TIMOR TENGAH SELATAN BIOLOGICAL FACTORS AFFECTING CORN PRODUCTION

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ABSTRACT

The goal of this research is to figure out what biological factors influence corn production in Timor Tengah Selatan. This is a qualitative research method that use a questionnaire as a research tool. Multiple linear regression analysis was conducted with SPSS to analyze the data. The results demonstrated that the usage of plant seeds, pesticides, and farming technology had a substantial impact on corn output, as evidenced by the p-value of 0.05.

Keywords *: multiple linear regression, corn production.*

1. INTRODUCTION

Timor Tengah Selatan district produces corn production which increases every year compared to other districts. Despite the fact that TTS has a smaller land area than East Sumba, the district chosen for the execution of the Planting Corn Harvesting Cattle (TJPS) program (Pallo et al, 2020). The amount of corn produced in TTS in 2017 was 178,647 tons, according to BPS data. When compared to the harvested area in 2017, which was 53,549 hectares and resulted in a productivity of 3 tons/ha, this amount is insufficient (BPS TTS, 2021). Increasing corn production technology using an integrated crop management method that combines multiple technological components to generate a synergistic impact is an effective technique, but it must be supported by an adequate institutional system sufficient (Balitbang Pertanian, 2007). Several factors, notably the cropping system, influence corn productivity. A good cropping scheme will yield the best outcomes. Other elements, such as the provision of appropriate fertilizers, also promote this (Asbur et al, 2019).

Corn production is affected by two types of factors: (1) biological factors, such as agricultural land type and fertility, seeds, varieties, fertilizers, pesticides, and so on; and (2) socio-economic factors, such as production costs, prices, labor, education level, income level, risk and uncertainty, institutions, credit availability, and so on (Habib, 2013). These factors are also known as internal and external influences, in addition to biological and socioeconomic considerations (Tabelak et al, 2019). The seed factor in South Sumatra was researched, and it was discovered that adding 1% more seed increased corn production by 0.112%, or 8.83 kg (Fermadi et al, 2015). Seeds had an effect in Malacca Regency as well, with 1 kg of corn seeds increasing corn production by 1,862 kg (Hoar & Fallo, 2017). Also significant in improving corn output are elements such as education level, number of family dependents, labor, usage of plant seeds, application of fertilizers, pesticides, agricultural technology, and cultivation techniques (Rohi et al & Neloe et al, 2018). Several criteria that have been evaluated show that good agricultural resource management and control of agricultural land conversion can result in an increase in corn yield (Harini et al, 2019). Linear regression analysis was utilized to examine the impact of various elements, particularly biological factors on corn production.

2. METHODS OF RESEARCH

The study method employed is a qualitative research approach with a questionnaire as the research instrument, and the variables to be researched include plant seeds, fertilizer application, pesticide application, agricultural technology, and culture practices. Purposive sampling was used in the sub-districts of Timor Tengah Selatan Regency (TTS) that had been selected as research locations. The first one is selected at the district level. The highest, medium, and lowest corn production centers with a reasonable and representative land area were the criteria for the selected sub-districts. Kuanfatu

District, Amanuban Selatan District, and Kota Soe District were chosen as sub-districts. A total of 30 farmers were chosen as sample members from each sub-district based on practicality, cost, time, accuracy, and data analysis. The sample size of respondent farmers was decided at random using proportional sampling, with 30 farmers per sub-district, for a total sample size of 90 farmers over three sub-districts.

Multiple Linear Regression Analysis was utilized to analyze the data and Statistical Product and Service Solutions (SPSS) was used to calculate the results. Corn production is the dependent variable (y) whereas plant seeds (x_1), fertilizer application (x_2), pesticide application (x_3), farming technology (x_4), and cultivation techniques (x_5) are the independent variables. The following model will emerge from Multiple Linear Regression Analysis:

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \varepsilon \quad (1)$$

3. DISCUSSION AND RESULTS

Corn Farmers' Characteristics in the Districts of Kota Soe, Kuanfatu, and Amanuban Selatan

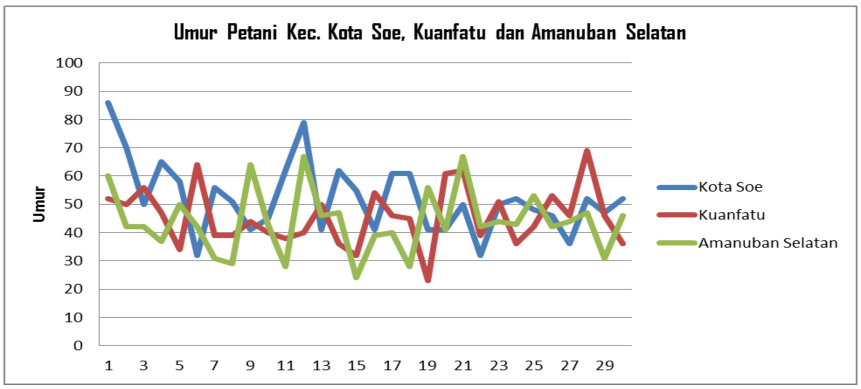

Figure 1. Corn Farmers' Characteristics in the Districts of Kota Soe, Kuanfatu, and Amanuban Selatan

Corn growers in the Soe City, Kuanfatu, and South Amanuban sub-districts are, on average, between the ages of 15 and 64. (BPS, 2021). In Kota Soe, the oldest farmer is 86 years old, whereas in Amanuban Selatan, the youngest is 24 years old. This demonstrates that regardless of whether someone is elderly or young, they may continue to work in the agricultural industry.

Table 1. Farmer's Age Descriptive Statistics

District	N	Minimum	Maximum	Mean
Kota Soe	30	32	86	52.10
Kuanfatu	30	23	69	45.67
Amanuban Selatan	30	24	67	43.83

Source: Primary data processing, 2021

Table 2 demonstrates that corn farmers in the three sub-districts had varying levels of formal education, ranging from those who did not graduate from elementary school to those who graduated from academies or colleges. In percentage terms, however, high school graduates have the highest level of formal education. This demonstrates that through formal education, a person might learn anything, particularly in agriculture, from his life experiences.

Table 2. Farmer Education Descriptive Statistics

District	N	Education levels									
		Primary school was not completed		elementary school		junior high school		high school		academies or colleges	
		f	%	f	%	f	%	f	%	f	%
Kota Soe	30	0	0	2	6.7	7	23.3	17	56.7	4	13.3
Kuanfatu	30	1	3.3	9	30.0	11	36.7	9	30.0	0	0
Amanuban Selatan	30	1	3.3	16	53.3	7	23.3	5	16.7	1	3.3

Source: Primary data processing, 2021

Classic Assumption Test

1. Multicollinearity

The VIF and Tolerance values in table 3 below show the results of the multicollinearity test. There is no multicollinearity in the independent variable if the VIF value of the independent variable is less than 10 or 5.

Table 3. Coefficients

Model		Unstandardized Coefficients B	t	Sig.	Collinearity Statistics	
					Tolerance	VIF
1	(Constant)	3251.390	2.396	0.019		
	Plant seeds	51.120	3.118	0.002	0.770	1.299
	Fertilizer	-2.431	-0.712	0.479	0.864	1.157
	Pesticide	0.062	4.804	0.000	0.774	1.293
	Farming technology	-911.344	-3.962	0.000	0.764	1.309
	Cultivation techniques	-1215.419	-1.377	0.172	0.835	1.197

Source: SPSS data processing, 2021

The VIF value for all independent variables is less than 10, with values ranging from 1.2 to 1.3, and tolerances ranging from 0.7 to 0.8. There is no multicollinearity in all of the independent variables because the VIF value of the independent variable is not larger than 10 or 5. A good linear regression model is one that is devoid of multicollinearity, according to the traditional assumptions of linear regression with Ordinary Least Square (OLS). As a result, the above model is multicollinearity-free.

2. Autocorrelation

The autocorrelation test can be seen in table 4 below, as can the Durbin-Watson test. The results of the Durbin-Watson test in SPSS were compared to the Durbin-Watson table values.

Table 4. Model Summary[b]

Model	R	R Square	Adjusted R Square	Sts. Error of the Estimate	Durbin-Watson
1	.577[a]	0.333	0.293	2144.7755	1,969

Source: SPSS data processing, 2021

The calculated DW refers to the Durbin-Watson value in table 4. The calculated DW value is 1.969. dL = 1.5420 and dU = 1.7758 are the values of the DW table with a 5% significance level (error) from the number of independent variables (k = 5) and the number of samples (n = 90). The computed DW value is bigger than dL and smaller than dU, indicating that there is no autocorrelation in this area. As a result, it may be stated that there is no autocorrelation in the linear regression model.

3. Normality

The normality test results are shown in Figure 2 below. The residual (data) created by a normally distributed linear regression model, not the independent or dependent variable, is the normality assumption test referred to in the classical assumption of the OLS method. The Normal P-P Plot technique can be used to determine whether a residual (data) is normally distributed or not by looking at the distribution of the points in the image. The residual (data) is said to be normally distributed if the distribution of these points is close to or close to a straight line (diagonal), but it is not normally distributed if the distribution of the points is away from the line. Because the distribution of the points in Figure 2 is close to the straight line, it may be argued that the residual (data) is normally distributed.

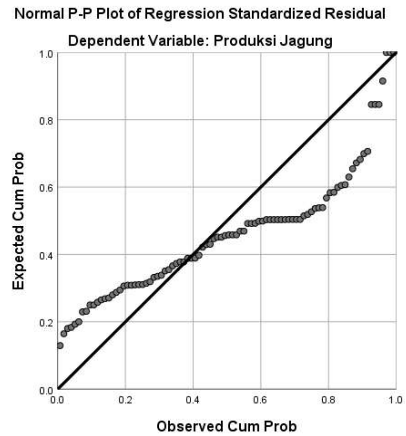

Figure 2. Normal P-P Plot

Model Feasibility Test

1. Simultaneous Test

The simultaneous test, sometimes known as the F test, is a model feasibility test. The test criteria are One Way Anova on SPSS software calculation results. The goal of this model's feasibility test is to determine whether the estimated model can be used to explain the effect of independent factors on the dependent variable. The calculated regression model is viable if the significance value in table 5 is less than the significance level or α = 0.05. The calculated regression model, on the other hand, is not feasible if the significance value in table 5 is bigger than the significance level or α = 0.05.

Table 5. ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	192709698.082	5	38541939.616	8.379	.000[b]
	Residual	386405190.807	84	4600061.795		
	Total	579114888.889	89			

Table 5 shows that the estimated linear regression model may be used to describe the effect of seeds, fertilizers, pesticides, farming technology, and cultivation techniques on corn production because the significant value is 0.000 less than the significance level α = 0.05.

2. Test for Regression Coefficients

The t test is another name for the regression coefficient test. This test is used to determine whether or not the regression model parameters were correctly estimated. This indicates that these factors can explain how the independent variable influences the dependent variable's behavior. The intercept (constant) and slope (regression coefficient) parameters are the ones that are estimated. The t test, on the other hand, is focused on the slope parameter (regression coefficient).If the t count in table 3 is less than or equal to 0.05, the independent variable has a significant effect on the dependent variable; otherwise, it does not.

The t value for the variables plant seeds (x_1), pesticide application (x_3), and farming technology (x_4) is less than 0.05, indicating that these variables have a significant effect on maize production at the

95 percent confidence level, as shown in Table 3. Table 3's t value, on the other hand, is for the fertilizer variable (x_2). as well as cultivation techniques (x_5). This variable has a significance of larger than 0.05, indicating that it has no effect on corn production.

3. Determination Coefficient

The coefficient of determination is defined as the percentage of the independent variable's influence on the dependent variable. The R-Square value in table 4 shows this value. The R-square value of 0.333 in the SPSS output in table 4 indicates that the independent variables, namely seeds, fertilizers, pesticides, farming technology, and cultivation techniques, have a 33.3 percent influence on corn production, while the remaining 66.7 percent is influenced by other variables not included in the linear regression model.

Interpretation of Multiple Linear Regression Models

A multiple linear regression model is created when the assumptions are tested and the model's feasibility is determined to be acceptable and feasible. The regression model's coefficients are derived from table 3 of the SPSS output. The following is the regression model that was discovered:

$$\hat{y} = 3251{,}39 + 51{,}12x_1 - 2{,}43x_2 + 0{,}06x_3 - 911{,}34x_4 - 1215{,}42x_5 + \varepsilon \qquad (2)$$

The regression model's coefficients are derived from table 3 of the SPSS output. The seed coefficient is positive, meaning that if the number of seeds utilized is increased, corn yield will increase as well. Similarly, if the amount of seed utilized is insufficient, corn production would suffer. Corn production will rise by 51.12 kg/ha if corn seed extra 1 kg/ha is used. On the other hand, reducing the amount of seeds per hectare by one kilogram reduces corn production by 51.12 kg/ha..

Fertilizer has a negative coefficient, which means that when a lot of fertilizer is utilized, corn yield drops. Corn production, on the other hand, will increase if fertilizer is used less. Corn output will be reduced by 2.43 kg/ha if 1 kilogram of fertilizer is applied per hectare. Similarly, reducing fertilizer consumption by 1 kg/ha increases corn productivity by 2.43 kg/ha. Farmers utilize chemical fertilizers, which can cause plants to wither if applied excessively. Urea and NPK are the chemical fertilizers most commonly employed by corn producers in the Kota Soe, Kuanfatu, and Amanuban Selatan sub-districts.

In equation 2, the pesticide use coefficient is positive, which implies it is the same as the seed coefficient, i.e., adding or increasing the pesticide used by 0.06 g/ha enhances corn yield by 0.06 kg/ha. Chemical pesticides are employed by maize producers in Kota Soe, Kuanfatu, and Amanuban Selatan sub-districts. When sowing corn, these pesticides are used to decrease pest infestations such as larvae and aphids.

The variable of farming technology is seen in x_4 not as a coefficient, but as a direction. Because the measuring scale for farming technology variables is nominal, it can only be seen in one of two directions: positive or negative. The direction of the farming technology variable in equation 2 above shows that reducing the farming technology tools that have been developed in farmers can result in a decrease in corn production because farming without technology can overwhelm farmers in cultivating corn over a large area of land.

The variable of cultivation technique is the same as agricultural technology at x_5, as measured by the direction of the coefficient rather than its magnitude. This is due to the ordinal measuring scale for cultivation technique variables. The cultivation technique variable in equation 2 has a negative direction, indicating that all stages of cultivation techniques, including land management, planting and maintenance, fertilizer, weeding, insect control, and harvesting, should not be overlooked. It has the potential to reduce corn production if ignored.

4. CONCLUSION

The use of plant seeds (x_1), pesticides (x_3), and farming technology (x_4) are the independent factors that have a substantial impact on corn production. The following is the regression model that was discovered: $\hat{y} = 3251{,}39 + 51{,}12x_1 - 2{,}43x_2 + 0{,}06x_3 - 911{,}34x_4 - 1215{,}42x_5 + \varepsilon$. It is possible to utilize the linear regression model to describe the impact of seeds, fertilizers, pesticides, farming technology, and cultivation techniques on corn production. The independent factors, such as seeds, fertilizers, pesticides, farming technology, and cultivation practices, account for 33.3 percent of the effect on corn production, while the remaining 66.7 percent is influenced by variables not included in the linear regression model.

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