Efficiency of Production Factors and Constraints of Organic Rice Farming at Rainfed Rice

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Abstract. This study aims to determine the efficiency of the use of production factors and the constraints of organic rice farmers in rainfed rice (whose irrigation depends only on rain). The research method used was a case study with 45 farmers as respondents. The level of efficiency of the use of production factors is calculated using Cobb Douglas method and the constraints in the implementation of organic rice farming are analyzed in a descriptive manner. The results showed: 1) Simultaneously, the factors of production used had a very significant influence on organic rice production. Partially, land production factors have a positive and very significant effect, while the factors of production of biological fertilizers and vegetable pesticides have a significant effect on organic rice production. Biological fertilizers are negative while plant-based pesticides are positive. Factors of production that do not significantly affect organic rice production are seeds, organic fertilizer, compound fertilizer, and labor. 2) Factors of land production and vegetable pesticides have not been efficient. While the factors of seed production, organic fertilizer / manure, liquid organic fertilizer, compound fertilizer, and inefficient labor production factors. 3) The major obstacle in the application of organic rice farming in the rainfed rice is the provision of production facilities, with a percentage of 37.80 percent, followed by the role of supporting institutions 34.52 percent.

1. Introduction
One of the agricultural products traded on the international market is rice. Even though until now Indonesia has been a rice importer, this does not mean that it has closed the possibility of Indonesia becoming an rice exporter. Indonesia is able to export rice specifically, namely high-quality, flavorful and distinctive rice, and organic rice. One of the requirements in exporting rice, through Minister of Trade Regulation No.19 / M-DAG / PER / 3/2014, is that rice must be produced through an organic farming system with a damage rate of less than 25%. Organic rice is used as a commodity to maintain sustainable agriculture without damaging the environment or natural biota. The organic rice market is increasing 5 percent per year, up to 11 billion sales in 2013. This increase is due to world market demand for organic agriculture. Global organic trade reached USD $ 72 billion in 2013 (IFOAM 2015). Demand was there and Indonesia faced previous export competitors, namely Thailand and Vietnam. The two countries are the highest exporting countries for organice rice (IFOAM 2015).

Organic rice in Indonesia has competitive advantages and comparative advantages. This is consistent with the results of research by Anita Suharyati, Slamet Hartono and Lestari Rahayu Waluyati (2016) which shows that organic rice farming in Karanganyar Regency has a competitive and comparative advantage that is with a PCR and DRC value of less than one. The competitive advantage of organic rice in Karanganyar Regency is greater than its comparative advantage.
of the PCR and DRC coefficients were 0.74 and 0.56, respectively. Thus, organic rice farming in Karanganyar Regency is feasible to be developed and has good competitiveness in the domestic and international markets. Furthermore, the development of organic rice in West Java, specifically Sukaraja Regency, Tasikmalaya Regency.

According to information from BP3K Sukaraja Regency (2017), an increase in production occurred due to the formation of several organic farmer groups and one of them is the support of innovation using rainfed rice. Utilization of rainfed rice fields automatically increases harvested area, which in turn can increase organic rice production. The success of organic farmer groups in Sukaraja Regency can be seen from the quite high productivity of 7.26 tons / ha producing 185 tons of organic rice. With high productivity, it can spur more intensive farmer groups to implement organic rice planting systems. Organic rice farming is spread in 3 villages in several farmer groups. Farmer groups that implement organic rice planting systems in Sukaraja can be seen in Table 1.

| No | Village Name | Group Name   | Land Area (Ha) |
|----|--------------|--------------|----------------|
| 1  | Leuwibudah   | KaryaTani    | 6              |
| 2  | Tarunajaya   | Balukbuk     | 4              |
| 3  | Linggaraja   | Putra Mandiri| 20             |
|    | Amount       |              | 30             |

Source: BP3K, Sukaraja District 2018

Table 1 shows the 3 groups of organic rice farmers (KaryaTani, Balukbuk, Putra Mandiri) in 3 villages (Leuwibudah, Tarunajaya, Linggaraja) differing in area of 6, 4, and 20 Ha, respectively. Based on the latest information that in Sukaraja District, the development of organic rice has been carried out in rain-fed rice fields with a planting area of 11.25 hectares spread across 3 villages (BP3K Sukaraja, 2017).

Rainfed rice are rice fields that have water sources that are dependent on or come from rainfall without permanent irrigation structures. Rice harvest production in rainfed rice fields is usually higher than in dry land (gogo), because rain water can be utilized better (accommodated in rice fields). Rainfed lowland rice fields are generally infertile (poor nutrition), often experiencing drought, and farmers do not have enough capital, so this agroecosystem is also known as a resource-poor area (Pirngadi and Mahkarim, 2006).

The purpose of this study was to determine 1) The effect of the use of production factors on the production of organic rice in the rainfed rice fields of Sukaraja District and Tasikmalaya District. 2) Efficient use of production factors in organic rice farming in lowland rainfed rice fields Sukaraja District, Tasikmalaya Regency and 3) Obstacles or problems in the application of organic rice farming in rainfed rice fields Sukaraja District, Tasikmalaya Regency.

2. Research Method

2.1. Method and Research Site
The research method used in this research is a case study, by selecting the case of organic rice farmers who do farming in rainfed rice in Sukaraja Regency, Tasikmalaya Regency. According to Nazir (2011) a case study is an in-depth study of certain characteristics of a research object which aims to provide a detailed description of the background characteristics and characteristics of the case under study. Operational definitions can be made in the form of measured operational definitions, or experimental operational definitions.

| Variabel         | Sub Variabel | Indikator          | SkalaUkur | Satuan |
|------------------|--------------|--------------------|-----------|--------|
| FaktorProduksi   | Land area    | 1. Status of land ownership | Ratio     | Hectare |
Area of land used

1. Varieties used
2. The volume used

Seed

Organic Fertilizer
1. Types of Organic Fertilizers
2. The volume used

Vegetative Pestiside
1. Type of vegetable pesticides
2. Volume used

labor
1. Type of labor
2. The volume used

Pendapatan
Receipts-Cost
1. Total Production
2. Selling Price
3. Fixed costs
4. Variable costs

Ratio
Kilogram
Ratio
Kilogram
Ratio
Kilogram/liter
Ratio
HKSP
Ratio
Rupiah

2.2. Sampling Technique
The sample in this study was organic rice farmers in rainfed rice lowland areas Sukaraja District, Tasikmalaya Regency in the period of planting season in October 2018 - January 2019. Sampling was carried out using the census method, which was spread in Leuwibudah, Tarunajaya and Linggaraja Villages, Sukaraja District, Tasikmalaya District with 42 participants.

2.3. Data Analysis Design
In the problem formulation regarding the effect of production factors on production, the Cob-Douglas production function is used. Analysis of the Cobb-Douglas production function is used to determine the effect of the use of production factors. Analysis of the Cobb-Douglas function is formulated as:

\[ Y = aX_1^{b_1} X_2^{b_2} \ldots X_i^{b_i} \ldots X_n^{b_n} e^u \]

To facilitate the estimation, it is stated by changing the form of multiple linear after logifying following equations

\[ \log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + \ldots + b_i \log X_i + \log u \]

where \( Y \) is Bound Variable / Yield of Organic Rice Production, \( X_1, X_2, X_i \) are Independent Variables / factors of production, \( u \) is error, \( e \) is natural logarithm (\( e = 2.718 \)), and \( a,b \) are Amount to be expected (\( a = \text{intercept} \), \( b = \text{production elasticity} \)). After the coefficient regression is obtained, then the F test is performed to determine the relationship between the independent variables \( (X_1, X_2 \ldots \ldots X_i) \) together against the dependent variable \( Y \). Furthermore, \( t \) test to determine the relationship of each variable is not free. The elasticity of the use of production factors is known from the magnitude of the \( b_i \) value.

Efficiency in the use of production factors is analyzed using price efficiency. The allocation of input is said to be efficient if the value of marginal input product (\( \text{NPMx}_i \)) is equal to the price of input \( (\text{Pxi}) \) which means that the allocation of production factors has reached an optimal or efficient point. It also shows that the comparison between the value of marginal products with the input prices at the combination point is equal to one. (Soekartawi, 2002) The formula for calculating price efficiency based on the use of the Cobb-Douglas production function technique is:

\[ \frac{\text{NPMx}_i}{\text{Pxi}} = 1 \]

where \( b_i \) is production elasticity, \( Y \) is output, \( X \) is input, \( \text{Py} \) is output price, \( \text{Pxi} \) is input price. With the calculation criteria, then:
1) \( \text{NPMx}_i / \text{Pxi} = 1 \), efficient use of production factors
2) \( \text{NPMx}_i / \text{Pxi} > 1 \), the use of production factors has not been efficient
3) \( \text{NPMx}_i / \text{Pxi} < 1 \), inefficient use of production factors

Meanwhile, to find out the obstacles faced by farmers in carrying out organic rice farming in rain-fed rice fields discussed descriptively.
3. Finding and Discussion

3.1. Effect of Use of Production Factors on Organic Rice Farming in Rain-Filled Rice Fields

Analysis in the activities of organic rice production in rainfed lowland is carried out by calculating the level of input used to the level of production obtained. The analysis used is the analysis of the Cobb-Douglas production function. Factors that are thought to influence the organic rice farming in rainfed lowland areas are land area (X1), seeds (X2), organic fertilizer / manure (X3), biological fertilizer (X4) liquid organic fertilizer (X5), compound fertilizer (X6), vegetable pesticides (X7) and labor (X8). These factors are the main inputs used in rice farming. The results of the estimation of the organic rice production function model in the rainfed lowland can be seen as follows:

\[ \text{Ln } Y = 3.164 + 0.818 \text{Ln } X_1 + 0.003 \text{Ln } X_2 + 0.156 \text{Ln } X_4 + 0.028 \text{Ln } X_5 + 0.05 \text{Ln } X_6 + 0.002 \text{Ln } X_7 - 0.007 \text{Ln } X_8 \]

Simultaneously, the use of production factors was analyzed using the F Test which can be seen in the Anova table as shown in Table 3:

| Model        | Sum of Squares | Df | Mean Square | F      | Sig.   |
|--------------|----------------|----|-------------|--------|--------|
| Regression   | 1.747          | 8  | .218        | 8674.846 | .000   |
| Residual     | .001           | 33 | .000        |        |        |
| Total        | 1.748          | 41 |             |        |        |

Table 3 shows the F-calculated value of 8674.846 while the F-table value (df = 8; 41) at the real level of 1 percent is 2.421. A significant value of 0.000 is smaller than alpha 0.010, so it can be concluded that the variable land area is partially very significant (highly significant) on production in organic rice farming in the rainfed rice. A positive effect is indicated by a positive sign on the coefficient of elasticity. The elasticity coefficient value of 1.002 means that every 1 percent increase in land area will increase production yields in the implementation of the Soybean SL-
PTT Development Program in paddy fields by 1.002 percent under ceteris paribus conditions. The value of the coefficient of land area shows the greatest coefficient, this also shows that the area of land is the most influential production factor in organic rice farming in the rainfed rice fields. This is consistent with the opinion of Rahim Abd and Hastuti D.R.D (2002), which states that agricultural land is a determinant of the influence of agricultural production factors. In general, it can be said that the greater the area of land (which is cultivated / planted), the greater the amount of production produced by the land.

3.1.2. **Seed.** Partial analysis using the t-test obtained the value of t-seed count of -0.197 which is smaller than t-table at 5 percent real level of 1.683. Significant value of 0.845 is greater than alpha 0.050, so it can be concluded that the seed variable is partially not significant (non-significant) on the production of soybean farming, a negative effect is indicated by a negative sign on the elasticity coefficient. The elasticity coefficient value of -0.002 means that each 1 percent addition of seed will reduce the yield of organic rice farming in rain-fed lowland 0.002 percent under ceteris paribus conditions. Seed production factors have no significant effect on organic rice farming in rain-fed rice, this is in accordance with research by Rahayu W and RiptantiErlyna W (2008) which states that the use of seeds has no significant effect on soybean yields in Sukoharjo Regency. Technically the need for soybean seeds for large soybeans is 40 kilograms, while the results of the average calculation of farmer respondents participating in the Soybean Model Development Program in the paddy fields use 39.99 kg / hectare.

3.1.3. **Manure.** Partial analysis using the t-test obtained the value of t-count of manure is -0.420 which is smaller than t-table at a 5 percent level of 1.683. Significant value of 0.678 is greater than alpha 0.050, so it can be concluded that the partial manure variable has no significant effect on production in organic rice farming in the rainfed rice, a negative effect is indicated by a negative sign on the coefficient of elasticity. The elasticity coefficient value of -0.004 implies that each addition of 1 percent manure will reduce the production of organic rice farming in the rain-fed rice by 0.004 percent in ceteris paribus conditions. Manure or organic fertilizer does not significantly affect the production of organic rice farming in the rain-fed rice, this is because the paddy fields used by respondents are productive land in intensive rice farming. If it is seen from the recommended use dose, the need for manure per hectare in the Model Soy Development Program, there are 500 kilograms per hectare, and the average use of respondent farmers is 496.90 kilograms per hectare.

3.1.4. **Biofertilizer.** Partial analysis using the t test obtained the value of biological fertilizer t-count of 2.108 which is greater than t-table at 5 percent real level of 1.683. A significant value of 0.043 is smaller than alpha 0.050, so it can be concluded that the variable manure partially has a significant effect on production on organic rice farming in the rainfed rice, a negative effect is indicated by a negative sign on the coefficient of elasticity. The elasticity coefficient value of -1,011 means that every 1 percent addition of manure will reduce the yield of organic rice farming in the rainfed rice by 1,011 percent in ceteris paribus conditions.

3.1.5. **Liquid Organic Fertilizer.** Partial analysis using the t test obtained the t-count value of liquid organic fertilizer of 0.606 which is smaller than t-table at 5 percent real level of 1.683. A significant value of 0.542 is greater than alpha 0.050, so it can be concluded that the variable manure partially has no significant effect (non-significant) on the production of organic rice farming in the rainfed lowland rice, a negative effect is indicated by a negative sign on the coefficient of elasticity. The elasticity coefficient value of -0.004 implies that each addition of 1 percent manure will reduce the production of organic rice farming in rain-fed rice fields by 0.004 percent in ceteris paribus conditions.

3.1.6. **Compound Fertilizer.** Partial analysis using the t test obtained a compound fertilizer t-value of 0.463 which is smaller than t-table at a 5 percent level of 1.683. Significant value of 0.646 is greater
than alpha 0.050, so it can be concluded that the partial manure variable has no significant effect (non-significant) on the production of organic rice farming in the rainfed rice, a positive effect is indicated by a positive sign on the coefficient of elasticity. The elasticity coefficient value of 0.005 means that each additional 1 percent of manure will increase the yield of organic rice farming in the rainfed rice by 0.005 percent under ceteris paribus conditions.

3.1.7. Vegetable Pesticides. Partial analysis using the t test obtained the value of vegetable pesticide t-count of -1,729 which is greater than t-table at 5 percent real level of 1,683. Significant value of 0.047 is smaller than alpha 0.050, so it can be concluded that the variable of pesticides is partially significant (significant) effect on production in organic rice farming of the rainfed rice, positive influence is indicated by a positive sign on the coefficient of elasticity. The elasticity coefficient value of 1.003 implies that each addition of 1 percent of pesticides will increase the yield of organic rice farming in rain-fed rice fields by 1,003 percent under ceteris paribus conditions. Partial use of pesticides in the soybean development program in Ciamis Regency is that there is no real effect, this is in accordance with the opinion of Matakena S, Syam'un E and Gany R. A (2011) in his research entitled efficiency of production factors and partnerships in order to increase soybean farming production in Miami District, Nabire Regency, Papua Province which states that the use of pesticides has a real and negative effect on soybean yields in Nabire District, Nabire Regency, Papua Province.

3.1.8. Labor. Partial analysis using the t test obtained t-count value of male laborers of 0.908 which is smaller than t-table at 5 percent real level of 1.683 Significant value of 0.671 is greater than alpha 0.05, so it can be concluded that the male workforce variable partially not significant effect (non-significant) on organic rice production in rainfed lowland rice, a positive effect is indicated by a positive sign on the coefficient of elasticity. The elasticity coefficient value of 0.020 means that every 1 percent addition of male labor will increase the yield of organic rice farming in the rainfed rice by 0.020 percent under ceteris paribus conditions.

3.2. Efficient Use of Production Factors in Organic Rice Farming in the Rainfed Rice
The use of production factors is said to be efficient if the Marginal Product Value (NPM) is the same as the price of the production factor added to obtain the NPM. By using mathematical equations, the statement is expressed in the form of NPMX = PX. The regression equation model for soybean farming obtained from the analysis results can be estimated as follows:

\[ \log Y = \log 3,653 + 1,002 \log X1 - 0,002 \log X2 - 0,004 \log X3 - 0,011 \log X4 + 0,004 \log X5 + 0,005 \log X6 + 0,003 \log X7 + 0,020 \log X8 \]

Or \[ Y = 3,653 X11,002 X20,002 X3-0,004 X4-0,011 X5-0,004 X60,005 X70,003 X80,020 \]

The number of production elasticity coefficients (\( \Sigma Epi \)) of the equation, which is the sum of the elasticity coefficient values of the factors of production from land, seeds, organic fertilizer / cages, biological fertilizers, liquid organic fertilizers, compound fertilizers, vegetable pesticides and power is 1,009 and notated mathematically with \( \Sigma Epi = 1,009 \). The value \( \Sigma Epi = 1,009 \) indicates that the scale of organic rice farming in rainfed lowland is at the irrational stage of production because \( \Sigma Epi > 1 \). The production function is on a scale of increasing returns to scale. In this area farmers are still able to obtain a number of production which is quite profitable when a number of inputs are still added, depending on product prices and factors of production.

This is in accordance with research conducted by Mahabirama et al (2010) which states to determine the scale of business can be done by adding up the coefficient values of the seven input variables. The total value obtained is 1,277, which means the scale of soybean farming in Garut Regency is at an increasing return to scale, i.e. the additional output is greater than the additional input. The coefficient is positive and is greater than one meaning that if the use of factors of
production is added together and proportionally by one percent, soybean production will increase by 1,277. To be able to see more clearly the level of efficiency of the use of production factors from land, seeds, organic/manure fertilizer, biological fertilizer, liquid organic fertilizer, compound fertilizer, vegetable pesticides and labor can be seen in Table 5.

Table 5. Calculation of Economic Efficiency Value on Organic Rice Farming in the Rainfed Rice

| Production factors | B | Xi | HXi | $ | HS | PM | NPM | $PM/HXi |
|--------------------|---|----|-----|---|----|----|-----|--------|
| Land               | 1.002 | 0.263 | 150000 | 1226.5952 | 11500 | 4665.70 | 53635527.81 | 357.70 |
| Seed               | -0.002 | 6.321 | 13500 | 1226.5952 | 11500 | -0.42 | -4827.82 | -0.36 |
| Pandang            | -0.004 | 351.662 | 500 | 1226.5952 | 11500 | -0.01 | -152.45 | -0.30 |
| Phayañi            | -0.011 | 5.212 | 2300 | 1226.5952 | 11500 | -2.64 | -30302.63 | -13.18 |
| Porganikcair       | -0.004 | 0.888 | 25000 | 1226.5952 | 11500 | 5.08 | 58384.80 | -0.23 |
| Pajajameuk         | 0.005 | 0.714 | 125000 | 1226.5952 | 11500 | 7.86 | 90387.82 | 0.72 |
| Pestisidaetable    | 0.003 | 0.554 | 35000 | 1226.5952 | 11500 | 7.63 | 87727.57 | 2.51 |
| Labor              | 0.020 | 51.667 | 50000 | 1226.5952 | 11500 | 0.49 | 5592.88 | 0.11 |

The efficiency value of land area production factor and plant pesticide factor in organic rice farming in rainfed rice fields is 357.70 and 2.51 which is greater than 1. This shows that the use of land area and vegetable pesticide in the farming is not efficient. The solution of the use of land area and vegetable pesticide production factors must be added because it will increase organic rice yield. While the factors of production that have a value of npm / hxi less than one, are the factors of seed production, organic fertilizer / organic fertilizer, biological fertilizer, liquid organic fertilizer, compound fertilizer, and labor. Each of which has values of -0.36, -0.30, -13.18, -0.23, 0.72 and 0.11. This means that the production factor is inefficient. The solution of using these factors of production is reduced.

3.3. Constraints Faced in the Implementation of Organic Rice in the Rainfed Rice

Based on the results of research conducted and on the basis of the limits used to explore the obstacles faced by organic rice farmers in rainfed lowland, limited in the scope of the agribusiness system consists of 1) the provision of production facilities, 2) the implementation of farming, 3) processing production results, 4) marketing and 5) the role of supporting institutions. The results of the study relate to the constraints of farmers in the implementation of organic rice farming in rainfed rice are as follows:

Table 6. Categories of Constraints Faced by Respondents in Organic Rice Farming in the Rainfed Rice

| No. | Information                  | Obstacles Category | Total Score |
|-----|------------------------------|--------------------|-------------|
|     |                              | Heavy             | Average     | Low       |
| 1   | Provision of factors of production | 127               | 116         | 93        | 336 |
|     | Percentage (%)               | 37,80             | 34,52       | 27,68     | 100,00 |
| 2   | Farming                      | 49                | 95          | 234       | 378 |
|     | Percentage (%)               | 12,96             | 25,14       | 61,90     | 100,00 |
| 3   | Processing yield             | 5                 | 40          | 81        | 126 |
|     | Percentage (%)               | 3,97              | 31,75       | 64,29     | 100,00 |
| 4   | Marketing                    | 3                 | 10          | 29        | 42 |
|     | Percentage (%)               | 7,14              | 23,81       | 69,05     | 100,00 |
| 5   | Supporting Institution       | 58                | 29          | 81        | 168 |
|     | Percentage (%)               | 34,52             | 17,26       | 48,21     | 100,00 |
|     | Total                        | 242               | 290         | 518       | 1050 |
|     | Percentage (%)               | 23,05             | 27,62       | 49,33     | 100,00 |

The results showed that, in general, the implementation of organic rice farming in rainfed lowland most of the respondents 49.44 percent rated facing a low obstacle, the moderate level of obstacle was 27.62 percent and the high rate was 23.05 percent. According to information from respondent farmers,
the serious obstacle faced by respondents in the implementation of organic rice farming in rain-fed rice fields was in the provision of production facilities, with a percentage of 37.80 percent, followed by the role of supporting institutions of 34.52 percent.

4. Conclusion and Suggestion

4.1. Conclusion

Based on the results and discussion, it can be concluded as follows:

- Simultaneously the production factors used have a very significant effect on organic rice production in the rainfed rice. Partially, the area of land production factor has a positive and very significant effect, while the factor of production of biological fertilizers and vegetable pesticides has a significant effect on organic rice production, biological fertilizers are negative while plant pesticides are positive. Production factors that did not significantly affect organic rice production in the rainfed rice were seeds, organic manure / fertilizer, compound fertilizer, and labor.
- Factors of production of land area and vegetable pesticides have not been efficient, while the factors of seed production consists of organic fertilizer / manure, liquid organic fertilizer, compound fertilizer, and inefficient labor production factors.
- The severe obstacle faced by respondents in the implementation of organic rice farming in the rainfed rice is in the provision of production facilities, with a percentage of 37.80 percent, followed by the role of supporting institutions of 34.52 percent.

4.2. Suggestion

Based on the results of research and discussion, it can be suggested:

- Based on the results of the study it is known that the area of land has a very strong influence (highly significant) on the production of organic rice in rain-fed lowland. Based on this, efforts to increase organic rice can be done by adding land area by utilizing rain-fed lowland.
- Although land area has a very significant positive effect on increasing organic rice production in rain-fed land, it is necessary to review the use of other production factors that can influence the increase in organic rice production in rain-fed lowland.
- Constraints faced related to obstacles in the provision of production facilities should be prepared together starting from planting planning to harvesting in a group.

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