Climate, land area and fertilizer distribution policy supports to Lampung strategic food production

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Abstract. Rainfall, land area, and subsidized fertilizer distribution system policies are predicted to affect the production of strategic crops in Lampung Province. This study aims to determine how much influence the rainfall, land area, and distribution system of subsidized fertilizers on the production of rice, corn and cassava in Lampung Province and determine the carrying capacity of climate, land and fertilizer distribution policies on the production of strategic food crops in Lampung. This study used a descriptive analysis method by taking data on rainfall, land area, subsidized fertilizer distribution system and time-series food crop production for 15 years (2002-2016). Data analysis used multiple linear regression with Eviews 9.0 software. Testing data using assumption tests (autocorrelation and multicollinearity), F test (overall), correlation coefficient (r), coefficient of determination (R). The results showed that each 1 mm/year increase in rainfall in Lampung Province from 2002-2016 would reduce rice production by 45.6 tons, corn by 87.97 tons and cassava by 733.6 tons. Meanwhile, every increase of 1 hectare of land in Lampung Province will increase rice production by 6.2 tons, corn 4.65 tons, and cassava 26.01 tons. In addition, the subsidized fertilizer distribution system variable which is also part of the production factor also plays a positive role in the production of rice, corn and cassava. The carrying capacity of rainfall, land area, and the distribution system of subsidized fertilizers on Lampung strategic food crop production are rice 96.1%, corn 86.9% and cassava 79.09%.

1. Introduction
Food crops are agricultural commodities that are very important for the basic needs of the population at all levels (regional, national, and international). Rice, corn and soybeans are strategic food crop commodities [1]. From time to time, the topic of food crops is an endless discussion which has resulted in various information and recommendations in every study conducted. The study of food commodities is a necessity considering the development of the need for food. It always changes according to time developments and shifting factors that influence it.

Lampung is a province with sufficient geographical, agro-ecosystem and human resources to become a strategic food crop production area. The economy of Lampung in general is still dominated by the agricultural sector (food, plantation and livestock). Based on data [2], it was stated that the production of food crops in Lampung Province from 2014 to 2017 is quite good in contributing to national food production, especially the cassava plant which has the highest contribution nationally. In 2017, food crop production in Lampung Province contributed 5.24% (rice), 8.59% (corn) and 28.18% (cassava) to the total national food crop production. This contribution can be continuously increased by improving
the carrying capacity of the factors that affect the production improvement in quantity, quality and continuity.

The three commodities, namely rice, corn, and cassava in the cultivation and development process face various challenges that result in fluctuations in production and affect the availability and value of the product. Therefore, we need a new study on the carrying capacity of the factors that influence the production of strategic food crops, especially in Lampung Province.

The main purpose of this study was to determine how much influence of climate especially the rainfall variable, land area, and distribution system of subsidized fertilizers on rice, corn and cassava production in Lampung Province and determine the carrying capacity of rainfall as climate variable, land and fertilizer distribution policies on production of Lampung strategic food plants.

2. Methodology
This study used descriptive analysis method and was conducted in Lampung Province. The type of data used is time-series data using 15 years of data (2002-2016) including rainfall data as climate variable, land area, policy of subsidized fertilizer distribution systems, and production of food crops (rice, corn, and cassava). The rice commodity data was not specifically categorized as irrigation or non-irrigation. The data were collected from Lampung Statistics Bureau and Lampung Plant Protection Office. The data were compiled and analyzed using multiple linear regression between variables of rainfall, land area, and distribution system policy for subsidized fertilizers on food crop production using Eviews 9.0 software. The multiple linear regression model in this study is as follows:

\[ Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 D_1 \]

where \( Y \) is production of food crops, \( \alpha \) is the intercept of the line on the Y axis, \( \beta_1 \) is multiple linear regression coefficient \( X_1 \), \( \beta_2 \) is multiple linear regression coefficient \( X_2 \), \( \beta_3 \) is multiple linear regression coefficient \( D_1 \), \( X_1 \) is annual rainfall (mm year\(^{-1}\)), \( X_2 \) is land area (ha), \( D_1 \) is dummy variable subsidized fertilizer distribution system (0 = open system fertilizer distribution policy, 1 = closed system fertilizer distribution policy).

In this study, testing was carried out with several assumption tests (autocorrelation test and multicollinearity test), F test (overall), correlation coefficient \( r \), coefficient of determination \( R \) from multiple linear regression equations. [3] stated that the assumption test is carried out to test whether the equations we use or the statistical tests used are normally distributed or not if they are normally distributed, meaning that the data we use is suitable for the Multiple Linear Regression test. It is also stated that the autocorrelation test is used to determine whether or not there is a deviation that occurs between the residuals in one observation and other observations in the regression model. To find out whether there is autocorrelation, it can be seen from the Durbin Watson value \( d \) compared to the Durbin Watson Table value. A good regression model is the absence of autocorrelation with criteria if the value is \( 1.587 < dw < 4-1.587 \) [4].

It was further stated by [3] that multicollinearity test is used to determine whether or not there is a linear relationship between the independent variables in the regression model. The prerequisite that must be met in the regression model is the absence of multicollinearity. The multicollinearity test is carried out by looking at the variance value for inflation factor (VIF) and the Tolerance value in the regression model. A good regression model is that there is no multicollinearity as evidenced by the VIF value <5 and the Tolerance value >0.1. F test to determine whether the independent variables \( X \) are simultaneously (overall) significant to the dependent variable \( Y \). In this test, \( F_{count} (Sig) \) is compared with \( F_{table} \) at a confidence level of 95% or \( \alpha = 5\% \) with the following conditions: if \( \text{sig} < 0.05 \) then \( H_0 \) is rejected (real). If \( \text{sig} > 0.05 \) then \( H_0 \) is accepted (not real). The correlation coefficient \( r \) is used to determine the strength of the relationship between the independent and dependent variables and the relationship between the production component variables.

The coefficient of determination \( R \) is used to determine how much change or variation in a variable is explained by changes or variations in other variables. If the value of \( R \) is getting closer to zero, it
means that the model is not good or the variation in the model in explaining it is very limited, on the contrary, the closer to one, the model is better at explaining independently of the dependent variable.

3. Results and discussion

3.1. Research data

The following table is the rainfall data, land area, subsidized fertilizer distribution system and strategic food crop production in Lampung Province from 2002 until 2016 which obtained from this study [5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20].

| Year | Rainfall (mm) | Land area2) (ha) | Subsidized fertilizer distribution system3) | Production2) (ton) |
|------|---------------|-------------------|--------------------------------------------|-------------------|
|      | Rice          | Corn              | Cassava                                    | Rice             | Corn  | Cassava      |
| 2002 | 1,225.9       | 475,461           | 320,008                                    | 295,156          | 0     | 1,951,109    |
| 2003 | 1,906.1       | 472,635           | 330,852                                    | 298,989          | 0     | 1,966,293    |
| 2004 | 1,994.5       | 495,519           | 364,842                                    | 266,586          | 0     | 2,091,996    |
| 2005 | 2,097.0       | 496,538           | 411,629                                    | 252,984          | 0     | 2,124,144    |
| 2006 | 1,371.6       | 494,102           | 332,640                                    | 283,430          | 0     | 2,129,914    |
| 2007 | 1,615.1       | 524,955           | 369,971                                    | 316,806          | 0     | 2,308,404    |
| 2008 | 1,913.3       | 506,547           | 387,549                                    | 318,969          | 0     | 2,341,075    |
| 2009 | 1,684.1       | 570,417           | 434,542                                    | 309,047          | 1     | 2,673,844    |
| 2010 | 2,548.2       | 590,608           | 447,509                                    | 346,217          | 1     | 2,807,676    |
| 2011 | 1,558.4       | 606,973           | 380,917                                    | 368,096          | 1     | 2,940,795    |
| 2012 | 1,729.6       | 641,876           | 360,264                                    | 324,749          | 1     | 3,101,455    |
| 2013 | 2,467.0       | 638,090           | 346,315                                    | 318,107          | 1     | 3,207,003    |
| 2014 | 2,048.1       | 648,731           | 338,885                                    | 304,468          | 1     | 3,320,064    |
| 2015 | 1,593.3       | 660,560           | 293,521                                    | 279,337          | 1     | 3,641,895    |
| 2016 | 2,200.1       | 796,768           | 340,200                                    | 247,571          | 1     | 4,020,420    |

Data Source: 1)Lampung Statistics Bureau; 2)Lampung Plant Protection Office.
3)0: Open system fertilizer distribution policy 1: Closed system fertilizer distribution policy.

3.2. Assumption test

The results of assumption test that carried out by autocorrelation and multicollinearity tests and was based on rainfall, land area, subsidized fertilizer distribution system and strategic food crop production are shown in table 2 and 3.

| Food crop | Durbin-Watson value | Test results          |
|-----------|---------------------|-----------------------|
| Rice      | 1.886               | No autocorrelation    |
| Corn      | 1.660               | No autocorrelation    |
| Cassava   | 1.660830            | No autocorrelation    |
Table 2 shows that the value of Durbin Watson in rice, corn and cassava plants does not have autocorrelation. This shows that no deviation occurs between the residuals in one observation and other observations in this regression model. The multicollinearity test results of rainfall and rainy days on food crop production in Lampung Province can be seen in table 3.

### Table 3. Multicollinearity test results.

| Food crop | X Variable       | Collinearity statistics (VIF) | Test results          |
|-----------|------------------|-------------------------------|-----------------------|
| Rice      | Rainfall         | 1.156179                      | no multicollinearity  |
|           | Land area        | 3.437143                      |                       |
|           | Fertilizer policy| 3.373756                      |                       |
| Corn      | Rainfall         | 1.325088                      | no multicollinearity  |
|           | Land area        | 1.184688                      |                       |
|           | Fertilizer policy| 1.131232                      |                       |
| Cassava   | Rainfall         | 1.152691                      | no multicollinearity  |
|           | Land area        | 1.155282                      |                       |
|           | Fertilizer policy| 1.304629                      |                       |

Table 3 shows that VIF values are 1.15; 3.43; 3.73 < 5 for rice commodity, 1.325; 1.184; 1.13 < 5 for corn and 1.152; 1.155; 1.304 < 5, then there is no multicollinearity. This means that there is a linear relationship between rainfall, land area and the fertilizer distribution system policy on food crop production in Lampung Province in the regression model. Then this linear regression model fulfills the good regression requirements. Thus the data used in this study are normally distributed so it is feasible to do the Multiple Linear Regression test.

The results of multiple linear regression analysis of rainfall, land area, and the distribution system policy of subsidized fertilizers on the production of strategic food crops in Lampung Province can be seen in table 4.

### Table 4. Multiple linear regression analysis of rainfall, land area, and the distribution system policy of subsidized fertilizers on the production of strategic food crops in Lampung Province.

| Food crop | X Variable       | Unstandardized coefficient | Std.Error |
|-----------|------------------|----------------------------|-----------|
| Rice      | constant         | -872282.0**                | 359149.9  |
|           | Rainfall         | -45.61337**ns              | 97.32066  |
|           | Land area        | 6.224297***                | 0.687055  |
|           | Fertilizer policy| 166655.0**ns               | 121154.5  |
| Corn      | constant         | -528758.0**ns              | 308683.5  |
|           | Rainfall         | 87.97723**s               | 107.8969  |
|           | Land area        | 4.650839***                | 0.897781  |
|           | Fertilizer policy| 469484.6***               | 72652.81  |
| Cassava   | constant         | -3462221.0**ns             | 2411155   |
|           | Rainfall         | 733.6561**ns              | 604.4973  |
|           | Land area        | 26.01792***               | 6.912538  |
|           | Fertilizer policy| 1890275***                | 468674.6  |

** significant at level (α) = 5%.
*** significant at level (α) = 1%.
ns not significant.
3.3. Relationship between rainfall, land area, and subsidized fertilizer distribution system policy on rice production
Rainfall based on the multiple linear regression test below shows that the variable value of rainfall (X1) is -45.61, meaning that every increase in rainfall of 1 mm year\(^{-1}\) will reduce rice production in Lampung Province by 45.61.53 tons. The variable value of rice land area (LLP) is 6,224, meaning that each increase in land area of one hectare will increase rice production in Lampung Province by 6,224 ton per hectare. The dummy variable value (KSP) of 166655.0 indicates that the subsidized fertilizer distribution system has a positive effect of the coefficient variable on rice production in Lampung Province.

\[ \hat{Y} = -872282.0^{**} - 45.61337 CH^{ns} + 6.224297 LLP^{***} + 166655.0 KPS^{ns} \]  

(2)

where \( \hat{Y} \) is rice Production (ton), CH is rainfall (mm year\(^{-1}\)), LLP is area of rice land (Ha), KPS is policy on subsidized fertilizer distribution system (0 = Policy open system fertilizer distribution 1 = fertilizer distribution policy closed system).

3.4. Relationship between rainfall, land area, and subsidized fertilizer distribution system policy on corn production
Rainfall based on the multiple linear regression test below shows that the variable value of rainfall (CH) is 87.97 which means that every 1 mm year\(^{-1}\) increase in rainfall will increase the production of corn in Lampung Province by 87.97 ton. The variable value of land area for corn (LLJ) is 4.6. It is means that every increase in land area of one hectare will increase the production of corn crops in Lampung Province by 4.65 ton per hectare. The dummy variable value (KSP) of 469484.6 indicates that the subsidized fertilizer distribution system has a positive effect on the coefficient variable value of corn production in Lampung Province.

\[ \hat{Y} = -528758.0^{ns} + 87.97723 CH^{ns} + 4.650839 LLJ^{***} + 469484.6 KPS^{***} \]  

(3)

where \( \hat{Y} \) is corn production (ton), CH is rainfall (mm year\(^{-1}\)), LLP is area of rice land (ha), KPS is policy on subsidized fertilizer distribution system (0 = Policy open system fertilizer distribution 1 = fertilizer distribution policy closed system).

3.5. Relationship between rainfall, land area, and subsidized fertilizer distribution system policy on cassava production
Rainfall based on the multiple linear regression test below shows that the variable value of rainfall (CH) is 733.6561 means that each increase in rainfall of 1 mm year\(^{-1}\) will increase the production of cassava plants in Lampung Province by 733.65 ton. The variable value of corn land area (LLJ) was 26.01 meaning that each increase in land area of one hectare would increase the production of cassava plants in Lampung Province by 26.01 ton per hectare. The dummy variable value (KSP) of 1890275 shows that the subsidized fertilizer distribution system has a positive effect of the coefficient variable on the production of cassava plants in Lampung Province.

\[ \hat{Y} = -346222^{ns} + 733.6561 CH^{ns} + 26.01792 LLU^{***} + 1890275 KPS^{***} \]  

(4)

where \( \hat{Y} \), cassava Production (ton), CH is rainfall (mm year\(^{-1}\)), LLP is area of rice land (ha), KPS is policy on subsidized fertilizer distribution system (0 = Policy open system fertilizer distribution 1 = fertilizer distribution policy closed system).

3.6. F Test (Overall)
The results of testing the \( F_{\text{com}} \) of rainfall and rainy days on the production of strategic food crops in Lampung province can be seen in table 5.
Table 5. F Test Results.

| Food crop | F test (Anova) |  |
|-----------|----------------|---|
|           | F              | Prob       |
| Rice      | 117.6214       | 0.000000*** |   |
| Corn      | 32.01521       | 0.000010*** |   |
| Cassava   | 18.65608       | 0.00127***  |   |

*** significant at level (α) = 1%.

Based on the F test above, it shows that all food plants in Lampung Province have a Significant value that is smaller than the probability value (Sig > 0.05). So it can be concluded that the rainfall, land area, and the application of the subsidized fertilizer distribution system in Lampung Province overall have a significant effect on the production variable at the 1% real level.

3.7. Correlation Coefficient (r) and Determination (R)

The correlation coefficient (r) and the coefficient of determination (R) of rainfall and rainy days on food crop production in North Sumatra can be seen in Table 6.

Table 6. Correlation coefficient and determination.

| Food crop | r            | Adjusted R-squared (%) |
|-----------|--------------|------------------------|
| Rice      | 0.8264 (very strong) | 96.1                  |
| Corn      | 0.5319 (quite strong) | 86.9                  |
| Cassava   | 0.2920 (low)      | 79.09                 |

Based on Table 6 above, it shows that the correlation coefficient (r) in rice and corn is classified as very strong and quite strong, respectively 0.826 and 0.531. This shows that rainfall, land area, and fertilizer distribution system policies are linearly correlated and have a very strong and quite strong relationship to rice and corn production in Lampung Province. Meanwhile, the rainfall, land area, and the fertilizer distribution system policy on the production of cassava plants in Lampung Province were classified as low.

Table 6 also shows the coefficient of determination (R) for each strategic food crop commodity in Lampung. For rice commodity, the effect of rainfall, land area, and the distribution system of subsidized fertilizers on rice production in Lampung Province is 96.1% and the remaining 3.9% may be influenced by other factors such as fertilizers, the use of superior seeds which are not studied in this study. The corn commodity shows the effect of rainfall, land area, and the distribution system of subsidized fertilizer by 86.9% and the remaining 13.10% may be influenced by other factors such as fertilizers, use of superior seeds, land conditions and others which were not examined in the study. This. Furthermore, the determination value for cassava is 79.09%, which indicates that 70.09% of the cassava production factor is influenced by rainfall, land area and the distribution system of subsidized fertilizers, the remaining 29.1% is influenced by other factors.

3.8. The effect of rainfall, land area, and subsidized fertilizer distribution system on food crop production in Lampung Province.

Rainfall and land area, and the subsidized fertilizer distribution system are factors that affect agricultural production. In the rainfall variable, every 1 mm year⁻¹ increase in rainfall in Lampung Province will reduce rice production by 45.6 tons. This is in line with research reports [21] which state that a 1% increase in rainfall will reduce productivity of rice to 0.00796% ceteris peribus. Furthermore, it is stated that the increase in maximum temperature and continuous rainfall will enlarge the decrease in rice productivity and in addition, the high amount of rainfall and the small number of sunny days become an optimal constraint on crop production [22]. Rainfall conditions in Lampung province from 2002-2016 had been predicted to be optimum for rice plants so that the results of the regression coefficient analysis show a negative value on rice production. Based on the average rainfall data for 15 years from 2002-
2016 in lampung province, it showed a rainfall of 1863.5 mm year\(^{-1}\), while the requirement for growing rice plants is 1200-2000 mm year\(^{-1}\) [21].

The variable of land area showed a significant effect on rice production in Lampung province, with land expansion every one hectare will increase rice production by 6.2 tonnes. It can be concluded that the land area factor greatly influenced rice production in Lampung Province. Even though the subsidized fertilizer distribution system variable was not significant, it indirectly shows a positive value on rice production. The results of this study were consistent with what was reported by santoso [23] which stated that the factors that influence rice production are the area of rice fields, the realization of subsidized urea fertilizer, the realization of subsidized SP-36 fertilizer, and the realization of subsidized ZA fertilizer.

The effect of rainfall, land area, and the distribution system of subsidized fertilizers as a whole had a significant effect on corn and cassava production in Lampung Province. Hastuti [24], in her research report also stated that there was a significant influence between land area and increased corn production in Gowa Regency, South Sulawesi. This study also produced a significant number on the regression result. The regression coefficient showed that every 1 mm year\(^{-1}\) increase in rainfall would increase corn production by 87.97 ton. This result was smaller in previous studies in North Sumatra, which amounted to 172 tons increase of corn production every 1 mm year\(^{-1}\) of rainfall increase [3]. Meanwhile, the cassava production in South Sulawesi was 733.6 ton which were three times more than the production in North Sumatra, namely 276.4 tons.

In the results of the observation of the variable of land area, the interpretation of each increase in land area of 1 hectare will increase corn production by 4.65 tons, this result is very different from the previous research [25] which stated that the regression coefficient of land area on corn production was 0.34. It is means that if the land area for corn has increased by 1%, then corn production will increase by 0.34%. In other words, every addition of 1 hectare of corn land will increase 0.34 tonnes of corn production.

The variable land area also has a significant effect on cassava production with a regression coefficient of 26.01 which can be interpreted that each increase in land area of 1 hectare can increase the production of cassava by 26.01 tons. This was corresponding as reported by [26] that the average cassava production in Central Lampung reached 26.16 which is far above the average national production of 22.46 tons per hectare. Therefore, based on the relationship between land area and crop production, it can be concluded that land is one of the determining factors for the level of production produced. The larger the planted area the greater the opportunity to produce greater production.

The distribution system of subsidized fertilizers for corn and cassava commodities is also indirectly positive for increased production of corn and cassava. The subsidized fertilizer distribution system with a closed pattern minimized the leakage of fertilizer distribution to other parties who do not have the right to use subsidized fertilizers. Subsidized fertilizer distribution system with a closed pattern is provided based on the Definitive Needs Plan for cultivated agricultural commodity needs with the target only for farmers who are members of farmer groups and are in the official distributor area or kiosk of subsidized fertilizer [27].

4. Conclusions and suggestions
1. Rainfall as a climate variable shows that every 1 mm year\(^{-1}\) increase in rainfall in Lampung Province from 2002-2016 will reduce rice production by 45.6 tons. Meanwhile, every 1 mm year\(^{-1}\) increase in rainfall will increase corn by 87.97 tons and cassava by 733.6 tons. Every increasing of 1 hectare of land in Lampung Province, it will increase the rice production by 6.2 tons, corn 4.65 tons and cassava 26.01 tons. In addition, the subsidized fertilizer distribution system variable which is also part of the production factor also has a positive role in the production of rice, corn and cassava.
2. The carrying capacity of rainfall, land area and the distribution system of subsidized fertilizers to the strategic food crop production in Lampung, namely the rice production of 96.1%, corn 86.9% and cassava 79.09% is 5.2. The further research is needed on the carrying capacity of rainfall, land area
and fertilizer policy on food crop production using a longer data range of at least 30 years to predict the amount of support for these variables for the next 10 years on food crop production.

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**References**

[1] Syafa’at N and Simatupang P 2006 Kebijakan pemantapan ketahanan pangan nasional kedepan (in Bahasa) *J. Pangan* **15** (2) 24–43

[2] Pusdatin 2018 *Statistik Pertanian 2018* (in Bahasa) ed A. Susanti and B. Waryanto (Jakarta: Pusat Data dan Sistem Informasi, Indonesian Ministry of Agriculture)

[3] Tampubolon K, Sulasri Y S, Hamzani I, Vika M and Debora 2017 Kontribusi curah hujan dan hari hujan terhadap produksi tanaman pangan di Sumatra Utara (in Bahasa) *J. Teknologi* **2** 64–80

[4] Nuryanto and Pambuka Z 2018 *Eviews untuk Analisis Ekonometrika Dasar, Aplikasi dan Interpertosiai* (in Bahasa) ed M Setio (1st ed.) (Magelang: Unimma Press)

[5] BPS Lampung 2002 *Lampung Dalam Angka 2002* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[6] BPS Lampung 2003 *Lampung Dalam Angka 2003* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[7] BPS Lampung 2004 *Lampung Dalam Angka 2004/2005* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[8] BPS Lampung 2006 *Lampung Dalam Angka 2006* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[9] BPS Lampung 2007 *Lampung Dalam Angka 2007* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[10] BPS Lampung 2008 *Lampung Dalam Angka 2008* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[11] BPS Lampung 2009 *Lampung Dalam Angka 2009* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[12] BPS Lampung 2010 *Lampung Dalam Angka 2010* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[13] BPS Lampung 2011 *Lampung Dalam Angka 2011* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[14] BPS Lampung 2012 *Lampung Dalam Angka 2012* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[15] BPS Lampung 2013 *Lampung Dalam Angka 2013* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[16] BPS Lampung 2014 *Lampung Dalam Angka 2014* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[17] BPS Lampung 2015 *Lampung Dalam Angka 2015* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[18] BPS Lampung 2016 *Provinsi Lampung Dalam Angka 2016* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[19] BPS Lampung 2017 *Lampung Dalam Angka 2017* (in Bahasa) (Lampung: Lampung Statistics Bureau)

[20] BPS Lampung 2018 *Provinsi Lampung Dalam Angka 2018* (in Bahasa) (Lampung: Lampung Statistics Bureau) 1–310

[21] Nurhayanti Y and Nugroho M 2015 Sensitivitas produksi padi terhadap perubahan iklim di
Indonesia tahun 1974-2015 (in Bahasa) *J. Agro Ekonomi* **27** (2) 183–196

[22] Masdar M, Kasim M, Rusman B, Hakim N and Helmi H 2006 Tingkat hasil dan komponen hasil sistem intensifikasi padi (Sri) tanpa pupuk organik di daerah curah hujan tinggi (in Bahasa) *J. Ilmu-Ilmu Pertanian*

[23] Santoso A B 2015 Effect of land use and subsidized fertilizer for national rice production *J. Ilmu Pertanian Indonesia* **20** (3) 208–212

[24] Hastuti D R 2016 Permodelan ekonometri dampak penggunaan input produksi dan karakteristik reponden terhadap peningkatan produksi jagung kuning (in Bahasa) *J. Ekonomi Pembangunan* **2** (2) 161–171

[25] Habib A 2013 Analisis faktor-faktor yang menpengaruhi produksi jagung (in Bahasa) *J. Agrium* **18** (1) 79–87

[26] Anggraini N, Harianto and Anggareni L 2016 Efisiensi teknis, alokatif dan ekonomi pada usahatani ubikayu di Kabupaten Lampung Tengah, Provinsi Lampung (in Bahasa) *J. Agribisnis Indonesia* **4** (1) 43–5

[27] Indonesian Ministry of Agriculture 2019 *Statistik Peternakan dan Kesehatan Hewan 2019/ Livestock and Animal Health Statistics 2019* (in Bahasa) ed M Nurdiman, A Ramadhany and L Ermansyah