Analysis on Factors Affecting The Risk of Rice Farming Production in West Tanjung Jabung Regency

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Abstract. This study aimed to determine factors affecting the risk of paddy rice farming in West Tanjung Jabung regency. Respondents were determined using the simple random sampling method. The number of samples taken was 90 farmers from 250 farmer populations. The measurement of production risk used the Just and Pope method. The results of the study indicated that those variables such as seeds, urea fertilizer, Sp36 fertilizer, and insecticides can significantly reduce the risk of lowland rice production, while organic fertilizers do not significantly reduce the risk of lowland rice production. Production factors that significantly affect the risk of rice production were fertilizer (KCl), organic fertilizer and labor.

1. Introduction

Indonesia is an agrarian country engaged in agriculture and most of its people work as farmers especially in the countryside. This is against the backdrop of Indonesia's geographical location in the tropics so that it has a suitable climate to develop agricultural potential. The utilization of agricultural resources is key in improving agricultural productivity so that those limited resources must be allocated as efficiently as possible. Agricultural resources consisting of land, labor, water and other elements contained therein are the main resources for human survival [1] [2]. Unwise management will result in a decrease in the quality of the resources themselves which ultimately affects agricultural productivity.

The agricultural sector is very important as a major source of income for the peasant community, generally farmers produce agricultural produce to meet the needs of their daily lives [3]. Agricultural commodities that are expected to move positively in terms of increasing production and income are rice. This commodity is considered the most dominant managed by farmers, because in addition to being a staple food stuff is also a strategic commodity of high economic value [4]. Even nationally, this commodity is expected to realize the government's desire to rice self-sufficiency as it did in 1984, but to achieve it is not an easy thing and needs to anticipate every problem.

Rice farmers are mostly included in the category of subsistence farmers, because the agricultural activities are carried out not only for commercialization purposes but also to meet the food needs of their households [5]. Various problems face obstacles in increasing production, income and realizing the food security of its households. The problem of failure is a risk that must be faced by farmers in carrying out their farming activities. The term risk is more widely used in the context of decision making, because risk is interpreted as the chance of a bad event occurring in the aftermath of an action. The higher the level of uncertainty, the higher the risk caused in decision making, therefore the
identification of risk sources is very important in the decision-making process. Conceptually farmers who are able to reduce production risk as well as price risk by improving their productivity, use of diversification, the use of proper planting patterns, institutional strengthening of farmers, and the bargaining position of farmers will be able to produce and income farmers [6].

West Tanjung Jabung Regency is one of the districts in Jambi Province which has the largest land area with a harvest area of 7841.31 ha, productivity of 41.59 Tons/ha and with production of 32610.52 Tons [7]. Although it has large land does not mean that it will produce large harvest, especially paddy production. The purpose of this study was to determine and analyze factors affecting the production of paddy rice farming in West Tanjung Jabung Regency.

2. Research Method
2.1. Research Place and Time
This research was conducted in Batang Asam sub-district. The determination of this location was chosen deliberately (Purposive), with the consideration that Batang Asam sub-district is the district with the highest productivity level in West Tanjung Jabung Regency as much as 54.61 Kw/ha, the harvest area is 1,929 Ha and the production of 10,533 tons. This research was conducted from December 2019 to March 2020.

2.2. Determination of Respondents
The determination of respondents in this study was done by simple random sampling method (where the population in this study was rice paddy farmers. The population in this study was all rice farmers in two villages namely Sri Agung Village and Rawa Medang Village which were as many as 900 people. Number of samples determination method in this study used Taro Yamane or known as Slovin formula: [8] [9].

\[
n = \frac{N}{1 + Ne^2} \quad \text{or} \quad n = \frac{N}{1 + N \times E^2} \]

Where:
\( n \) = Sample size
\( N \) = Population
\( E \) = critical value (precision limit) desired. The study used 10% as a critical value.

The calculation above obtained the sample value that will be used in this study, namely as many as 90 farmers were considered to have represented from the total farmers namely as many as 900 rice paddy farmers.

2.3. Data Collection Techniques
The data collected in this study included primary and secondary data. Primary data was obtained from observations by directly reviewing the location of research and in-person interviews with respondents using a list of questions, while secondary data was obtained from various sources, namely various agencies related to this research as well as from various related literatures.

3. Data Analysis
Production risk measurement in this study used the Just and Pope method. Just and Pope's production risk function model equation consists of production functions and production variance functions. The most commonly used functional format in the framework of Just and Pope's production risk model is the Cobb-Douglas function in the form of natural logarithm. Rice field production in Batang sub-district was influenced by production factors and external factors. The difference in using of
production factors could affect the production of rice fields, this leads to the productivity of rice fields produced by diverse farmers. Production factors were used by farmers include land, seeds, labor, urea fertilizer, SP36 fertilizer, KCL fertilizer, Organic fertilizer and Pesticide. The production function and risk function of rice paddy production were as follows.

1. Production Function

\[
\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + \beta_6 \ln X_{6i} + \beta_7 \ln X_{7i} + \beta_8 \ln X_{8i} + \beta_9 D + \varepsilon.
\]

2. Production Risk Function

\[
\ln \sigma^2 Y_i = \theta_0 + \theta_1 \ln X_{1i} + \theta_2 \ln X_{2i} + \theta_3 \ln X_{3i} + \theta_4 \ln X_{4i} + \theta_5 \ln X_{5i} + \theta_6 \ln X_{6i} + \theta_7 \ln X_{7i} + \theta_8 \ln X_{8i} + \theta_9 D + \varepsilon.
\]

The effect of using the factors together on the risk of lowland rice production can be determined by the F test.

3. Variance Production

\[
\sigma^2 Y_i = (Y_i - sa)^2
\]

Where:
- \( Y = \) Actual Rice Field Production (kg/ha)
- Average Rice Production (kg/ha)
- \( X_1 = \) Number of seed uses (kg/ha/MT)
- \( X_2 = \) Amount of urea fertilizer usage (kg/ha/MT)
- \( X_3 = \) Total use of SP36 fertilizer (kg/ha/MT)
- \( X_4 = \) Total use of KCL fertilizer (kg/ha/MT)
- \( X_5 = \) Amount of organic fertilizer usage (kg/ha/MT)
- \( X_6 = \) Number of pesticide use (liter/ha/MT)
- \( X_7 = \) Number of workers per growing season (HOK)
- \( X_8 = \) Total Land Area (ha)
- \( D = \) Dummy Growing Season

\( \beta_1, \beta_2, \ldots, \beta_7 = \) Conjecture parameter coefficient \( X_1, X_2, \ldots, X_8 \)
\( \theta_1, \theta_2, \ldots, \theta_7 = X_1 \) conjecture parameter coefficient, \( X_2, \ldots, X_8 \)

4. Results and Discussions

4.1. The Age of the Respondent

![Age of Respondent](image)

**Figure 1.** Respondent age. Farmers aged 43 to 48 years and 49 to 54 years has the highest percentage, 23.60 % with the number of farmers as many as 21 families.
Figure 1 showed that the age of the respondent’s farmers ranges from 31 to 78 years old, with the average age of farmers of 43-54 years. This showed that farmers in Batang Asam have an age group of farmers who were young or of productive working age, thus rice farmers have great potential to increase production and develop their farms.

4.2. Farming experience
The experience of farming could generally influence the knowledge of farmers in cultivation techniques in agricultural activities carried out. Farmers who were more experienced in rice farming in general will be better able to increase productivity than less experienced farmers.

![Farming Experience](image)

**Figure 2.** Farming experience. The highest length of farming experience was in aged 19 to 23 years, with 25.84 percent of 23 families.

The average experience of rice farming in Batang Asam sub-district was 19-23 years, in this study respondents have experience of farming that varies between 4 to 43 years. This farmer’s experience showed that, respondents have a lot of experience in managing their business and more careful in making decisions in the development of their business.

4.3. Respondent's Level of Education.

![Level Of Education](image)

**Figure 3.** Level of education in research area on 2017
Generally, the level of education affects the way and mindset of farmers, because education was a process of developing knowledge, skills and attitudes of farmers that were implemented in a planned manner, thus obtaining changes in the increasing standard of living [10]. The higher the level of education of a person then developed also one's mindset, so that it could easily make decisions in carrying out its agricultural activities. From the observations showed somewhat constrained in applying this technology related to the level of education at the research site was still relatively low where the largest level of formal education lies in the elementary school education group which is 38.20 percent or as many as 34 people so as to cause less in decision making and receiving innovation as well as in terms of the application of technology.

4.4. Influencing Factors
4.4.1. Agricultural Production.

![Figure 4. Distribution of farmers by area of land use in 2017](image)

Land as a medium of growing crops was one of the important production factors in the management of farming. The more land planted the higher the production. On the other hand, the narrower the land planted, the lower the production produced.

![Figure 5. Use of seeds average on paddy rice farming in 2017](image)

Seed was one of the factors to be able to increase high production was by the use of good and quality seeds (superior seedlings). The seeds used by the respondent farmers in their farms were seeds purchased in a shop, in addition farmers also obtain seeds through government assistance. However, most used seeds from previous crops to be replanted. The used of seeds by farmers in Batang Asam sub-district could be known that 22.47 percent of farmers or as many as 20 families of farmers used seeds with a range of seeds between 34 - 42 Kg (figure 5). The amount of seed used by farmers tends to vary, this was due to differences in land area and planting distance of farmers. The decision of
farmers in the research area in the use of seeds was one of the determining factors regarding the efficiency of rice paddy farming.

Figure 6. Distribution of farmers based on the use of (a) urea and (b) sp36 fertilizers in the study area on 2017

Figure 6 showed that the use of urea in the study area ranges from 60 - 540 Kg and the use of SP36 was between 30 - 510 Kg. The highest percentage of urea use was 21.35 percent with the amount of fertilizer used was 60-120 kg and 180-240 kg, or as many as 19 families. Most of the farmers used SP36 fertilizer with a range of 210-270 kg fertilizer with a percentage of 21.42 percent and 15 farmers.
Figure 7. Distribution of farmers based on the use of KCl and organic fertilizers in 2017

Fertilizer was one of the factors that is expected to increase production if its use was carried out effectively and efficiently and in accordance with the dose required by the plant. Fertilization was carried out with the aim of adding nutrients that were not present in the soil. Fertilizer was a nutrient needed by plants that can support optimal growth and development for rice fields that are used according to soil conditions. Fertilizers used by farmers in research areas are generally urea fertilizer, SP36 fertilizer, KCL fertilizer and organic fertilizer. The use of urea fertilizer with the largest percentage is 60-120 and 180-240 kg / ha / MT, the average use of SP36 fertilizer is in the range of 210-270 kg / ha /MT, the use of KCL amounted to 15-159 kg/ha/MT and the average use of organic fertilizer amounted to 250-3450 kg/ha/MT (figure 7).

Figure 8. Average use of pesticides in paddy rice farming on 2017
One of the efforts to increase the production of rice paddy, needs to be carried out pest and disease protection techniques. Farmers in the research area protect their rice fields by providing liquid insecticides. The use of liquid insecticides is used to eradicate insects or pests that interfere with rice paddy fields. Pesticide use is usually carried out before signs of pest or disease attack, but in the research area pesticide spraying is carried out if there are visible symptoms in rice fields, as well as pest attacks such as birds, snails and rats, from the observation of the average farmer using liquid insecticides as much as 150 - 450 ml (figure 8).

Figure 9. Employment of labor in the research area on 2017

Labor is one of the important inputs in rice farming management The use of labor in rice farming activities including soil processing, planting, fertilization, weeding, HPT control and harvesting. Based on the research of existing rice farmers, the average use of rice fields per growing season is 82.41 HOK/ha. From the average labor use in rice farming above, a lot of labor is devoted to land processing activities with a percentage of 37.09 percent. Land processing becomes the stage of production with the most labor use, this is because at the time of processing of land generally in the research area, the use of labor is more intensive in preparing planting media for rice seeds that are ready to be moved and weeding, and fertilization, for better rice growth. Therefore, processing activities require the most manpower.

4.5. Factors That Affect The Risk of Rice Farming Production
To determined the risk of lowland rice production on the use of lowland rice production factors, it could be analyzed using the Just and Pope production risk function model. The results of the production risk function estimation could be seen in Table 1

Table 1. Result of Estimation of the Risk Function of Rice Farming Production with Dummy in the Study Area

| Variable    | Production Function | Production Risk |
|-------------|---------------------|-----------------|
|             | Coefficient | Prob | Coefficient | Prob |
| X1_SEED     | 0.23213     | 0.0007 | -0.18634   | 0.0365 |
| X2_UREA     | 0.13179     | 0.0092 | -0.14577   | 0.0275 |
| X3_SP36     | 0.12358     | 0.0064 | -0.14264   | 0.0161 |
| X4_KCL      | 0.00296     | 0.957  | 0.024833   | 0.7297 |
| X5_ORGANIC  | 0.0426      | 0.2437 | -0.0615    | 0.199  |
| X6_INSECTICIDE | 0.13887 | 0.0001 | -0.18855   | 0      |
Estimation result of the production risk function model provided a coefficient of determination of 0.950667. This showed that 95.07% of the diversity of risk in lowland rice production could be explained together by the factors of seed production, urea fertilizer, SP36 fertilizer, KCl fertilizer, organic fertilizer, insecticide, labor, and land area. While the remaining 4.93% was explained by other factors outside the model. Based on the results of the production risk function estimation in Table 1, the risk function for lowland rice production could be estimated with the following equation:

\[
\text{Ln } Y \text{ (risk) } = 21.16 - 0.19 \text{ LnX1} - 0.15 \text{ LnX2} - 0.14 \text{ LnX3} + 0.02 \text{ LnX4} - 0.06 \text{ LnX5} - 0.19 \text{ LnX6} + 0.02 \text{ LnX7} + 2.82 \text{ LnX8} - 0.21 \text{ Dummy}
\]

We also obtained Fcount of 379.98 with a probability of 0.0000, meaning that the independent variables contained in the model are collectively, significantly affect the risk of lowland rice production. The probability value that was smaller than alpha (0.05) indicates a significant effect, meaning that the independent variables in the model jointly affected the risk of lowland rice production. The results of this study were in accordance with those conducted by Zakirin, et al. (2013) on rice commodities on tidal land which stated that together the variables of land, seeds, labor, urea fertilizer, TSP fertilizer, herbicide, pesticide, labor, Farmers education and age affected the risk of rice farming production in tidal fields [11].

The seed variable (X1) had a positive and significant effect on rice production and a significant negative effect on the risk of rice fields in the acid stem sub-district. The more seeds used in the production process, the production will increase and the risk of rice field production decreased, so seed variables were a factor that reduced the risk. The coefficient value of seed used parameters was negative at 0.19. If there was a seed addition of 1% it will lower the risk of rice production by 0.19% assuming all other variables remain. The seed variable had a probability value of 0.0365 smaller than the real level of 0.05 meaning the seed variable had a real effect on the risk of rice production. This was in line with Zakirin et al. research revealed increase of using quality seeds to some extent will increase plant populations, so as to increased productivity and could ultimately lower production risk. The use of seeds in the research area was in accordance with the recommendation of 25 kg / ha with the advice given in the range of 20-30 kg / ha. by using suitable varieties on irrigation rice fields in Jambi Province.

Urea fertilizer variable (X2) had a positive and significant effect on rice production and had a significant and negative effect on the risk of rice paddy in the acid stem sub-district. This meant that the more Urea fertilizer used in the production process, the production will increased and the risk of rice production will decreased, so that the variable urea fertilizer was a risk reducing factor. The coefficient value of Urea fertilizer usage parameters was negative at 0.15. If there was an increase in Urea fertilizer by 1% it will lower the risk of rice by 0.15% assuming all other variables remain (cateris paribus). The Urea fertilizer variable had a probability value of 0.0275 smaller than the real level of 0.05 meaning that the Urea fertilizer variable had a real effect on the risk of rice production. The results of this study were in line with Apriana et al. research (2017) stated that chemical fertilizer variables were production variables that could lower the risk of production and research in line with fauziyyah research (2010) where chemical fertilizers in the form of Urea lower the risk of production [12][13].

Variable fertilizer SP36 (X3) had a positive and significant effect on rice production and had a significant and negative effect on the risk of rice production in stem sub-districts. The more SP36
fertilizer used in the production process, the production will increased and the risk of rice production will decreased, so the variable fertilizer SP36 was a risk reducing factor. The coefficient value of sp36 fertilizer usage parameters was negative at 0.14. In the event of the addition of SP36 fertilizer by 1% it will lower the risk of rice by 0.14% assuming all other variables remain (ceteris paribus). Fertilizer variables had a probability value of 0.0161 smaller than the real level of 0.05 meaning the SP36 fertilizer variable had a real effect on the risk of rice production. The results of this study were in line with Apriana research (2015) stated that chemical fertilizer variables were production variables that could lower production risk [12]. The use of an excess fertilizer dose of 125.78 kg/ha proved that the use of chemical fertilizers could lower the risk of production.

KCL fertilizer variable (X4) had no significant effect on rice production and negative value did not have a significant effect on the risk of rice production in the acid stem sub-district. KCL fertilizer used in the production process could not had a significant influence on the production results or the result of rice paddy production risk. The coefficient value of KCL fertilizer usage parameters was positive at 0.024. In the event of the addition of KCL fertilizer by 1% it will increased the risk of rice paddy by 0.02% assuming all other variables remain (ceteris paribus). Fertilizer variables had a probability value of 0.7297 greater than the real level of 0.05 meaning the KCL fertilizer variable had no real effect on the risk of rice production. The results of this study in line with Suharyanto's research (2015) suggest that the production risk regarding the use of KCL fertilizer had no real effect on the reducing risk of rice farming production [14]. The use of KCL fertilizer in the research area did not match the dose which is 40.33 kg/ha which should be 75 kg/ha so that there was no influence in the reduction of production risk.

Variable organic fertilizer (X5) had no significant effect on rice production and negative value had no significant effect on the risk of rice production in the acid stem sub-district. Organic fertilizers used in the production process could not had a significant influence on the production results or the result of rice paddy production risk. The coefficient value of organic fertilizer usage parameters was negative at 0.06. If there was an addition of organic fertilizer by 1% it will lower the risk of rice by 0.06% assuming all other variables remain (ceteris paribus). Fertilizer variables had a probability value of 0.1990 greater than the real level of 0.05 meaning organic fertilizer variables had no real effect on the risk of rice production.

Insecticide variables (X6) had a positive and significant effect on rice production and a significant negative effect on the risk of rice production in stem sub-districts. The more insecticides used in the production process, the production will increased and the risk of rice production will decreased, so insecticide variables were a risk reducing factors. The coefficient value of insecticide use parameters was negative at 0.19. In the event of the addition of insecticides by 1% it will lower the risk of rice by 0.19% assuming all other variables remain (cateris paribus). Fertilizer variables had a probability value of 0.00 smaller than the real level of 0.05 meaning insecticide variables had a real effect on the risk of rice production. The results of the analysis were also in line with Pusptasari (2011) which states that pesticides were a risk reduction factor. Spraying was carried out when the population of pests according to farmers had increased [15].

The labor variable (X7) was positively marked and had no significant effect on rice production and the risk of rice production in the acid stem sub-district. The production and risk of rice was not a significant influence on the production results or the result of rice production risk. The coefficient value of labor usage parameters was positive at 0.020. If there was an increase in manpower by 1% it will increase the risk of rice paddy by 0.02% assuming all other variables remain (cateris paribus). The labor variable had a probability value of 0.7743 greater than the real level of 0.05 meaning the labor had no real effect on the risk of rice production. The results of this study were in line with suharyanto research (2012) suggesting that production risks regarding labor used had no real effect on the decreased in the risk of rice farming production [14]. The same went for Thahir's research et al. [16] states that labor had a real effect on production risk so that increased labor will increased production risk. This was because if the use of labor exceeded the limit and was not supported by increased production it will harm farmers [16].
Land area variable (X8) had a positive and significant effect on rice production and rice production risk in the acid stem sub-district. This meant that the larger the area of land used in the production process, the production will increase and the risk of rice production will increased, so that the variable area of land was a factor that adds to the risk increasing factors. The coefficient value of land area parameters was positive at 2.83. If there was an increase in land area by 1% it will increased the risk of rice paddy by 2.83% assuming all other variables remain (ceteris paribus). The variable area of land had a probability value of 0.00 smaller than the real level of 0.05 meaning the area of land had a very real effect on the risk of rice production of rice fields. These results are in line with Apriana’s research (2015) which revealed land inputs were risk increasing inputs [12]. The addition of land area that was not offset by the technological components in rice cultivation of rice fields will increased the risk of production variabel.

Dummy showed a parameter coefficient value of 0.215984 with a probability value smaller than 0.05 which meant that dummy production function had a very real effect between rice farming in the rainy season and dry season. In the rainy season the attack rate of Neck Blast disease caused by rainfall was quite high and lack of sunlight, but could be overcome by the use of such disease-resistant varieties such as ciherang used in research areas. This was in line with research (Ghani, 2013) that rainfall was a risk-increasing factor [17]. In the dry season there was not much disease attack rate, because in the research area rice fields used technical irrigation so that drought could be overcome. Several efforts could be made to reduce the gap results between seasons, among others knowing the prevalence of pest/disease attacks, mapping specific varieties in both the rainy and dry seasons. For example recommendations in technology components named fertilization, planting distance, irrigation, and management of pests/diseases of plants [18].

5. Conclusion and Suggestion

5.1. Conclusion

Simultaneously the production factors observed in the study such as seed factors, urea fertilizer, Sp36 fertilizer, KCL fertilizer, organic fertilizer, insecticide, labor and land area were production factors that can increase rice field production. Increased use of seeds, urea fertilizer, Sp36 fertilizer, insecticides and land area could increase rice production in real terms while increasing the use of KCL fertilizer, organic fertilizer and labor can increase rice production in an unreal way.

The production factors of seeds, urea fertilizer, Sp36 fertilizer, insecticides and organic fertilizers were production factors that could reduce the variety of rice field production, so these five production factors were factors that can reduce the risk of production. Increased use of seeds, urea fertilizer, Sp36 fertilizer, and insecticides could reduced the risk of rice production in real terms while organic fertilizer reduced the risk of unreal rice production. KCL fertilizer production factors, organic fertilizers and labor are factors that could increased the variation of rice field production, so these three production factors were factors that could increase the risk of production increased use of these three factors can increase the risk of rice production in an unreal way.

5.2. Suggestion

Increasing productivity could be done by applying appropriate technology, expanding the planting area of the rice planting area by increasing the cropping index (IP), reducing yield losses at harvest and post-harvest. Increasing yield stability by implementing integrated crop management and reducing production risk through the application of local specification technology. The use of lowland rice farming production factors based on the portrait of lowland rice farming in the area in the use of inputs is still below the recommendation so that the production decreases so it is necessary to use the input according to the recommendation.

Rice farming in the research area is still relatively traditional so there needs to be the application of technology that will increase production in this case there needs to be innovations made by the government in helping farmers production and improving the welfare of farmers.
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