Efficiency of organic rice farming inputs in the dry season at Purworejo Regency, Central Java, Indonesia

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Abstract. Climate change will cause changes to the organic rice production inputs. This research aims to know the factors and season determining the production of organic rice, as well as to know the efficiency level of organic rice farming, too. The research was carried out in three villages, namely Bleber, Legetan, and the Ngainan villages in Bener District, Purworejo Regency, Central Java, Indonesia. The samples were taken by a census technique, all were organic farmers which were member of the farmer group. There were total of 92 farmers respondents. The primary data were obtained by interviewing with the questionnaire. Then, the data were analyzed using the production model of Cobb-Douglas. The results showed in general, the land, seed, manure, petroganic fertilizer, labor and season significantly influenced the organic rice production. While in the partial areas, it was only manure, labour and season. The use of the land and labors on the organic rice farm has been efficient, but not with the use of manure, yet. The risk of organic rice in the dry season is higher than the rainy season.

1. Introduction
Organic farming is known as agriculture that is more environmentally friendly. Organic farming is no longer oriented towards high production, but with organic farming, sustainable production can increase later while maintaining land, and the quality of environmental sustainability and producing products that are safe and healthy for consumption. According to the International Federation of Organic Agriculture Movements [1] in the 2010 ministry of organic agriculture as a whole farming activity from the production process in the processing of products that are environmentally friendly and managed naturally, so as to produce products that are considered healthier and more nutritious. Organic rice has advantages when compared to non-organic rice. Organic rice is relatively safe for consumption because it does not contain chemical residues, has a fluffier texture, and has a longer shelf life [2].

Purworejo is one of the districts in Central Java with rice production reached 53.37 q/ ha, which is higher than national rice production (51.52 q/ ha) [3]. Purworejo Regency is also one of the regions that has implemented the organic farming system through Go Organic 2010 program launched by the local government, which focusing on organic rice commodities.
The risk during the dry season pests attack [4]. The presence of pests and diseases also cause losses to farmers, especially in Central Java, there are three risks in growing rice, namely: flooding, drought and pests. The risk during the dry season pests attack [4]. The presence of pests and diseases also cause losses to farmers, specifically plant hopper and stinky plant hopper. Pests can be eradicated using *Beauveria bassiana* insecticide, a natural insecticide and specific for insects. *Beauveria bassiana* insecticide is environmentally friendly because it does not leave harmful residues in the production and do not damage the environment. While climate change has the potential to influence the rice yield directly by heat and water stresses, it can also have an indirect impact by affecting the fertilizer supply, pathogens, and pests [5]. These attacks by pests and diseases will cause a further decrease in crop production [6].

In addition to changes in climate, the problem of decreasing productivity is alleged because not all farmers have run their farms efficiently, be it technical, economic and price efficiency. According to [7], productivity can be increased through increased farm efficiency and technological innovation. The level of application of technology components that are not in accordance with the recommendations or farmers in conducting their farming is still in accordance with the habits will lead to the use of inefficient inputs is one of the factors that lead to not achieving the maximum level of production. A comprehensive study showed that El Nino events typically lead to delayed rainfall and decreased rice planting in Indonesia’s main rice-growing regions [8]. Change in climate impacts cropping patterns, water availability and to some extent productivity of crops as well [9].

Problems faced by farmers in the management of organic rice farming associated with the use of manure. Farmers sometimes use excessive, but sometimes less. This is because manure is a homemade fertilizer. Viewed from the side the availability of manure is still limited because not many farmers who keep livestock. The farmers are not informed about the condition of the soil, so if the soil does not need a lot of nutrients, the use of fertilizers that much will be wasted. Moreover, in the manufacturing process sometimes immature already used to fertilize crops. The use of fertilizers immature rice will result in the growth process becomes less than optimal. The problems can bring inefficient use of factors of production and may raise the risk of production. From some of the problems associated with input factors of production, it is necessary to study the factors of production what affects the production of organic

![Figure 1. Rice production (q/ha) in Purworejo Regency 2012-2017](image-url)
2. Methods
The study was conducted in the Bleber Village, Legetan, Ngasinan Bener District, Purworejo Regency. Determination of research locations using a purposive method. Sampling was done using census techniques, as many as 92 farmers were taken as respondents. The data obtained in the field are then analyzed by the Cobb-Douglas function [10]. Mathematically the Cobb-Douglas function can be written in equation form:

\[ Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} e^u \]  

In the model, there are two variables that are used, the dependent variable (independent) and the independent variables (not free). The dependent variable is the production of organic rice and the independent variables consist of land \(X_1\), seeds \(X_2\), manure \(X_3\), petroorganic fertilizer \(X_4\), labour \(X_5\) and season \(X_6\).

3. Results and discussion

3.1 Analysis of production function
Research efficiency analysis of organic rice farming in Purworejo Regency aims to determine the factors that influence organic rice farming. The use of factors of production (input) greatly affects the results of farming, both based on the number and type. The use of factors of production can also affect the level of efficiency of a farm. The amount and type of input that will be used can be influenced by the area of land owned by farmers, farmers' habits, capital availability and farmers' needs in conducting production activities. Here is a table of average production and the use of production factors:

| Table 1. Average of production and used factors production of organic rice farming |
|--------------------------------------|----------------|----------------|
| Description                        | Input Farming | Input 1 Hectare |
| Production (kg)                    | 377.11        | 2961           |
| Land (m²)                          | 1232.31       | 1              |
| Seed (kg)                          | 5.48          | 50             |
| Manure (kg)                        | 350.92        | 3028           |
| Petroorganic fertilizer (kg)       | 102.15        | 942            |
| Manpower (days)                    | 17.23         | 161.38         |

To determine the effects of each factor of organic rice production seen from the regression coefficient. The coefficient of determination obtained at 0.741. This value indicates that the organic rice production can be explained by the six factors of production, land, seeds, manure, organic fertilizers, labor and seasons by 74.1% and the remaining 25.9% described other factors which are not included in the analysis, such as climate, age and education level of farmers.

Based on Table 2 it can be seen that the regression coefficients are tested using T-test results are not all factors significantly affect the production of organic rice products. Factors used in the production of organic rice farm real effect on the confidence level of 90% and 99%. The production factor of land or significant influence on the production of organic rice. So if the land use increased by 1% and the other factors held constant, then the organic rice production could increase by 0.625%. This is in accordance with his research [11] states that the variable land area affects organic rice production in Tasikmalaya Regency and if the area of land is added by 1%, then organic rice production will increase by 0.77% at a 99% confidence level.

This is because the average area of land owned by farmers is not so widespread only around 1232.31 m². In addition, land owned by farmers is still in one plot or scatter, so as to facilitate the supervision and care. With a production rate that is proportional to the area of land, the land area where the addition will increase the production of rice. However, with limited land owned by farmers, it is necessary innovative technology to increase the productivity of the land.
Table 2. Value regression coefficients factors of production and organic rice production function

| Variables           | Regression coefficients | T-count  | T-table |
|---------------------|-------------------------|----------|---------|
| Land                | 0.625                   | 4.692 *  | 2.656   |
| Seed                | -0.059                  | -0.518   | 1.67    |
| Manure              | 0.195                   | 2.932 *  |         |
| Organic fertilizer  | 0.031                   | 0.516    |         |
| Labour              | 0.296                   | 1.846 ** |         |
| Season              | 0.169                   | 2.027 ** |         |
| R2                  | 0.741                   |          |         |
| F count             | 31.474                  |          |         |
| F Table             | 3.14                    |          |         |
| N                   | 92                      |          |         |

Description: *: T-table $\alpha = 1\% = 2.656$  **: T-table $\alpha = 10\% = 1.67$

This is because the average area of land owned by farmers is not so widespread only around 1,232.31 m². In addition, land owned by farmers is still in one plot or scatter, so as to facilitate supervision and care. With a production rate that is proportional to the area of land, the land area where the addition will increase the production of rice. However, with limited land owned by farmers, it is necessary innovative technology to increase the productivity of the land.

The seed has a negative correlation to the organic rice production, so if its use plus 1% will reduce the tendency of organic rice production. This is because in the process of seedling and planting all the seeds do not grow normally because to grow the seed of at least 85%, and in the process of planting the workers less careful so that the seed dies after being planted. The amount of use of the seed more than a seed that is planted, it is because not all the seeds were sown land to be planted. The seed that is used most of the previous harvest. Dose use of seeds as much as 4kg of 1,000m², was based on Standard Operational Procedure (SOP) as much as 1 kg for 4 m². There is a difference between the uses of SOP with a dose of reality; this is due to the SOP for the SRI system.

The manure production factors significantly affect the production of organic rice Manure is used as a base fertilizer use is at 3,028 kg/ha, while SOP as much as 2,000 kg / ha. Difference dose of fertilizer use because farmers do not trust the advice and were not satisfied. The use of manure is used to add nutrients to the soil and improve the physical structure of the soil. Manure is used as a base fertilizer it is important to be done before planting. Manure used comes from animal manure mixed with microbes decompose. This Fertilizer is a lot of phosphorus, nitrogen and potassium. The use of petroganic fertilizer production factors did not significantly influence the production of organic rice. This is because the fertilizer with stocked ways to save time impact of fertilizer used is lost and less stable than that absorbed by plants when watering. These indicated significant labor factor or influence on the production of organic rice. Thus, if the use of labor increased by 1% and the other factors held constant, the organic rice production could increase by 0.296%. Factors production area of land, seed and manure have a significant effect on the production of organic rice with a positive coefficient, while petroganic fertilizer has a significant effect on the negative coefficient [12]. The season a significant influence on the result of organic rice production. In the rainy season, the production is higher than the dry season by a margin of 16.9 kg. This is because there are different seasons and irrigation systems in season. So there is a real difference to the results of production between the rainy seasons to the dry season.

3.2 Analysis of production efficiency factor usage
To determine the level of efficiency of use of production factors, by comparing the value of the marginal product (VMPx) with input prices (Price x), or can be written in the form VMPx/ Price ex. The use of factors of production is said to be efficient if VMPx/ Price x = 1; VMPx/ Price x > 1, the use of production factors have not been efficient so that the use of factors of production should be increased. But if VMPx/
Price $x < 1$, inefficient use of production factors, so that the use of factors of production needs to be reduced. The level of efficiency of the use of production factors can be seen in the following table:

**Table 3.** Value marginal product, price factor and efficient production of organic rice farming

| Variable  | Value of Marginal Product (VMP) | Price ($x$) | $\text{VMP(x)}/P(x)$ | T count | T table |
|-----------|---------------------------------|-------------|-----------------------|---------|---------|
| Land ($X_1$) | 1806.52                         | 1500        | 1.20                  | -0.77   | 2.656   |
| Manure ($X_3$) | 1996.05                         | 300         | 6.65                  | -3.01   | -2.656  |
| Labour ($X_5$) | 61611.84                        | 23935       | 2.57                  | -1.12   |         |

Description: Significant at $\alpha = 1\%$

Value VMPx/ Price to farm production factor ($X_1$) of 1.20, manure ($X_3$) of 6.65, and labor ($X_5$) of 2.57. Judging from the value VMPx/ Price x per farm production factor of land ($X_1$), manure ($X_3$) and labor ($X_5$) value greater than 1 (VMPx/ Price x > 1), meaning that the use of production factors land, manure and labor yet efficient The use of manure production factors have not been efficient, to be efficient, the manure production factors should be added in its use. Viewed from the side the availability of manure, it is available but limited, because not many farmers who raise goats respondents. Land with an average area of 1232.31 m² farmers use manure as much as 350.92 kg, thus the use of manure can be added as much as 5000 kg/ha (Installation Research and Technology Assessment Mataram).

### 3.3 Risk analysis farming

Risk is an uncertain thing that happens because of the threat. The magnitude of the risks faced by farmers in organic rice farming can be seen from the coefficient of variation. Higher risks faced by farmers in organic rice farming can be seen from the coefficient of variation. More and more high large profits the higher the risk will be borne by farmers.

Based on Table 4 dry season had a higher risk compared to the rainy season. It can be seen that the coefficient of variation of production and profits in the dry season was higher than the rainy season. The resulting organic rice production in the dry season is less than the rainy season. This is because during the dry season farmers' land in part of the respondents of the drought, so it is possible the occurrence of crop failure. In addition, the coefficient of variation is higher in the dry season than the wet season. This shows that the certainty of the result of the dry season is lower compared to the rainy season.

**Table 4.** The risk analysis of rice farming organic

| Description | Rainy season | Dry season |
|-------------|--------------|------------|
|              | Average      | Standard deviation | Coefficient of variation | Average | Standard deviation | Coefficient of variation |
| Production  | 397.94       | 473.64 | 1.19 | 355.63 | 508.34 | 1.43 |
| Price       | 9515.15      | 916.89 | 0.096 | 9500 | 892.68 | 0.094 |
| Profit      | 2,314,460    | 3,136.4 | 1.36 | 1,739,730.30 | 3,355,611.54 | 1.93 |

The coefficient of variation is greater profits dry season than the wet season, this was due to differences in the product and the price received by farmers. The product received among farmers could be affected by the climate, irrigation systems and ways of treatment. While the price difference is caused by the quality of organic rice and consumer factors

The coefficient of variation is a greater production of dry season than the rainy season due to the dry season will be a shortage of water. A land so that there is no water for the rice crop. Treatment intensity also affects the coefficient of rice production, more intensive treatments by farmers than the production will be higher with a wide range of fertilizers and medicines for plants. Meanwhile, if the farmer is less intensive in treatment, the production will also decrease.
The land productivity of farmers who make adaptations to climate change is higher than those who do not make adaptations. Farmers who do not make adaptations to climate change experience a higher risk of crop failure [13]. The coefficient of variation of prices during the rainy season was higher than during the dry season, because the production of the rainy season is higher compared to the dry season. This resulted in the price of rice fell because of many competitors in sales. In addition, the price is also affected by the quality of rice produced. Good quality of rice sold at prices ranging from IDR 10,000, - to IDR 12,000/ kg. While the price of rice with ordinary qualities sold at IDR 8,000, - up to IDR 9,000, -. Buyer factors are the person who bought, whether a trader or end consumers. When sold to the end-users, the price obtained is higher compared to the merchant.

4. Conclusions
Climate change and seasons affect the production and risk of organic rice production. Based on the analysis of variance that the production factor of land, seed, fertilizer, pesticides, fertilizers, labor and seasons together significantly affected the production of organic rice. While only partially there are four factors that affect the real production, namely land, manure, labor and seasons. The use of production factors in organic rice farming land and labor are already efficient, while the use of manure has not been efficient. The risk of produce organic rice in the dry season is higher compared to the rainy season.

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