Analysis of Factors that Influence the production of wetland rice in Banten Province

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Abstract. Banten Province has a harvested area of paddy fields on the 2017 year of 415,687 ha and production of 2,369,731 tons of milled dry grain (MDG). The objectives of this study are: 1) Knowing the condition of wetland rice farming in Banten Province, 2) Knowing the factors that influence the production of wetland rice in Banten Province, 3) Knowing the efficiency of the use of production inputs. The sampling method used purposive sampling with 123 respondents. The analytical method used multiple linear of Cobb Douglas production functions and descriptive analysis. The results of the study are: 1) Rice paddy farming in Rainy Season (RS) 2017/2018 has a B/C ratio of 1.7. The productivity of paddy rice is 5.91 tons harvested dry grain (HDG)/ha. 2) Significant factors affecting the production of paddy rice in RS 2017/2018 are The amount of use of solid organic fertilizer, The amount of solid herbicide use, The amount of use of human labor rent, and the arable land area, 3). The cumulative elasticity is 0.97, is inelastic, meaning that the addition of 1% of the production factor will increase production by 0.97% or decreasing return to scale. So rice farming is relatively inefficient.

Keywords: factor analysis, lowland rice, Cobb Douglas, efficiency.

1. Introduction
Banten Province has an area of 9,662.92 km², with the population in 2015 amounting to 11,955,243 people, and the population density of Banten is 1,237 people / km² and an average of four people per household [1]. The rice harvest area in 2017 was 428,628 ha with production of 2,413,478 tons unhusked rice or with productivity of 5.63 tons unhusked rice/ha. Other food crops namely corn, the harvested area in the same year was 16,018 ha with a production of 63,518 tons of dry shelled rice (productivity of 3.96 tons/ha), while the soybean harvested area was 1,646 ha with a production of 2,126 tons [2].

Based on district, in 2017 year, Pandeglang Regency is the highest in paddy production, which is 789,311 tons MDG GKG (32.7% of the total production of Banten Regency), then the second is Lebak

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Regency with production of 608,036 tons (25.2%), third is Serang District is 506,892 tons (21.0%) and fourth is Tangerang Regency amounted to 410,535 tons of milled dry paddy (17.0%) and the remaining four other cities (Tangerang, South Tangerang, Cilegon and Serang) were 98,706 tons or 4.1% of Banten's total production [2].

According to CBS [3], the area of agricultural land in Banten Province in 2015 was 716,324 ha where the area of rice fields was 201,270 ha (28.1%) and not rice fields covering an area of 515,054 ha (71.9%). The area of this paddy field is 94.6% in four main regencies of rice producers, namely Regency: Pandeglang, Lebak, Tangerang, and Serang. Based on the types of plants planted, 99.1% were planted with rice and the rest were not-rice (2014 CBS; CBS 2015) [3,4].

Increasing rice production by optimizing the use of farming inputs is very necessary. According to Soekartawi (2002) [5] analysis of production, functions are needed to find out the optimum combination of some farming inputs, namely seeds, fertilizers, labor, drugs and limited land that produces maximum production. One of the production functions is the Cobb Douglas production function, which is a function or equation involving two or more variables, one of which is called the dependent variable (which is explained) and the other is called independent variables (which explain) and solved by regression (Soekartawi, 2002) [5].

This research is useful to find ways to increase the production of lowland rice. The benefits can be used as input in policy formulation in an effort to increase rice production.

2. Methodology

2.1. Research method data collection data
The method used in this study was the survey method. The survey method was conducted for primary data collection. Primary data were collected by interviews using a structured questionnaire to rice farmer respondents. It is also collected secondary data from desk study that related to this study. Primary data collection at the farm level using a purposive sampling method. This research conducted at the same time with the research of Effectiveness and Efficient in Management of Agriculture Machine Vehicle Study (Siagian et al. 2018) [6]. Total farmer’s respondents amounted to 123 respondents farmers.

2.2. Location and Time
The assessment was conducted in Banten Province. The location of this study was conducted in four regencies of rice producer: 1) Tangerang Regency, 2) Serang Regency, 3) Pandeglang Regency, and 4) Lebak Regency. This study had been conducted since January 2018 - December 2018.

2.3. Methods Data Processing and Analysis
This study used consisted of qualitative and quantitative analysis. Qualitative analysis used descriptive statistics and quantitative analysis used multiple linear regression of Cobb Douglas function. The equation to guess production of rice on RS 2017/2018 is:

\[ \text{PRODKT1} = a_0 + a_1 \text{JBES1} + a_2 \text{JURE1} + a_3 \text{JSP361} + a_4 \text{JNPK1} + a_5 \text{JKDG1} + a_6 \text{JPOP1} + a_7 \text{JPUDP1} + a_8 \text{JPDUC1} + a_9 \text{JPESP1} + a_{10} \text{JPPSC1} + a_{11} \text{JHERBP1} + a_{12} \text{JHERBC1} + a_{13} \text{JTRDK1} + a_{14} \text{JTKMDK1} + a_{15} \text{JTKMSW1} + a_{16} \text{LGRP1} + \epsilon \]

Where:
- PRODKT1 = Production of wetland rice on RS 2017/2018 (kg/ha)
- \(a_0\) = intercept
- JBES1 = Total Use of Certified Seed (kg/ha)
- JURE1 = Total Use of Urea Fertilizer (kg/ha)
- JSP361 = Total Use of SP-36 Fertilizer (kg/ha)
- JNPK1 = Total Use of NPK Fertilizer (kg/ha)
- JKDG1 = Total Use of Manure Fertilizer (kg/ha)


### 3. Results and Discussion

#### 3.1. Characteristics of Farmers Sample and Farming System in Banten Province

Based on the survey results, the average age of the family head is 47.1 years old with a range of 25 - 75 years. The average length of education of the family head is 7.9 years with the lowest education 0 year (illicit) and the highest 16 years or university graduated. The average number of family members (including the head of the family) is 4.0 people with a range of 1 - 8 people. From the survey results, it is known that the average of cultivated land area in Banten Province is 1.35 ha per household (hh) with a range of 0.2 - 8.0 ha. This land area consists of an owned land area of 0.9 ha/hh with a range of 0 - 9 ha, and an unowned land area of 1.1 ha/hh with a range of 0 - 20.0 ha. The width of rice field cultivation in Rainy Season (RS) 2017/2018 is 1.35 ha per household. In general, the cropping pattern in the survey area is rice - rice - fallow.

#### 3.2. Analysis of Wetland Paddy Farm

Based on the results of enumeration, the average productivity of rice in Banten Province in the Rainy Season (RS) 2017/2018 is 5.914 tons harvested dry grain (HDG)/ha. With an average harvest price of IDR 4,151.6/kg HDG, the revenue is IDR 24.55 million/ha. The total production cost is IDR 8.99 million/ha so that the income of IDR 15.55 million/ha can be obtained. Based on the analysis of B/C the ratio is known to be 1.7 in financial prices. This means that rice farming is financially profitable. Details of Analysis of wetland rice farming in RS 2017/2018 are presented in table 1 below.

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**Table 1. Analysis of Rice Farming per Ha on RS 2017/2018 in Banten Province**

| Nr | Type of Input/Output | Vol | Price/unit (IDR) | Value (IDR) |
|----|----------------------|-----|-----------------|-------------|
| 1  | Seeds (kg):         |     |                 |             |
|    | a. certified        | 26.5| 10,162.7        | 269,312     |
|    | b. non certified    | 0.3 | 3,000           | 900         |
| 2  | Fertilizer (kg):    |     |                 |             |
|    | a. Urea             | 183.3| 1,961           | 359,451     |
|    | b. SP-36            | 104 | 2,137.3         | 222,279     |
|    | c. KCL              | 2.1 | 2,223.9         | 4,670       |
|    | d. ZA               | 1.3 | 1,600           | 2,080       |
|    | e. NPK Ponska       | 155.5| 2,290.3        | 356,142     |
|    | f. Manure Fertilizer| 80.3| 114.6          | 9,202       |
| Nr | Type of Input/Output          | Vol  | Price/unit (IDR) | Value (IDR) |
|----|------------------------------|------|-----------------|-------------|
| g. | Organic fertilizer (s) (kg)  | 51.3 | 114.1           | 5,853       |
| h. | Solid Leaf Fertilizer (kg)   | 0.8  | 24,448.8        | 19,559      |
| i. | Fluid Leaf Fertilizer (ltr)  | 2.1  | 64,303.8        | 135,038     |
| 3  | a. Fluid Growing Stimulants (ltr) | 0.1 | 172,093        | 17,209      |
|    | b. Solid Growing Stimulants (kg) | 0.1 | 32,363.6       | 3,236       |
| 4  | Pesticide:                   |      |                 |             |
|    | a. Solid (kg)                | 6.4  | 20,560.5        | 131,587     |
|    | b. Fluid (ltr)               | 5.5  | 50,874.7        | 279,811     |
| 5  | Herbicide:                   |      |                 |             |
|    | a. Solid (kg)                | 0.3  | 77,454.6        | 23,236      |
|    | b. Fluid (ltr)               | 1.0  | 70,429.8        | 70,430      |
| 6  | Others:                      |      |                 |             |
|    | a. Tax of building and land  |      |                 | 14,748      |
|    | b. Contribution of Irrigation Water Fee |      |                 | 1,918      |
|    | c. Rent of water pump and others | 4.3 | 17,494.8      | 75,228      |
| 7  | Cost of Hired Labour:        |      |                 |             |
|    | a. Hired labour (Man Day Work) | 54 | 113,362       | 6,121,548   |
|    | b. Family Labour (Man Day Work) | 8  | 39,336.7      | 314,694     |
|    | c. Wage of Livestock Service | 0.3  | 93,500         | 28,050      |
|    | d. Cost of Family Livestock  | 0.1  | 77,000         | 7,700       |
| 8  | Total Cost                   |      |                 | 8,999,916   |
| 9  | Revenue                      | 5,914| 4,151.6        | 24,552,562  |
| 10 | Income                       |      |                 | 15,552,647  |
| 11 | R/C                          |      |                 | 2.7         |
| 12 | B/C                          |      |                 | 1.7         |

Source: Processed primary data, 2019 year.
Explanation: n = 123 respondents.

3.3. Equation of Production of Wetland Paddy
The results of the guess equation of Wetland Rice Production at RS 2013/2014 (PRODKT1) are described in detail in table 2. The explanatory variables that significantly affect rice paddy production in RS 2017/2018 are Total Use of Solid Organic Fertilizer (JPOP1), Total Use of Solid Herbicide (JHERBP1), Number of Family Human Labour (JTKMDK1), Number of Rent Human Labour (JTKMSW1), and Cultivated Land Area (LGRP1).

The value of the coefficient of elasticity of paddy production on the number of solid organic fertilizer (EPRODKT1, JPOP1) is 0.00628 (inelastic) means that any increase in the number of solid organic fertilizer 1% will increase rice production by 0.006% at the level trust 85%, meaning that Paddy production is unresponsive to the change in the number of solid organic fertilizer.

The coefficient value of rice production elasticity to the amount of Solid Herbicide (EPRODKT1, JHERBP1) is 0.01130 (inelastic) meaning that every 1% increase of Solid Herbicide will increase rice production by 0.011%, that means Paddy Production Unresponsive to change of amount of solid Herbicide.
The coefficient value of rice production elasticity to the amount of SP-36 fertilizer (EPRODKT1, JTKMSW1) is 0.26146 meaning that any increase of 1% Rent Human Labour amount will increase production rice by 0.26%, meaning that Paddy Field Production is not responsive to changes in the amount of Rent Human Labour. The value of the elasticity of paddy production to the number of solid pesticides (EPRODKT1, LGRP1) is 0.75681 (inelastic) meaning that any increase in the amount of Land Area Cultivated by 1% will increase rice production by 0.76%, meaning that Rice Production is unresponsive to changes in amount of Land Area Cultivated. Sembiring (2018) [7] also conducted research in North Sumatra province, Indonesia it was found that factors that significantly affected the production of paddy namely paddy planted area with value of elasticity are 1.398, that’s mean elastic.

Based on the study of Muhajirin et al. (2014) [8], factors affected by wetland rice production significantly in Sarolangun district, province of Jambi are Land area, number of seed, number of KCL fertilizer, and number of Curater pesticide. Based on the study of Prabandari et al. (2013) [9] in Mambal Subak, Badung Regency and Subak Pagutan in Denpasar City, Bali Province, it is known that the factors that influence rice production significantly are: Number of workers, fertilizer, and water at 99% confidence level.

Asnawi (2013) [10] in his research in Lampung Province found that the factors that influenced the production of inbred and hybrid paddy rice were the area of land and NPK fertilizer. Based on the results of the Siagian (2011a) [11] and Siagian (2011b) [12] study in South Sumatra Province, Indonesia it was found that the factors that significantly affected the production of paddy in the 2009 in Dry Season I were, Number of Certified Seeds, Amount of Urea, Number of SP-36, Amount of other Fertilizers, Amount of Solid Leaf Fertilizer, Cultivated Land Area.

Based on the results of the study of Onibala et al. (2017) [13] in the District of South Tondano-Celebes, Indonesia, it is known that the factors that influence the production of rice fields significantly are: land area, seeds, and Urea fertilizer. Also, the results of the study by Akbar et al. (2017) [14] in Kesesi Sub-district, Pekalongan District, Central Java Province in Indonesia found that factors that significantly affected rice production were land area, production, number of seed purchases, while variable urea and cropping systems did not affect rice productivity.
Falatehan and Othman (2017) [15] found that factors that influence SRI rice production are TSP fertilizer use, NPK fertilizer use, labor use, Karawang regency dummy, SRI dummy, middle region dummy, dummy interaction between Karawang regency dummy and SRI dummy, dummy middle region interaction with SRI dummy.

Lubis (2018) [16] in her research in Langkat District, North Sumatra province, found that factors affected rice production are the site of land, labor, seed, and fertilizer and significance at α = 5%. It was also found that the coefficient of elasticity was 1.671 (elastic), this implies that the production of paddy in Langkat, provide increasing in returns.

Afriani et al. (2019) [17] found that the influence of production factors toward production paddy rice farming, namely the Bestari varieties Salino Village, in Kotabaru District South Borneo, with used Cobb-Douglas type production function shows that production factors (land area, fertilizer, pesticides, human labor, and machine labor) have a significant effect on rice production.

Gultom et al. (2014) [18] in the research about semi-organic rice in Cigombong Subdistrict, Bogor District, West Java showed that the land area variable, seed, compost (manure fertilizer), urea, and labor has a significant effect on production. Variable area of land, compost, and urea significantly at the confidence level of 95%, seeds had a significant effect on the confidence level of 90%, and labor had a significant effect on the confidence level of 85%.

Based on the study of Nwaobiala and Adesope (2014) [19], where the study used the Cobb Douglas function in its analysis. in Bangian Ebonyi State, Nigeria found that the factors that significantly affect rice production on dry land were the age of farmers, farming experience, farm size, input variables, and farmer income. While the factors that significantly affect rice production in swamps were education level, labor costs, farm size, input variables, and farm income.

Based on the study of Ambali et al. (2012) [20] in Nigeria using stochastic frontier analysis, it is known that the variables that affect food production are the amount of farming, the number of rental workers, the number of family workers, and plant materials.

4. Conclusions and Recommendations

4.1. Conclusion
Rice paddy farming in Rainy Season (RS) 2017/2018 has a B/C ratio of 1.7. Productivity of paddy rice was 5.91 tons harvest dry paddy (GKP)/ha.

Significant factors affecting the production of paddy rice in RS 2017/2018 were The amount of use of solid organic fertilizer, The amount of solid herbicide use, The amount of use of human labor rent, and the Cultivated land area.

The cumulative elasticity was 0.97, is inelastic, meaning that the addition of 1% of the production factor will increase production by 0.97% or decreasing return to scale. So rice farming is relatively

4.2. Recommendations
Efficiency is needed in increasing the production of lowland rice by reducing inefficient inputs.

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