

## **Efficiency of Production Factors use of Corn Farming in Type C Tidal Land, Banyuasin Regency**

*Efisiensi Penggunaan Faktor Produksi Usaha Tani Jagung di Lahan Pasang Surut Tipe C Kabupaten Banyuasin*

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### **ABSTRAK**

Tujuan penelitian ini adalah menganalisis faktor-faktor produksi yang mempengaruhi produksi usaha tani jagung, efisiensi dan elastisitas penggunaan faktor produksi usaha tani jagung. Penelitian ini dilakukan di Desa Mulia Sari, Kecamatan Tanjung Lago, Kabupaten Banyuasin, sampel random 30 petani jagung dari 320 anggota populasi. Hasil penelitian menunjukkan faktor-faktor yang memiliki pengaruh positif yang signifikan terhadap produksi jagung adalah penggunaan pupuk urea dan pupuk SP-36, sedangkan penggunaan herbisida memiliki efek negatif, penggunaan tenaga kerja, pupuk KCl, insektisida dan ZPT tidak berpengaruh signifikan, penggunaan tenaga kerja dan ZPT secara teknis tidak efisien, penggunaan pupuk urea, SP-36, KCl, insektisida dan ZPT secara teknis efisien. Secara keseluruhan penggunaan faktor produksi pada usaha tani jagung secara teknis, ekonomis dan harga efisien, dan nilai elastisitas sebesar 0,925.

Kata kunci: efisiensi, elastisitas, pasang surut, pengaruh

### **ABSTRACT**

The purpose of this study were to analyze the production factors affecting corn farming, the efficiency and elasticity of the use of production factors in corn farming. This research was conducted in Mulia Sari Village, Tanjung Lago District, Banyuasin Regency. A random sample of 30 corn farmers from 320 populations was employed in this research. The results showed factors that had a significant positive effect on corn production were the urea fertilizer and SP-36 fertilizer, while the factor of herbicides had a negative effect, and factors of labor, KCl fertilizer, insecticide and ZPT had no significant effect, labor and growth regulator were technically inefficient, while the urea, SP-36, KCl fertilizers, and insecticides were technically efficient. Overall, the use of production factors in corn farming was technically efficient in term of economy and price with the elasticity value by 0.925.

Keywords: efficient, elasticity, influence, tidal land

### **INTRODUCTION**

Corn (*Zea mays* L.) is one of the most important food crops in the world, besides

wheat and rice. As the main carbohydrate source in Central and South America, corn is also an alternative food source of staple food of the residents of several regions in

Indonesia (for example in Madura and Nusa Tenggara) (Khalik, 2010). Apart from being a source of carbohydrates, corn is also cultivated for animal feed (forage or cob), oil (taken from seeds), flour (made from seeds, known as cornstarch), and industrial raw materials (from seed flour and cob flour) for pentose, which is used as a raw material for furfural production. Corn which has been genetically engineered is also now cultivated for pharmaceutical ingredients (Soekartawi, 2003; Adisarwanto and Yustina, 2004).

South Sumatra, as one of the provinces with diverse agroecosystems, is one of the contributors of national corn production. Based on statistical data, the area of corn harvest in South Sumatra in 2017 was 138,232 hectares. (Central Bureau of Statistics, 2018). Some mainstay areas of corn development are South OKU Regency with harvest area of 39,414 hectares, East OKU Regency of 25,667 hectares, and Banyuasin Regency of 20,510 hectares. Other regencies in South Sumatra Province are less suitable for the development of maize plants, only limited to side crops and focus more on the development of other food crops.

As one of the regencies that has become the mainstay of the South Sumatra region in terms of corn production, the Banyuasin Regency government attempted to increase corn production in order to achieve the goal of self-sufficiency in corn. In 2017, the Minister of Agriculture of the Republic of Indonesia announced the integration of corn plants between Palm Oil and Rubber plants, so that the area of corn plants in Banyuasin Regency during 2017 reached 20,000 hectares.

Observing such an agroecosystem, Banyuasin Regency still has the potential for the development of corn after other food crops. In fact, with an increase in cropping index (IP), it is possible to plant corn after rice or vice versa (Akil and Dahlan, 2009). In fact, in 2017 the implementation of the program reached and even beyond the target of planting area of 22,712 hectares

(Statistical Report of the Banyuasin Distan, 2018).

Banyuasin Regency corn production in 2017 reached 147,605.7 tons, which means that the average production per hectare was 6.75 tons per hectare, making it higher than the national average of 6.57 tons per hectare. This showed that the corn commodity (Goldsworthy, 2000) is very suitable to be developed in Banyuasin Regency, especially in sub-districts that have not yet reached the planting index (IP) 200 such as Air Saleh District, Muara Padang District, Makarti Jaya District, Air Telang District, Sumber District Marga Telang and part of Banyuasin II District.

In order to develop production through the application of the 200 Planting Index, in the context of increasing the economic performance of maize commodities, it is necessary to conduct research on the relationship of various micro factors, both aspects of production such as productive area, new area, replanting corn production, and aspects of corn production related with the demand and price of corn as well as aspects of the corn trade. The research was conducted in tidal land type C of Mulia Sari Village, Tanjung Lago District, Banyuasin Regency.

Tidal land type C is the tidal land with the condition of the land not flooded but the depth of ground water at high tide is less than 50 cm (Munir, 2001; Hardjowigeno, 2003; Ermanita *et al.*, 2004). Efforts to increase production can be done by means of intensification by increasing the use of production factors such as labor, capital and technology on a fixed area of land, and extensification by extending the planting area without adding capital, labor and technology (Rukmana, 2009). This phenomenon created the chance of research on how to manage corn commodities so that farmers can use production factors efficiently. Based on this background, this study aims to analyze the factors of production that affect the production of corn farming in Mulia Sari Village, and analyze the efficiency and elasticity of the

use of corn farming production factors in Mulia Sari Village.

**MATERIALS AND METHODS**

This research was conducted in the tidal land of Mulya Sari Village, Tanjung Lago District, Banyuasin Regency, with consideration that it is one of the biggest corn producing districts in Banyuasin Regency. The research method is a survey (a method by taking a sample of a fairly large population) (Babbie, 1990; Sugiyono, 2013). The sampling method uses a random sampling, with a total sample of 30 sample farmers from 320 population members (Nasution, 2012; Cochran, 1965). Data in the field was obtained through direct interviews with sample farmers using a list of questions or questionnaires that had been prepared (Soekartawi, 2002). Analysis of the data illustrated the relationship between input and output in the production process known as the Cobb Douglas production function application, through the SPSS 16.0 program for Windows, with the following equation (Soekartawi, 2003):

$$Y = \alpha \cdot X^{b1} \cdot X^{b2} \cdot X^{b3} \cdot X^{b4} \dots E^U$$

This equation was then changed in the form of logarithm with formula as follows:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + u$$

To estimate the factors that influence output (Y), the Cobb-Douglas model is appropriate, because this model is the most relevant model. Furthermore, the MLE (Maximum Likelihood) method will present the coefficients of each of these factors that affect production or the dependent variable.

**Uji Efisiensi**

Efficiency is a relative concept. Testing of efficiency is performed to see how the combination of certain factors of production can produce optimal output. There are three

concepts of efficiency, namely technical efficiency (ET), economic efficiency (EE), and price efficiency (EH). Technical efficiency is a production process using a combination of only a few (smallest) input sets to produce the largest output (in this study the value of technical efficiency is automatically seen from the output of the regression coefficient). Price efficiency is a production process using a certain level of output that can produce similar output, with lower costs. In this study the value of price efficiency is calculated by the formula:

$$NPM = bYpYxPx$$

- b : coefficient of elasticity
- Y : output
- Py : output price
- X : production factor
- Px : price of production factor

Economic efficiency will be achieved if technical efficiency and price efficiency have been achieved, calculated by the equation:

$$EE = ET \times EH$$

If the efficiency has value of more than 1, it means the use of inputs needs to be increased, if the value of efficiency = 1, it means the optimal input allocation, if the efficiency value less than 1, it means the use of inputs needs to be reduced (Soekartawi, 2003).

In accordance with the initial hypothesis in this study that if the average efficiency (technique, price, and economy) values are not equal to one, then the hypothesis is accepted. But if the value of efficiency (technique, price, and economy) is on average equal to one, then the hypothesis is rejected.

**Approaching Model**

The approaching model in this research was the diagrammatic approaching model as shown in Figure 1.

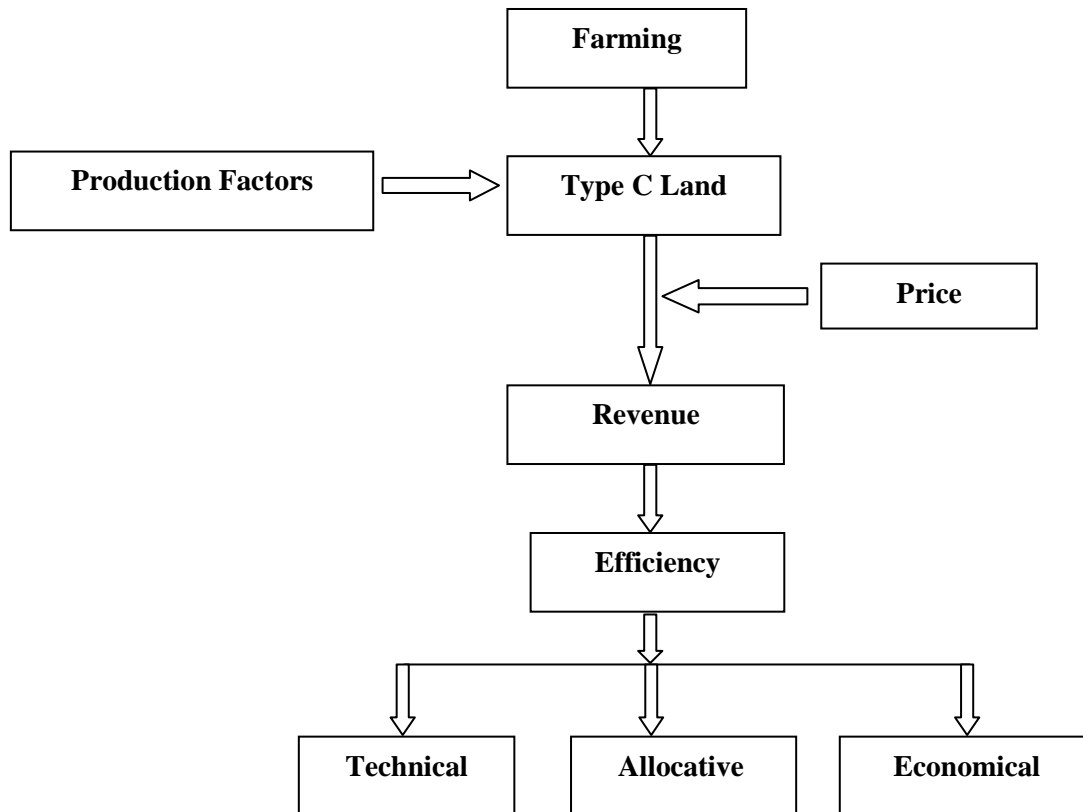


Figure 1. Diagrammatic model of the relationship between corn farming and its technical, allocative, and economical efficiency.

## RESULTS AND DISCUSSION

### Factors That Influence Corn Production

There are seven factors that were suspected to influence the productivity of corn farming, namely the amount of labor (TK), the dose of Urea fertilizer (DU), the dosage of SP-36 (DS), the dose of KCl fertilizer (DK), the dose of herbicide (DH), the dose insecticide (DI), and dose of growth regulator (DZ).

Variable land area was not included because the area of land owned by the same farmers was one hectare. Likewise with the number of seeds, the amount per hectare used was the same. The magnitude of the influence of these factors was determined by the analysis of the multiple regression equation and because the equation that would be assumed to be a production function, multiple Cobb-Douglas type

regression was employed. The results of the alleged regression equation using the help of a SPSS computer program (Table 1).

The alleged results in Table 1 can also be presented in the form of the guessed regression equation as follows:

$$Y = -2,082TK^{-,065}DU^{,826}DS^{,247}DK^{,134}DH^{-,404}DI^{,051}DZ^{,136}t^{-1,877}-0,065$$

$$0,8260,2470,134-0,4040,0510,136$$

$$R^2 = 0,475; F_{hit} = 2,840; df = 29; dw = 1,823$$

or in the linier form as follows:

$$Y = -2,082 - 0,065\text{LogTK} + 0,826\text{LogDU} + 0,247\text{LogDS} + 0,134\text{LogDK} - 0,404\text{log DH} + 0,051\text{Log DI} + 0,136\text{Log DZ}$$

Table 1. The estimation result of factors affecting the production of corn farming in Mulia Sari Village, Tanjung Lago District, Banyuasin Regency, 2018

Variable	Regression Coefficient	t value	Sig.	Remarks
Intercept	-2,082	-1,877	,074	A
Log Labor(LTK)	-,065	-,212	,834	-
Log Urea fertilizer dosage (LDU)	,826	1,744	,095	A
Log SP-36 fertilizer dosage (LDS)	,247	1,241	,228	C
Log KCl fertilizer dosage (LDK)	,134	,855	,402	-
Log Herbicide dosage (LDH)	-,404	-1,182	,250	C
Log Insecticide dosage (LDI)	,051	,277	,785	-
Log Growth Regulator dosage (LDZ)	,136	,962	,347	-
R2 = 0,475; F=2,840; df = 29; dw = 1,823				
F-tabel (5%) = 2,4638; t-tabel(5%)= 2,04				

Remarks: A = significant at  $\alpha = 10\%$ , B = significant at  $\alpha = 15\%$ , C = significant at  $\alpha = 25\%$

Table 2. The average use of production factors, input price, product price, and product quantity in Mulia Sari Village, Tanjung Lago District, Banyuasin, Regency, 2018

Production Factor	Usage quantity	
	Dosage (kg or ltr/ha)	Price (IDR/kg/ltr)
Labor	25,37	92.497
Urea Fertilizer	410,00	2.000
SP-36 Fertilizer	316,67	2.400
KCl Fertilizer	85,00	9.000
Herbicide	4,67	60.000
Insecticide	0,92	234.667
Growth Regulator	3,90	58.928

Remarks : Pproduction = 4,68 ton, Price= Rp. 3.272.155/ton

Table 3. The value of efficiency of the use of production factors in Mulia Sari Village, Tanjung Lago District, Banyuasin Regency, 2018

Xi	PR (Y/Xi)	PM ( $\beta \times PR$ )	NPM (PMxHy)	Hx	Efficiency Index	t <sub>statistic</sub>	Criteria
25,37	0,184	- 0,012	- 39.212	92.497	- 0,42	- 1,44	E
410,00	0,011	0,009	30.830	2.000	15,41	1,84	E
316,67	0,015	0,004	11.936	2.400	4,97	1,32	E
85,00	0,055	0,007	24.124	9.000	2,68	0,79	E
4,67	1,002	-0,405	-1.324.783	60.000	- 22,08	-1,31	E
0,92	5,102	0,260	851.391	234.667	3,63	0,22	E
3,90	1,199	0,163	533.635	58.928	9,06	0,96	E

Remarks: 1. Labor, 2.Urea, 3. SP-36, 4. KCl, 5. Herbicide 6. Insecticide, 7. growth regulator, t-tabel (5%)=2,04, E= Efficiency

### Level of Efficiency and Elasticity in the use of Production Factors in corn farming

The large number of inputs used in a production process will affect the amount of output produced. Efficiency is an attempt to use the smallest possible input to obtain the maximum output. To determine the technical efficiency of the use of production factors can be done by looking at the elasticity of production that can be known from the regression coefficients in the Cobb-Douglas type regression equation.

Price or allocative efficiency can be achieved when the Marginal Product Value (NPM) is the same as the Input Price (Hx). Conclusions about the condition of inefficient use of production inputs in order to apply to the population, then the index k was done using the t test.

If the index value t is smaller or equal to the value of t table at a certain level of confidence, then the use of production inputs is allocatively efficient, conversely if the t-index value is greater than t table, then it is inefficient/inefficient. More clearly the

results of price efficiency analysis can be seen in the following table.

### The use of Input

The input of corn farming production in this research location were labor, Urea fertilizer, SP-36, KCl, herbicide, insecticide and growth regulator (ZPT). The land was not included in the analysis because the area is the same among farmers, and so is the seed of the same number of uses per hectare between farmers. Average dose of input use and price are shown in Table 2. Table 3 shows the value of the efficiency of the use of corn farming production factors (Table 3).

### Discussion

#### Regression Analysis

Based on the summary of the regression results presented or the alleged regression equation in Table 1, economically this estimation equation was satisfactory as seen from the magnitude of all estimated parameter values close to the value of one, which refers to elastic criteria ie if it is smaller than one it is called inelastic, whereas if it is greater than one, it is called elastic. Values greater than one will not be too far from one let alone up to two digits, the expected parameter sign, the sign can be positive or negative. If it is negative, technically the use of the production factor is excessive, whereas if it is positive it can mean that the use has not been efficient or technically efficient.

This means that economically, the results of the alleged equation had no problem. Statistically, the results of this alleged equation had been relatively good, although the coefficient of determination (R<sup>2</sup>) was relatively small at 47.50 percent, this indicated the use of labor and the dose of use of inputs (Urea fertilizer, SP-36, KCl, herbicide, insecticide and growth regulators) can explain 47.50 percent of the variation in corn productivity, the remaining 52.50 percent is caused by other factors.

Factors did not included in the equality model such as land area, number of seeds, farmers' experience, farmers' education and guidance provided by the instructor. The relatively small value of the coefficient of determination does not matter if the purpose of the study was not to make a forecast as in the purpose of this study. So that the R<sup>2</sup> value generated by the alleged equation below 50 percent was not used as an indicator of dominant statistical criteria. Then from the joint test represented by the F test, it was good because it was statistically significant at the 95 percent confidence level ( $\alpha = 5$  percent). Furthermore statistical criteria based on individual tests namely the t test were also quite satisfactory because by using the lowest level of confidence 75 percent ( $\alpha = 25$  percent), three independent variables were significant and four were not statistically significant.

Although the number of significant independent variables was less than the insignificant, but from other criteria, especially econometric criteria, namely multicollinearity does not occur, then this condition was not a problem (it can be concluded that the statistical equation is satisfactory). Based on econometric criteria, the results of the alleged equation were also satisfactory. Econometrics criteria can be seen from the presence or absence of multicollinearity, autocorrelation and heteroscedasticity problems.

Multicollinearity problems (Barbara *et al.*, 1983) can be seen from the Tolerance and VIF (Variant Index Factor) results of data processing with SPSS. Tolerance value cannot be less than 0.1, while VIF value cannot be more than 10. If this is violated, there will be a multicollinearity problem.

Regression results show that tolerance values range from 0.29 to 0.48, while VIF values range from 1.9 to 3.5 (this means that the assumed equation does not have multicollinearity problems). The second econometrics criterion, the autocorrelation

problem, can be seen from the Durbin Watson (dw) value of the alleged regression equation. The alleged equation does not indicate an autocorrelation problem if the dw value is close to 2, conversely if it approaches 0 a positive autocorrelation will occur and if it approaches 4 there is a negative autocorrelation. The Durbin Watson test value obtained from the regression results is 1.82 (the dw value is close to 2), so it can be concluded that there is no autocorrelation problem in the results of the alleged regression obtained. Furthermore, the last criterion of econometrics is the problem of heteroscedastasis.

The problem of heteroscedasticity can be seen from the results of data processing with SPSS and if the image of the relationship between standardized residual values (regression studentized residuals) with standardized predicted values does not have a certain pattern. Based on the resulting image, there was no pattern, so it could be concluded that there was no heteroscedastity problem in the obtained equation. It could be concluded that the econometric equation of the regression equation was satisfactory. Based on the description that discusses the three criteria, namely economic criteria, statistics and econometrics, it can be concluded that the regression equation obtained was satisfactory, so it can be interpreted the value of the influence of each. The following will discuss the effect of each variable on the production of corn.

### **The Influence of Labor Usage**

The influence of labor usage on corn productivity was -0.065 which was the estimated parameter value. This value after being tested with the t test turned out to be insignificant at the level of  $\alpha = 25$  percent because of the significant level of 0.834, this meant that the productivity of corn was not affected by the amount of outpouring of labor. The average workforce used at the study site was 25.37 Days of Workers (HOK), while according to the standard it

was 62 HOK, meaning the amount of workforce use was less than half lower than the recommendation, so it was natural for workers to have no significant effect on corn productivity. Labor was used for land preparation, planting, maintenance and harvesting. Because of maintenance activities, the use of herbicides and growth regulators (ZPT) were not in accordance with the recommendations so that the use of labor was also reduced.

### **The Influence of the Dose of Urea Fertilizer**

The effect of the dose of the use of urea fertilizer on corn productivity can be seen from the estimated parameter values of the variable which was 0.826. This value turned out to be statistically significant at  $\alpha = 0.10$  (90 percent confidence level). Because the value of this parameter was automatically an elasticity value, corn production was not responsive to changes in the dose of Urea fertilizer, meaning that the parameter value if the dose of urea fertilizer increased by one percent, then corn production would increase by 0.826 percent or vice versa. Based on the data, the dose of using urea fertilizer was an average of 410 kg per hectare. When compared to the recommended dosage (300-450) kg per hectare, the dose of the use of urea fertilizer by farmers was in accordance with the recommended dosage (Sutejo, 2002).

### **The Influence of the Dose of SP-36 Fertilizer**

The influence of the use of SP-36 fertilizer dosage can be seen from the estimated parameter values of the variable in the regression equation that was equal to 0.247. This value was then performed a t test and it turned out that the use of fertilizer was significant at  $\alpha = 25$  percent. This means that if the SP-36 fertilizer dose was added by one percent, then corn production would increase by 0.247 percent or vice versa, *ceteris paribus*. The average use of SP-36 fertilizer was 316.67 kg per hectare. The recommended dosage for SP-

36 fertilizer was 100 kg per hectare, this meant the dosage applied by farmers was three times more than the recommendation.

### **The Influence of the Dose of KCl Fertilizer**

The effect of the dose of the use of KCl fertilizer can be seen from the estimated parameter values of the variable in the regression equation that was equal to 0.138. This value was then performed a t-test and it turned out that the use of KCl fertilizer was not significant to a maximum level of confidence of 75 percent. This meant that adding or reducing the KCl fertilizer dosage will not significantly affect the corn production. In this condition, not all fertilizer applied to the soil can be absorbed by plants. According to Olson and Sander (1988), several factors that influence the availability of nutrients in the soil to be absorbed by plants include the total supply of nutrients, soil moisture and aeration, soil temperature, and physical and chemical properties of the soil (all of these factors are generally applicable to each element nutrient).

### **The Influence of the Dose of Herbicide**

The effect of the dose of herbicide use on corn productivity can be seen from the estimated parameter values of the variable which was -0.404. This value turned out to be statistically significant at  $\alpha = 0.25$  (75 percent confidence level). Because the automatic parameter value was the elasticity value, maize production was not responsive to changes in herbicide dosage. The meaning of the parameter value if the dose of herbicide increases by one percent, then corn production will decrease by 0.404 percent or vice versa (in this condition the parameter value has a negative effect on plants) (Sastroutomo, 1990).

### **The Influence of the Dose of Insecticide**

The effect of the dose of insecticide use can be seen from the estimated parameter values of the variable in the regression equation that was equal to 0.051. This value

was then carried out a t test and it turned out the use of insecticides was not significant to a maximum level of confidence of 75 percent. This meant the addition or reduction of insecticide doses did not significantly affect the corn production (Sastroutomo, 1990).

### **The Influence of the Dose of Plant Growth Regulators (PGR)**

The effect of the use of growth regulator on corn productivity was 0.136. This value after being tested with the t test was apparently not significant at the  $\alpha = 25$  percent level, because the significance level was 0.347. This means that corn productivity was not affected by the PGR dose, so with an estimated parameter value of less than one which was 0.069, it meant that production was not responsive to changes in the PGR dose. The average dose of PGR used at the study site was 3.90 liters per hectare (PGR is an element of the hormone also known as phytohormone which has a significant effect on stimulating, inhibiting or changing plant growth, development and movement). PGR is different from plant nutrients or nutrients, both in terms of function, shape, and its constituent compounds. Each type of plant has a different response to the growth regulators given. (Dwijoseputro, 1990).

### **The Analysis of Technical Efficiency**

The elasticity of the Cobb-Douglas type production function Was shown from the regression coefficient values of each production factor. The factors of corn production were as follows.

#### **a. Labor**

The estimated parameter values in the Cobb Douglas type regression equation were elastic values, so the elasticity value of the labor variable as presented in Table 1 was -0.065. The value of the elasticity of labor production was negative ( $E_p < 0$ ) indicating that the use of 25.37 HOK laborers was irrational or is in region III, the area of increasing yields which was



increasingly reduced. So that the workforce on this type of land must be reduced. Though the use of labor was still below the standard of use of labor for corn plants which amounted to 62 HOK. This was because in tidal land more labor was needed for processing and maintaining land (Ridwan, 1992; Saidah *et al.*, 2004; Rukmana, 2009).

#### **b. Urea Fertilizer**

The estimated parameter value of the Urea fertilizer variable as presented in Table 1 was 0.826. The elasticity value of urea fertilizer production was between zero to one ( $0 < Ep < 1$ ) or is in the production area II, namely the rational area. This means the dosage of using Urea fertilizer was 410 kg per hectare. The dosage of the use of this fertilizer was in accordance with the recommended dosage of Urea fertilizer for corn plants which was (300-450) kg per hectare.

#### **c. SP-36**

The estimated parameter values for the SP-36 fertilizer variable as presented in Table 1 was 0.247. The elasticity value of this fertilizer production was between zero to one ( $0 < Ep < 1$ ) or was in the area of production II, namely the rational area. This means that the use of SP-36 fertilizer was 316.67 kg per hectare. This dosage of fertilizer use was more than three times the recommended dosage for corn plants which is only 100 kg per hectare (this was because in the tidal land, more phosphorus was needed compared to other mineral fields).

#### **d. KCl**

The estimated parameter value of the KCl fertilizer variable as presented in Table 1 is 0.134. The elasticity value of this fertilizer production, which was between zero to one ( $0 < Ep < 1$ ) or is in the area of production II, namely the rational area. This means that the use of KCl fertilizer which was 85 kg per hectare was technically efficient. The dosage of the use of fertilizer was almost close to the recommended

dosage for corn, which was 100 kg per hectare.

#### **e. Herbicide**

The estimated parameter value of the herbicide variable as presented in Table 1 was -0,404. The elasticity value of this herbicide production was negative, meaning that it was in the production area III ( $Ep < 0$ ) or irrational region. This means that the dosage of herbicide used had exceeded recommended or technically inefficient. The dosage of herbicide used was 4.67 liters per hectare, exceeding the recommended dosage of only 2 liters per hectare.

#### **f. Insecticide**

The estimated parameter value of the insecticide variable as presented in Table 1 was 0.051. The elasticity value of this insecticide production was positive and had a value between zero and one ( $0 < Ep < 1$ ), which means that it was in production area II or rational area. This means the dosage of herbicide use was technically efficient. The insecticide dose used was 0.92 liters per hectare, almost close to the recommended dose of 1 liter per hectare.

#### **g. Plant Growth Regulators (PGR)**

The estimated parameter value of the PGR variable as presented in Table 1 was 0.136. The PGR production elasticity value was positive and had a value between zero and one ( $0 < Ep < 1$ ), which means that it was in the production area II or the rational area. This means that the dose of using PGR was technically efficient. The PGR dose used was 3.90 liters per hectare in type C land, in accordance with the recommended dosage (3-4 liters) per hectare.

#### **Price Efficiency**

Furthermore, based on Table 3, all production factors used in corn farming have reached price efficiency, which are as follows:

### a. Labor Usage

Based on the calculation of the efficiency of the use of corn production factors as shown in Table 3, the efficiency index value for the labor variable was -0.42. The efficiency index value shows the ratio between the value of marginal products (NPMx) and factor prices (Hx). The efficiency index value was smaller than 1. Then to find out the statistical value expressed by the t-count value, the different efficiency index value (k) was tested.

Furthermore, the t-count value is compared with the t-table value. The level of confidence used in this test was 95 percent or at the real level of 5 percent ( $\alpha = 5\%$ ). The tcount obtained was -1.44 at the 95 percent confidence level. Furthermore, this value was compared to the value of table, where the value was 2.04, this means the value of count was smaller than table. This shows that the efficiency index value was not significantly different from one ( $k = 1$ ) which means that the use of an average labor of 25.37 HOK per hectare was allocatively efficient or has reached price efficiency.

Although according to the recommended number of workers was 62 HOK per hectare. HOK depends on the number of workers, working days, and hours of work per day, but at the location of this study it seemed that the use of less than half the recommendations was efficient (Ridwan, 1992; Saidah *et al.*, 2004; Rukmana, 2009).

### b. Urea Usage

The use of urea fertilizer has been allocatively efficient or reached price efficiency. This was because the calculated value of the efficiency index test (1.84) was still smaller than the value of 2.04 at a 95 percent confidence level. The fertilizer dose used by farmers is 410 kg per hectare according to the recommendations, which was between (300-450) kg per hectare. According to Azzaimy (2016), nitrogen or Urea fertilizer was usually used in three stages of administration, the first stage was

75 kg, the second stage was 150 kg, and the third stage was 75 kg, so that in one hectare the dose of urea fertilizer was 300 kg. This means that the Urea fertilization dose carried out will result in additional costs incurred was still smaller than the income received (Sutejo, 2002) as a result of the addition of a unit of additional costs of these inputs.

### c. SP-36 Usage

The use of SP-36 fertilizers had also been allocatively efficient or achieved price efficiency. This was because the calculated value of the efficiency index test (1.32) was still smaller than the value of 2.04 at a 95 percent confidence level. The fertilizer dosage used by farmers, which was 316 kg per hectare, had exceeded the recommendation of only 100 kg per hectare (Azzamy, 2016). In this condition, although the dosage exceeds the recommendation, the dosage would result in additional costs incurred was still smaller than the income received as a result of adding one unit cost of the SP-36 fertilizer.

### d. KCl Usage

The efficiency index value for KCl fertilizer or the comparison of the marginal product value (NPMx) with the price of production factor (Hx) was 2.68, which means the efficiency index value was greater than 1. Then a different efficiency index value was tested using the t test and the real level used was equal to 5%, then the tcount value obtained was 0.79. If the tcount value was compared to the ttable value (2.04), then the efficiency index was not significantly different from one ( $k = 1$ ) because the tcount was smaller than the ttable. This means that the use of KCl fertilizer at the research location was efficient by using allocative efficiency criteria. The dose of KCl fertilizer used by farmers was 85 kg per hectare, while the recommended dosage was (50-100) kg per hectare (Azzamy, 2016). This means that the dose used by farmers was in accordance with what was recommended.

**e. Herbicide usage**

The use of herbicides had been allocatively efficient or reached price efficiency. This is because the calculated value of the efficiency index test (-1.31) was still smaller than the value of 2.04 at a 95 percent confidence level. The dose of herbicide used by farmers was 4.67 hectares, which was twice the recommended dosage of only 2 liters per hectare (Dessy, 2015).

This means that at the dose of the use of the herbicide, even though more than the recommendation will still result in additional costs incurred less than the income received as a result of the addition of one additional unit of input costs.

**f. Insecticide usage**

The use of insecticides had also been allocatively efficient or achieved price efficiency. This was because the calculated value of the efficiency index test (0.22) was still smaller than the value of 2.04 at a 95 percent confidence level. The insecticide dose used by farmers was 0.92 liters per hectare which was already close to the recommended dosage of 1 liter per hectare (Dessy, 2015).

This means that at the dose of the use of the insecticide even though a little smaller than the recommendation would result in additional costs incurred less than the income received as a result of the addition of a unit of additional costs of these inputs.

**g. PGR usage**

The use of PGR had also been allocatively efficient or achieved price efficiency. This was because the calculated value of the efficiency index test (0.96) was still smaller than the value of 2.04 at a 95 percent confidence level. The dose of ZPT used by farmers was 3.90 liters per hectare which was in accordance with the recommendations, namely (3-4) liters per hectare (Sitompul and Guritno, 1995). This meant that at the dose of the use of the ZPT it would still produce additional costs incurred less than the income received as a

result of the addition of one additional unit of input costs.

**The value of production elasticity**

Based on the elasticity value of each of the factors of production, the total elasticity of production can be obtained. The total elasticity of production is obtained by adding up the elasticity of all the factors of production. The following formula is the total elasticity of corn production in tidal land, namely:

$$E = \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7$$

Keterangan :

- E = Total production elasticity
- $\beta_1$  = labor elasticity
- $\beta_2$  = urea fertilizer elasticity
- $\beta_3$  = SP-36 fertilizer elasticity
- $\beta_4$  = KCl fertilizer elasticity
- $\beta_5$  = herbicide elasticity
- $\beta_6$  = insecticide elasticity
- $\beta_7$  = PGR elasticity

Then the value of production elasticity is:

$$E = -0,065 + 0,826 + 0,247 + 0,134 - 0,404 + 0,051 + 0,136$$

$$E = 0,925$$

Total elasticity of production was 0.925 which means the value is between 0 and 1 or the region of production I or return to scale. Thus technically the use of production facilities by corn farmers was efficient.

**CONCLUSION**

Factors that had a significant positive effect on the productivity of corn farmers in Mulia Saria Village were the use of Urea fertilizer and SP-36 fertilizer, while the use of herbicides had a significant negative effect. The use of labor, KCl fertilizer, insecticide and PGR had no significant effect. The use of labor and herbicides was not technically efficient. The use of Urea, SP-36, KCl, insecticide and PGR were technically efficient. All factors of production, namely labor, Urea fertilizer, SP-36, KCl, herbicides, insecticides and

PGR were already efficient in terms of price.

### RECOMMENDATION

Based on the results of research conducted, it is recommended:

1. In order to achieve efficient use of production factors, farmers should follow the recommendations and suggestions of relevant agencies such as the Agency for Agricultural Research, Agriculture Services and other institutions.
2. We recommend the use of herbicides according to the recommended dosage in order to obtain the maximum production and technical efficiency of the use of labor, the PGR needs to be reduced because it had no real effect on increasing production.
3. Assistance and further study was needed in the typology of the land, especially in the business of corn farming from various parties such as Universities, Agricultural Research and Development Agency, Agricultural Services and other Research Institutions.

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