting to 4,165.43. This number is small compared to other areas in Central Java Province, such as Grobogan, Sragen, and Blora Regencies, which have the highest yearly harvests. (BPS, 2020).

Based on the background, the formulation of the problem in this research is whether the production factors of land area, urea fertilizer, NPK fertilizer, labor, and pesticides affect the amount of rice production; what is the level of production based on the production scale; and what is the economic efficiency of using production factors.

II. RESEARCH METHODS

1. Basic Method

The case study method is used in this research. A case study (case study) is a method of exploring a particular case in more depth by collecting various sources of information. According to Bhaskara (2017), a case study is considered an empirical methodology suitable for conducting research related to community participation because it uses various research methods, starting from interviews, observations, and secondary data collection.

The location of the research to be carried out is in Purwosari Village, Mijen District, Semarang City. It was centered on 4 Farmer Groups in Purwosari Village, namely the Lohjinawi Farmer Group in RW 01, the Mbangun Karso Farmer Group in RW 02, the Sumber Rejeki Farmer Group in RW 03, and the Guyub Rukun Farmer Group in RW 05.

2. Sampling Method

According to Purwosari Village Monograph data, the number of farmers cultivating lowland rice in Purwosari Village is 153 farmers. Sampling in this study used the Slovin technique because in sampling, the number must berepresentative so that research results can be generalized and calculations do not require a table of sample sizes but can be done using simple Formula 1 (Soekartawi, 2016).

$$n = \frac{153}{1+153(0,1)^2} = \frac{153}{2,53} = 60,474 \text{ ---------- (1)}$$

Based on the calculations above, the respondents in this study were 61 lowland rice farmers in Purwosari Village, Mijen District, Semarang City. Next, determining who the samples will be taken as respondents is done using the methodpurpossive sampling. Methodpurpossive sampling is a method of selecting a group of subjects based on certain characteristics and characteristics which are considered to be closely related to previously known characteristics or properties of the population (Soekartawi, 2016). Respondents were determined based on the following characteristics:

(1). The respondents taken were residents who owned and cultivated rice fields in Purwosari Village, either with ownership or rental status.
(2). The respondents taken were residents of Purwosari Village who have large areas of land.
(3). The respondents who were taken are the residents of Purwosari Village who are members of the Farmer Group with the provisions of the Lohjinawi Farmer Group RW.01 as many as 14 respondents, the Mbangun Karso Farmer Group RW.02 as many as 14 respondents, the Sumber Rejeki Farmer Group RW.03 as many as 17 respondents, and the Guyub Farmer Group Pillar RW.05 as many as 16 respondents, with a total of 61 respondents.

3. Data Collection Method

Data collection in quantitative research is by means of interviews, recording, questionnaires and observation. An interview is a conversation process in the form of face-to- face questions and answers assisted by a questionnaire. Recording is collecting data in the form of information originating from relevant and trustworthy sources by recording and documenting it.

4. Analysis Method

The analysis used to determine the functional relationship between production factors, in this case land area, urea fertilizer, NPK fertilizer, labor and pesticides and the amount of rice production, is multiple linear regression analysis with the Cobb-Douglas production function model. The function equation can be written as follows Formula 2. Where: AND = Rice crop production (kg), B_0 = Constant, $b_1...b_5$ = Koefisien gas variable, X_1 = land area (m^2), X_2 = urea fertilizer (kg), X_3 = NPK fertilizer (kg), X_4 = workforce (HOK), and X_5 = pesticide (ml).

$$Ln\ Y = b_0 + b_1 LnX_1 + b_2 LnX_2 + b_3 LnX_3 + b_4 LnX_4 + b_5 LnX_5 \quad \text{---------- (2)}$$

5. Statistic Test

a. Determination Coefficient Test (R^2)

Test of the coefficient of determination (R^2) basically measures how far the model's ability to explain the variance of the dependent dependent variable. Coefficient of determination test (R^2) is carried out to test how much influence the independent variables together have on the dependent variable.

b. F-Statistics Test

The F test basically shows whether the estimated regression model is feasible or not and tests whether all the independent variables included in the model together have a significant effect on the dependent variable. If valueprob. F count (SPSS output is shown in columnsay) is smaller than the error rate of 0.05, it can be said that the estimated regression model is feasible, while if the valueprob. The calculated F is greater than the error rate of 0.05, so it can be said that the estimated regression model is not feasible.

c. T-Statistics Test

The t statistical test is basically how far the influence of one explanatory variable individually influences the dependent variable. Whether an independent variable is a significant or insignificant explanation of the dependent variable. The hypothesis for the t-test is:

(1). H0 : $b_1 \ldots b_n = 0$, meaning that individually each independent variable consisting of land area, urea fertilizer, NPK fertilizer, labor, and pesticides has no influence on the dependent variable, namely the amount of rice production.

(2). H1 : $b_1 \ldots b_n > 1$, meaning that individually each independent variable consisting of land area, urea fertilizer, NPK fertilizer, labor and pesticides has a significant effect on the dependent variable, namely the amount of rice production.

6. Analisis Return to Scale (RTS)

Returns to scale analysis is a characteristic of production that shows the relationship between the comparison of changes in all inputs and the resulting changes in output, to find out whether the activities of a business under study are in good condition. incresing, decreasing, orconstant return to scale (Sinabang et al., 2021). According to Soekartawi (2003), the production scale can be determined by adding up the elasticity coefficients of each production factor. So there are three possibilities, namely:

(1). If $\beta_1+\beta_2+b_3+b_4+b_5 <1$ then it happensdecreasing return to scale, this means that adding production factors in the production process will cause an additional decrease in output.
(2). If $\beta_1+\beta_2+b_3+b_4+b_5 >1$ then it happensincreasing return to scale, this means that additional production factors will increase additional production output.
(3). If $\beta_1+\beta_2+b_3+b_4+b_5 = 1$ then it happensconstant return to scale, this means that the increase in production factors is proportional to the increase in production output.

7. Economic Efficiency Analysis

This analysis is used to answer the third hypothesis. According to Soekartawi (2003), economic efficiency occurs when the marginal product value of each additional unit of input is equal to the price of each unit of input which can be written as follows as Formula 3. She = regression coefficient or production, elasticity He = product unit price, Hx = factor input price, AND = product or output, Xi = factor input, NPM = value of marginal product, BKM = marginal cost of sacrifice

$$\frac{PMxPP}{BKMxPP} = 1\frac{she\frac{ana}{xP1P}.He}{Heh1} \quad \text{---------- (3)}$$

When $\frac{NPMxNN}{BKMxNN}$ >1, then economically the use of production factors is not yet efficient, in the sense that the use of production factors can still be increased.

When$\frac{NPMxNN}{BKMxNN}$ = 1, then economically the use of production factors is efficient.

When$\frac{NPMxNN}{BKMxNN}$ <1, then economically the use of production factors is inefficient, in the sense that the use of production factors is excessive.

III. RESULTS AND DISCUSSION

1. General Description

Purwosari Village is an area located in North Semarang District, Semarang City, Central Java Province. This area has a land area of 48,049 Ha and was formed and inaugurated in 1993. Purwosari Village is one of 14 sub-districts in Mijen District. (BPS, 2020). The administrative area boundaries of Purwosari Village where north is Kuningan Village, South is Pandansari Village, West is Plombokan Village, and East is Dadapsari Village.

2. General Description

The characteristics of respondents be seen in the Table 1. Table 1 showed that the majority of rice farmer respondents are in the age range 51-59 years, namely 26 farmers with a percentage of 43%. It is considered that the productive age of farmers in Purwosari Village is 51 to 59 years old. The explanation regarding the different age range groupings is proof that the various age ranges of the population in Purwosari Village make their living as farmers. Susanti et al (2016) explained that farmers aged 30 – 59 years have the physical potential to support farming activities, are dynamic, creative and quick to accept new technological innovations. Farmers aged over 59 years have an advantage in terms of experience. The population in Purwosari Village has different ages from one farmer to

another. The difference in age of each farmer can influence their mindset and performance in farming.

Table 1. Respondent's characteristics of the farmers.

Indicator	Respondents	Presentase (%)
Age (Years)		
40-49	17	28
50-59	26	14
60-69	14	23
70-79	4	7
Total	61	100
Length of Farming (Years)		
1 – 10	8	13
10 – 20	15	25
20 – 30	17	28
30 – 40	9	15
>40	12	20
Total	61	100
Land Area (m^2)		
<3000	12	20
3000 - <5000	19	31
5000 - <7000	15	25
7000 - <9000	7	11
≥9000	8	13
Total	61	100

Based on the Table 1, the grouping of respondents based on years of farming, the majority fall into 3 groups, namely in the 10 - 20 year range, namely 15 respondents with a percentage of 25%, in the 20 - 30 year range, namely 17 respondents with a percentage of 28%, and in the range >40 years namely 12 respondents with a percentage of 12%. Based on this grouping, farmers in Purwosari Village have been involved in farming for a long time. Each respondent's reasons for maintaining their farming business are different, but most argue that farming is their main job. It was showed that the longer the experience gained in farming, the better the understanding in lowland rice cultivation, while the experience of new farmers is also the same as farmers who have gained experience, this is possible that the area is still at the stage of reviving enthusiasm for lowland rice farming (Wahyu, 2017).

Table 1 also showed that most respondents have a land area of around 3000 - <5000m^2, namely 19 respondents or a percentage of 31%. Farmers fill out a questionnaire regarding land area based on the farmer's personal understanding by comparing the land area of other farmers around him. Farmers use monthly numbers to estimate the area of land they own. According to Wahyu (2017), the more land that is utilized, the more production will be produced. According to Susanti et al (2016).

3. Use of Production Inputs in Rice Farming

Production inputs for land area, urea fertilizer, NPK fertilizer, labor and pesticides are

usually used in running a farming business, which in this case is rice farming carried out by farmers in Purwosari Village, Mijen District, Semarang City (Table 2). Optimal use of inputs will provide maximum production for farmers. Before analyzing the relationship between the influence of the use of production inputs on rice farming, the following presents the conditions for the use of production inputs in Purwosari Village.

Table 2. Average inputs in peas production per planting season processing rice land in Purwosari Village.

Production Factors	Per Farmer	Per Hectare
Urea Fertilizer (kg)	149,75	321,9
NPK Fertilizer (kg)	26,69	54,7
Workforce (HOK)	23,73	46,5
Pesticide (ml)	723,28	1621,1
Production Amount(kg)	2885,73	5452,17

The average land area used for rice farming in Purwosari Village is 0.51 Ha. Meanwhile, the average use of urea fertilizer is 149.75 kg or equivalent to 321.9 kg in hectares, the average use of NPK fertilizer is 26.69 kg or equivalent to 54.7 in hectares, the average use of labor is 23.73 HOK or equivalent to 46.5 HOK in hectares, and the average use of pesticides is 723.28 ml or equivalent to 1621.1 ml in hectares.

Providing fertilizer is very important for farmers in Purwosari Village, Mijen District, Semarang City because providing sufficient fertilizer and the appropriate dosage can fertilize the growth of rice plants, this is also supported by good rice field conditions which are free from other factors. which influences it. How to fertilize rice is one of the keys to getting optimal harvest results. At certain age stages, rice requires special nutrition. When it is still young (0-2 weeks) it is given NPK fertilizer and after the rice is 21 DAT it can be given urea fertilizer and after 42 HST it can be given urea and fertilizer according to the farmer's needs. Farmers in Purwosari Village also add a lot of manure to their fields as organic input. This manure is obtained by buying it or by using cow dung raised by several farmers.

4. Multiple Regression Analysis and Cobb-Douglas

The production function describes the relationship between the level of output and the level of use of the inputs used in the production process. According to Karmini (2018), exponential production functions can differ from each other depending on the characteristics of the data used. The exponential production function is usually called the Cobb-Douglas function. The Cobb-Douglass function is a function or equation that involves two or more variables. One variable is called the dependent variable, which explains (y) and the other is called the independent variable, which explains (x). Data analysis was carried out to determine the magnitude of the influence of production factors (variable x) on the amount of production (variable y) produced (Hidayah, 2012). In this research, the Cobb-Douglas production function was used to analyze the data. The Cobb-Douglas production function analysis was carried out using the multiple linear regression method. Regression using SPSS. The SPSS output shows that it is free from disease. Followed by statistical tests.

5. Adjusted Determinant Coefficient Test (R^2) and F Test

Based on the table above, the R value is obtained^2 is 0.914 (Table 3), meaning that the data shows that the total percentage variation in variable Y (production results) explained by variable X (land area, urea fertilizer, NPK fertilizer, labor, and pesticides) is simultaneously 91.4%, while 8.6 % explained by other variables outside the model. The simultaneous test was carried out by comparing the F-count value with the F-table value, the F-count value obtained was 117.559 (Table 4) while the F-table value obtained was 2.38. Based on the results above, it is obtained that 117.559 >2.38 or F-count >F-table, so that H0 is accepted and H1 is rejected, which means that the production factors of land area, urea fertilizer, NPK fertilizer, labor and pesticides simultaneously have a significant effect on production results. The F test can also be carried out by looking at the significance table in Table 4. The significant value of F is 0.000, indicating that at the confidence level $\alpha = 0.05$, the significant value of F is 0.000, which is smaller than 0.05, which means that simultaneously all variables have a significant influence on production result.

Table 3. Coefficient of Determination Table (R^2) processing rice land in Purwosari Village.

Model	R	R Square	Adjusted R Square	Durbin- Watson
1	0,956	0,914	0,907	1,832

Table 4. Anova table calculated F Values processing rice land in Purwosari Village.

Model	Sum ofsquares	df	Mean square	F	Say
Regression	18,374	5	3,675	117,559	0,000
Residual	1,719	55	,031		
Total	20,093	60			

Based on the table above, the probability value of land area X_1 is 0.000 <0.01 (α), it can be concluded that land area has a very significant effect on the amount of rice production (Table 5). The probability value for urea fertilizer is 0.020 <0.05 (α) and NPK fertilizer is 0.011 <0.05 (α), so it can be concluded that urea fertilizer and NPK fertilizer have a significant effect on the amount of rice production. The probability value for labor is 0.560 >0.05 (α) and pesticides is 0.238 >0.05 (α), so it can be concluded that labor and pesticides have an insignificant effect on the amount of rice production. The land area variable has a very significant effect because on average Purwosari Village rice farmers have large areas of land so that rice productivity can reach maximum.

The elasticity of land area (X_1) is 0.534, the elasticity of urea fertilizer (X_2) is 0.348, the elasticity of NPK fertilizer (X_3) is 0.362, the elasticity of labor (X_4) is 0.034, and the elasticity of pesticides (X_5) is -0.012 (Table 6). These results show that the elasticity for each input variable is <1 (smaller than one), which means that the variables of land area, urea fertilizer, NPK fertilizer, labor and pesticides are inelastic. If X_1 increases by 10% then Y (the amount of rice production) will increase by 5.43%. Other things being equal, X_2 increases by 10% then Y will increase by 3.48%. Other things being equal, X_3 increases by 10% then Y will increase by 3.62%. Other things being equal, X_4 and X_5.

Table 5. T Test results at 5% significance level processing rice land in Purwosari Village.

Variable	T-count	T-table	Prob. themselves	a	Conclusion
Ln_X1	4,981	2,004	0,000	0,01	Very significant
Ln_X2	2,124	2,004	0,020	0,05	Significant
Ln_X3	3,029	2,004	0,011	0,05	significant
Ln_X4	0,353	2,004	0,560	0,05	Not significant
Ln_X5	-0,133	2,004	0,238	0,05	Not significant

Table 6. Level of production scale on results processing rice in Purwosari Village.

Coefficient	Elasticity of Production Factors
b1	0,543
b2	0,348
b3	0,362
b4	0,034
b5	-0,012
Amount	1,276
Conclusion	*Increasing Return to Scale*

6. Return to Scale (RTS)

According to Soekartawi (2003), return to scale (RTS) needs to be known to determine whether the activities of a business being studied follow the rules of increasing, constant, or decreasing return to scale. Return to scale (RTS) or production scale can be found by adding up the elasticity coefficients of each production factor. The sum of all the respective coefficients shows more than 1, so the rice production yield scale is included increasing the return to scale. This means that every additional factor of production will produce additional production output whose proportion increases, if there is an increase in inputs X1 (land area), X2 (urea fertilizer), X3 (NPK fertilizer), % Other things being equal.

7. Economic Efficiency Analysis

Efficiency is defined as an effort to use as little input as possible to obtain the greatest production. Such a situation will occur if farmers are able to try if the marginal product value (NPM) for an input is the same as the input price (BKMxi) (Soekartawi, 2003). The level of economic efficiency in the use of rice farming production factors showed in Table 7.

The NPMxi/BKM value for the land area production factor is 21.07, which means more than 1. So it can be concluded that the land area production factor is not yet efficient, so to increase rice production this variable needs to be increased. According to Respikasari (2014), land area will determine the scale of the business which ultimately affects efficiency. Therefore, in order to increase production and achieve economic efficiency, farmers need to expand the land used in rice farming or maximize the productivity of land use that farmers already own. Meanwhile, according to research by Giamerti and Yursak (2013) on various types of Jajar Legowo planting systems, it is stated that the 2:1 Jajar Legowo planting system can produce higher productivity (6.5 tonnes/ha) than the 4:1 Jajar Legowo planting system (5 .57 tons/ha) and tile system (5.09 tons/ha). This research is also in line with research by Megasari et al (2021) which states that the Jajar Legowo 2:1 planting system produces higher

production (6.1 tonnes/ha) compared to the Jajar Legowo 3:1 planting system (5.3 tonnes/ha) and 4:1 (5.7 tons/ha). The research also stated that the 2:1 jajar legowo system made the average plant height higher than other jajar legowo systems, besides that the number of seedlings from the 2:1 jajar legowo system was greater than in other jajar legowo systems.

Table 7. Calculation of PM, NPM, BKM, and NPM/BKM processing rice in Purwosari Village.

Production Factors	Xi	Y/Xi	PM	NPM	BKM	NPM/BKM
Land	0,5	10329,76	5619,39	28096954,49	1333333,33	21,07
Urea Fertilizer	321,9	16,94	5,89	29471,97	2300,00	12,81
NPK Fertilizer	54,7	99,64	36,07	180346,46	3400,00	53,04
Labor	46,5	117,37	3,99	19952,99	120000,00	0,17
Pesticide	1621,1	3,36	-0,04	-201,80	145,00	-1,39

Therefore, it is necessary to modify plant spacing to enable increased efficiency of sunlight interception which affects photosynthesis performance. The ratio of plant spacing can be reduced to 2:1 so that there are more empty aisles which allow sunlight to be evenly distributed throughout the plant clump, thereby influencing the photosynthesis process which results in increased rice productivity. According to research by Novitaningrum et al (2020), the size of the plant population will affect production results, too many plant populations will cause competition between plants and production results will not be optimal. Apart from that, farmers need to strive for agricultural intensification to increase their rice production, namely with five farming efforts which include the use of superior seeds, irrigation, the right type of fertilizer, dose, time, and method. These results are in line with previous research, namely Suzana et al (2011), Andryani (2021), Parlindungan (2019), and Kaban (2012) which stated that the land area variable is not yet economically efficient, so additional production factors are needed. land area.

The NPMxi/BKM value for the urea fertilizer production factor is 12.81, which means more than 1. So it can be concluded that the urea fertilizer production factor is not efficient. The average use of urea fertilizer from respondent farmers is 320 kg/ha, while the recommendation for use of urea fertilizer from the Semarang City Agriculture Service is 250 kg/ha. According to Respikasari's research (2014), the average use of urea fertilizer production factors in the research area is 280 kg/ha and is at an efficient level with the NPM/BKM calculation being 1. So based on previous research, a suggestion can be drawn, namely farmers in the sub-district Purwosari needs to recalculate the need for NPK fertilizer on their land, then reduce the amount of fertilizer dose used and follow government recommendations.

The NPMxi/BKM value for the NPK fertilizer production factor is 53.04, which means more than 1. So it can be concluded that the NPK fertilizer production factor is not efficient. The average use of NPK fertilizer from respondent farmers is 55 kg/ha, while the recommendation for use of NPK fertilizer from the Semarang City Agriculture Service is 75 kg/ha. Fertilizer use is less than recommended because the average respondent farmer buys NPK fertilizer based on the capital they have. If they feel they have enough capital, they will

buy NPK fertilizer according to the recommendation or minimum recommendation, but if capital is low then they can only buy as much NPK fertilizer as they can afford.

The ideal and efficient use of NPK fertilizer will have a positive effect on rice plants. According to research by Paiman and Ardianto (2019), applying NPK fertilizer can increase the growth and yield of rice plants, namely the number of tillers, leaf area, crown dry weight, root dry weight, stover dry weight, grain dry weight, and harvest index. These results are in line with previous research, namely Hartono et al (2018) and Maharani (2019) which stated that the NPK fertilizer variable is not yet efficient, so the NPK fertilizer variable can still be added to achieve efficiency. The NPMxi/BKM value for the labor production factor is 0.17, which means less than 1. So it can be concluded that the labor production factor is inefficient. So to achieve economic efficiency, the labor production factor is excessive and needs to be reduced. Farmers need to streamline the number of HOK from the use of labor by reducing the number of HOK. /The average use of labor in Purwosari Subdistrict is 46.5 HOK/ha, whereas in previous research by Sugiarti (2017) the average use of labor for respondent farmers in the research area was 31.16 HOK and was at an efficient level with results The NPM/BKM calculation is 0.94 or close to 1. Based on previous research, a suggestion can be drawn, namely that farmers in Purwosari Village need to reduce the number of HOK workers in rice farming to achieve efficiency.

Reducing the number of HOK can be done with the help of agricultural machinery which can speed up farmers' work time so that the number of HOK can be reduced. One example of agricultural machinery commonly used by the public is a tractor. Using a tractor will save labor and even the time required to cultivate the land will be shorter. According to research by Adi Suyatno et al (2018), even though it causes an increase in costs as a result of the substitution of human labor by tractors, the use of tractor machinery can save labor use and speed up land processing activities and increase the productivity of rice farming. These results are in line with previous research, namely Anwar (2021) and Maharani (2019) which stated that the labor variable is inefficient, meaning that the variable is excessive, so it needs to be reduced to achieve efficiency.

The NPMxi/BKM value for the pesticide production factor is -1.39, which means less than 1. So it can be concluded that the pesticide production factor is inefficient. So to achieve economic efficiency, pesticide production factors need to be reduced. According to Sholeh et al (2019), the use of pesticides aims to eradicate pests and diseases of rice plants which will reduce plant productivity. The more often the control is carried out using pesticides, the more the decline in rice production will be minimized. The average use of pesticides by respondent farmers is 1,621 ml/ha, while the recommendation for pesticide use given by the Semarang City Agriculture Service is 1,500 ml/ha, which means that pesticide use in Purwosari Village is slightly excess of the recommended dose.

On average, the pesticides used by farmers are pesticides for pests that often attack rice leaves, such as planthoppers, armyworms, grasshoppers, gasir, worms, etc. But in the last two planting periods, farmers in Purwosari Village have been worried about rats attacking their rice plants. The rat pest is worrying the respondent farmers in Purwosari Village because it reduces rice production. The community has also implemented rat pest management, namely providing rat poison in every rat hole in the rice fields. These results

are also in line with previous research, namely Anwar (2021) and Hartono et al (2018) which stated that the pesticide variable is inefficient, meaning that the variable is excessive, so its use needs to be reduced to achieve efficiency.

IV. CONCLUSIONS

Production factors in the form of land area, urea fertilizer, NPK fertilizer, labor, and pesticides, together have a significant influence on rice farming production. Production factors in the form of land area, urea fertilizer and NPK fertilizer partially have a significant effect on rice farming production. Meanwhile, other production factors in the form of labor and pesticides, partially have an insignificant effect on rice farming production. The production scale obtained shows that rice farming is on an increasing return to scale scale, that is, every time an additional production factor occurs, additional production results will increase.

Suggestion From the research that has been carried out, several suggestions can be put forward as follows: Rice farming farmers in Purwosari Village need to re-measure the labor requirements needed and adjust them to the area of land being worked on. When using pesticides, rice farmers in Purwosari Village should be guided by the recommendations set by the relevant agencies, so that their use is not too little or too much. Rice farming farmers in Purwosari Village need to coordinate again well between fellow farmers, agricultural extension workers and the government so that the increasing production scale can be maintained and happen again in future rice production.

V. REFERENCES

Andryani, R. (2021). Analysis of the Efficiency of Using Production Factors in Rice Farming (Case Study of Setrak, Teluk Mengkudu District, Serdang Bedagai Regency). In *Scholar*.Muhammadiyah University of North Sumatra.

Anggraini, F., Suryanto, A., Aini, N. (2017). Planting System and Age of Seedlings in Lowland Rice Plants (*Oryza sativa* L.) Inpari 13 Variety. *Over the Rim, 1*(2), 191–199.

Anwar, M. T. (2021). *Analysis of Rice Production Efficiency in Lengayang Nagari Kambang Timur District, Pesisir Selatan Regency, West Sumatra Province*. University of Northern Sumatra.

Bhaskara, G. I. (2017). *Use of Case Study Methodology; Philosophy, Methodology and Methods*. Udayana University.

BPS. (2020). *Harvest Area and Rice Production*. Central Java Province BPS.

Giamerti, Y., & Yursak, Z. (2013). Performance of Yield Components and Productivity of RiceInpari 13 Varieties in Various Planting Systems Yield Component Performance and Productivity of Rice Inpari 13 Varieties in Various Planting Systems.*Widyariset, 16*(3), 481–488.

Hartono, R., Aritonang, M., Hutajulu, J. P. (2018). Efficiency Analysis of Rainfed Rice Farming Production Factors in Bukit Batu Village, Sungai Kunyit District, Mempawah Regency. *Agricultural Student Science Journal, 7* (3).

Hidayah, A. N. (2012). Analysis of the Cobb Douglas Production Function using the Gauss Newton Iteration Method. In*Journal of Chemical Information and Modeling* Vol. 53, Issue 9. University of Jember.

Ishaq, M., Rumianti, A. T.,1Permatasari, E. O. (2017). Analysis of Factors Affecting Rice Production in East Java Province Using Semiparametric Spline Regression. *ITS Science and Art Journal*, *6*, 101–107.

Kaban, F. T. (2012). *Analysis of the Efficiency of Using Production Factors in Rice Farming in Sei Belutu Village, Sei Bamban District, Serdang Bedagai Regency*. University of Northern Sumatra.

Karmini. (2018). *Economics of Agricultural Production*. (Thesis) Mulawarman University.

Maharani, A. D. (2019). Analysis of the Economic Efficiency of Using Production Factors in Rice Farming in the Sidomakmur I Farmer Group, Pati District, Pati Regency. *Agrisaintifika: Journal of Agricultural Sciences*, *3*(1), 18.

Manyamsari, I., & Mujiburrahmad, M. (2014). Karakteristik Petani Dan Hubungannya Dengan Kompetensi Petani Lahan Sempit (Kasus: Di Desa Sinar Sari Kecamatan Dramaga Kab. Bogor Jawa Barat). *Jurnal Agrisep*, *15*(2), 58-74.