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Production Risk of Hybrid Maize in Sugihmanik Village, Tanggungharjo Subdistrict, Grobogan Regency (Case Study: Faisal Tani Store)

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ABSTRACT

This study aims to examine the impact of production factors on hybrid corn production and to assess the level of production risk in Sugihmanik Village, Tanggungharjo District, Grobogan Regency (Case Study: Faisal Tani Store). The research adopts a quantitative approach with a sample of 69 hybrid corn farmers. The data analysis method utilized the Cobb-Douglas production function with multiple linear regression and coefficient of variation analysis. Data processing was conducted using SPSS 25. The results indicated that capital, land area, and labor factors collectively influence hybrid corn production. In addition, the land area and labor variables were found to have a significant effect on hybrid corn production, while the capital variable did not show a significant effect. The coefficient of variation (CV) for production risk in hybrid corn farming in Sugihmanik Village, Tanggungharjo District, Grobogan Regency (Case Study: Faisal Tani Store) was 0.33, indicating a low level of production risk.

Keywords: *Hybrid, Maize, Production, Production Risk*

INTRODUCTION

Maize is a food crop that is also used by farmers to fulfill their small-scale needs including animal feed, food ingredients and fuel. The high demand for maize is not accompanied by an increase in national production. As an agricultural product, maize experiences production fluctuations depending on the production input factors used, both internal and external production input factors. These production fluctuations are a risk that is present in every maize farming operation. Fluctuations in production will affect income, farmers' interest in cultivating soybean crops, and the ability of a country to meet the food needs of its citizens.

To strategically ensure the availability of maize in the market to achieve National Food Independence, the government is increasing maize production through land extensification and intensification. However, extensification of agricultural land is currently more difficult due to the rampant conversion of agricultural land into non-agricultural land, such as industry and housing. Intensification efforts through increasing land productivity are more feasible.

One way to increase maize productivity is by selecting superior maize varieties. Based on the results of the tuber survey in (Astuti et al., 2021) it can be seen that hybrid maize has an average productivity of 59.49 ku/ha. Meanwhile, the average productivity of local maize is the lowest at 35.97 ku/ha. Hybrid maize varieties have higher yield potential than other varieties due to the heterosis effect of the genes that make up hybrids so that they have higher yield potential and are more resistant to pests and diseases. (Sutoro, 2015). According to (Anggraeni et al., 2017)(Anggraeni et al., 2017), hybrid

maize seeds are made by preparing pure strain (F0) seeds from two parents that have been selected for superior traits. The production of hybrid maize seeds is done at the research station with equipment and experienced experts. Before being sold, hybrid maize seeds are given a certificate from the Seed Supervision and Certification Center indicating that they have met all the requirements, including planting conditions, superior traits, and authenticity. According to (Mubarakkan et al., 2012)(Mubarakkan et al., 2012), hybrid maize seeds have an average productivity level of 8 tons/ha which is higher than the productivity of non-hybrid maize which only reaches 1.5-2 tons/ha.

Grobogan District is one of the corn producing areas that ranks first in Central Java Province and nationally, with a harvest area of 116,848.80 ha or 19% of the total corn harvest area in Central Java Province (Astuti et al., 2021). (Astuti et al., 2021) where maize production in 2020 amounted to 772 thousand tons (Grobogan District Government, 2021). (Government of Grobogan Regency, 2021). In terms of average productivity, Grobogan Regency has a higher maize productivity than the national maize productivity of 6.5 tons/ha in 2020 (Badan Pusat Statistik Kabupaten Grobogan, 2021). (Badan Pusat Statistik Kabupaten Grobogan, 2021)..

According to data from the Grobogan Regency TPH Agriculture Office (Central Bureau of Statistics of Grobogan Regency, 2021), the area of corn harvest in Tnggungharjo Subdistrict is 6,744 hectares with a production of 43,893 tons, so the productivity is 6.5ton/ha. Most of the maize production in Tanggungharjo sub-district comes from Sugihmanik village. Furthermore, according to the researcher's initial observation with the head of the farmer group in Sugihmanik village, the majority of farmers in Sugihmanik village and its surroundings buy hybrid maize seeds from Shop Faisal Tani. Toko Faisal Tani ranks as the 5th largest provider of hybrid maize seeds in Central Java. Toko Faisal Tani also sells hybrid maize seeds wholesale and directly to farmers, while other retailers are only distributors who distribute hybrid seeds to large stores or sell them wholesale. In addition to selling hybrid maize seeds, the location of Faisal Tani stores is very close to farmland. Faisal Tani stores are also licensed to distribute subsidized and non-subsidized fertilizers. Faisal Tani also sells herbicides, fungicides and insecticides, as well as a service workshop for agricultural equipment. Therefore, Faisal Tani is the most visited agricultural facilities shop by farmers around Grobogan.

The agricultural production process is a process of changing inputs into certain outputs with the aim of increasing the value of a good. Factors that affect production according to (Dr. M. Afdhal Chatra P, M.Ec.Dev Anisa Fatmawati, S.E. et al., 2023) capital, labor, land area, and management. Capital is a major factor used in a production process.

In agricultural production, capital is categorized into two types: fixed and non-fixed capital. Fixed capital refers to expenses in the production process that are not fully consumed in a single production cycle, whereas non-fixed capital represents costs that are entirely used up during one production cycle (Soekartawi, 2003). (Soekartawi, 2003).

Land is the factory of agricultural products, i.e. the place where production takes place and from where production comes out. In general, it is said that the more land that is cultivated, the greater the amount produced. Furthermore, labor is the energy devoted in an activity process to produce a product. In farming, the labor used generally comes from within the family plus labor from outside the family. (Mulyanti & Jamhari, 2020).

In running a farm, there will always be risks that cause a decrease in crop yields and production. Risk is present in all agricultural management decisions as a result of various sources of uncertainty. Production risks can occur due to the influence of external factors or factors that are difficult to control such as climatic factors (rainfall, air temperature, air humidity, pest and disease attacks and so on). The amount of risk faced in maize

farming will depend on the farmer's courage to make decisions. If the farm fails, this will affect farming decisions in the future. The decision to allocate inputs in soybean farming activities is strongly influenced by farmers' behavior towards the risks faced. In addition to crop failure, it will also result in low income earned by farmers.

Based on the background presented, the author is interested in conducting research titled "Risk of Hybrid Corn Production in Sugihmanik Village, Tanggungharjo Subdistrict (Case Study: Faisal Tani Store)." The aims of this research are: 1) to identify the impact of production factors (capital, land area, and labor) on hybrid corn production in Sugihmanik Village, Tanggungharjo Subdistrict (Case Study: Faisal Tani Store), and 2) to assess the level of production risk for hybrid corn in Sugihmanik Village, Tanggungharjo Subdistrict (Case Study: Faisal Tani Store).

METHODS

The research employs a quantitative method. The research location was selected purposively based on the consideration that Sugihmanik Village is a promising area for corn cultivation development in Tanggungharjo Subdistrict. According to data from the Agriculture Office of Grobogan Regency (Badan Pusat Statistik Kabupaten Grobogan, 2021), the area of corn harvest in Kecamatan Tanggungharjo is 6,744 ha with a production of 43,893 tons, so the productivity is 6.5ton/ha. Most of the maize production in Tanggungharjo Subdistrict comes from Sugihmanik Village.

The respondent sampling method was determined using the quota sampling method. According to (Firmansyah & Dede, 2022) Quota sampling is a non-random sampling technique where participants are selected based on predetermined characteristics, ensuring that the sample mirrors the distribution of traits found in the broader population. This study involved 69 respondents as the sample.

Furthermore, to determine the factors affecting hybrid maize production, multiple linear regression analysis was conducted. The dependent variable (Y) in this study is corn production, while the independent variables (X) include capital usage, land area, and labor. Therefore, the production function model in this research can be expressed as follows:

$$Y= 〖ax〗 _1^{b1} x_2^{b2} x_3^{b3} \quad (1)$$

To simplify the equation estimation, the equation is transformed into a multiple linear form by applying logarithms. The logarithm of the above equation is as follows:

$$LnY = \alpha + \beta 1 \ln X_1 + \beta 2 \ln X_2 + \beta 3 \ln X_3 + e \quad (2)$$

Description:

Y	= Maize production (Kg/Ha)
α	=intercept
β1, β2, β3, β4	= Regression coefficient
X1	= Capital (Rp)
X2	= Land area (Ha)
X3	= Labor (HOK)
e	= error

Before conducting multiple linear regression analysis, the prerequisite test for analysis is first carried out.

The requirement for simple linear regression analysis involves conducting a classical assumption test. This test is used to verify that the multiple linear regression model is econometrically valid by meeting the criteria of BLUE (Best Linear Unbiased Estimator), which ensures the estimation is unbiased, linear, and consistent.

The classical assumption test includes assessments for normality, multicollinearity, and heteroscedasticity. Once these assumptions are satisfied, T-tests and F-tests are performed to determine the influence of the independent variables on the dependent variable. The analysis of factors affecting corn production was systematically conducted using SPSS software for data analysis.

Additionally, to assess the level of risk in maize farming, the risk level is determined by examining the coefficient of variation (CV). The relative risk level is calculated by dividing the standard deviation of production by the expected value. The formula is systematically expressed as follows:

$$KV = \sigma / Y \quad (3)$$

Description:

KV = Coefficient of Variance

σ = Standard deviation

Y = Average production (Kg/MT)

According to (Kadir, 2015)According to (Kadir, 2015), the coefficient of variance (KV) < 0.5 (L) > 0 then the farm analyzed has a low risk otherwise if the value of KV > 0.5 (L) < 0, it means that the production risk is high and the possibility of farmers suffering losses will be greater, while if the value of KV = 0 with the lower limit value (L) = 0 it will break even.

RESULTS AND DISCUSSION

The characteristics of respondents based on gender, age, education level, farming experience, number of family members, and land area are presented in Table 1 below:

Table 1. Characteristics of Maize Farming Respondents

Characteristics	Criteria	Number (Person)	Percentage (%)
Gender	Male	69	100
	Female	0	0
Age	15-64	61	88
	>64	8	12
Education	Not in School	3	4
	SD	19	28
	SR	28	41
	SMP	9	13
	HIGH SCHOOL	13	19
Farming Experience	<10 years	0	0
	10-20 years	18	26
	>21 years old	51	74
Number of Family Members	<4 people	6	9
	≥4 people	63	91
Land Area	<0,5	15	22
	0,5-1	54	78

Source: Data Processing

Based on Table 1, all respondent farmers were male. According to (Mulyanti & Jamhari, 2020) gender is one of the factors that influence productivity because male farmers act as the main breadwinners in the family so that the level of participation in work is higher than women. Furthermore, the majority of maize farmers are aged 15-64 years, which is 88% so that they are classified as productive age, namely physically farmers still have great potential to produce products (goods and services).

The majority of farmers graduated from community schools, 19 people or 41% of farmers, and there are 4% of farmers who did not receive formal education at all. This shows that the education of farmers in the study area is still low so that farmers' minds are not open enough to accept new innovations in technology.

Furthermore, the results showed that 74% or 51 of the sample farmers had long experience in maize farming, i.e. more than 20 years (Manyamsari & Mujiburrahmad, 2014). (Manyamsari & Mujiburrahmad, 2014).. The longer the farming experience, the more farmers will know the characteristics of the land where rice is cultivated, so that the selection of the type of innovation applied in the cultivation process will be better. (Agatha & Wulandari, 2018)..

The majority of respondent farmers have a family size of ≥ 4 people, amounting to 91% or 63 people. This means that the average number of family members in the study area is in the medium category. The greater the number of family members, the greater the possibility of the number of workers in the family, so as to reduce production costs for labor outside the family.

Based on the results of the study, the majority of respondent farmers have a land area of 0.5-1 Ha, namely 78% or 54 people. The size of the farmer's land tenure affects the determination of the amount of expenditure in detail such as land tax, labor, the amount of fertilizer up to the production results. The more extensive the farmer's land, the more efficient the allocation of production costs.

Classical Assumption Test

Normality Test

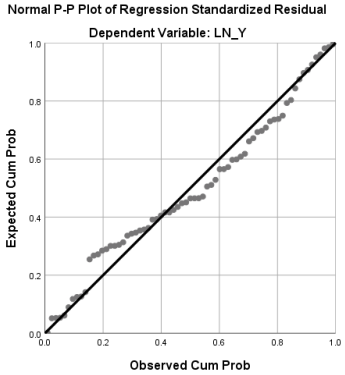

Figure 1. P-Plot Graph Source: SPSS 25 Output Results
Source: Data Processing

Based on Figure 1, it can be seen that normality has been fulfilled, namely the points on the Normal P-Plot graph spread around and follow the diagonal line / straight line in the graph and do not spread too far. So it can be concluded that the assumption model is in accordance with normality and the data is suitable for use.

Multicollinearity Test

Table 2. Multicollinearity Test Results

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Correlations	Collinearity Statistics

		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	6.631	1.320		5.025	.000					
	LN_X1	.077	.087	.072	.884	.380	.831	.109	.037	.256	3.902
	LN_X2	.529	.083	.641	6.353	.000	.933	.619	.262	.168	5.964
	LN_X3	.227	.080	.261	2.848	.006	.887	.333	.118	.203	4.922

Source: Data Processing

Table 2 indicates that the VIF values for the capital, land area, and labor variables are ≤ 10, with tolerance values > 0.10, signifying that the regression model in this study is free from multicollinearity issues. This implies that there is no strong correlation between the independent variables in the multiple linear regression model.

Heteroscedasticity Test

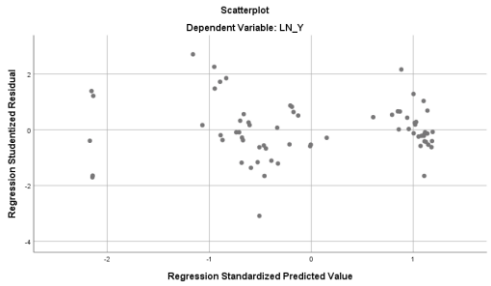

Figure 2. Heteroscedasticity Test Results
Source: Data Processing

Figure 2 shows that there is no wavy pattern that alternately widens and narrows, nor are there any triangular, quadrilateral, or consistently curved patterns. Additionally, the points are distributed both above and below the value of 0 on the Y-axis, indicating the absence of heteroscedasticity. in all variables in the research instrument. This means that the regression model occurs inequality of variance of residuals between one observation and another observation**.**

Factors Affecting Maize Production

Regression tests are conducted to measure the extent to which the independent variables influence the dependent variable. The multiple regression analysis between capital (X1), land area (X2), and labor (X3) on corn production (Y), after converting all variables into natural logarithms (Ln), produces the results presented in Table 3 below:

Table 3. Multiple Linear Regression Test Results

No.	Variables	Regression Coefficient	T-Count	Prob Sig.
1	Constant (C)	6,631	5,025	0,000
2	Capital (X1)	0,077	0,884	0,380
3	Land Area (X2)	0,529	6,353	0,000
5	Labor (X3)	0,227	2,848	0,006
9	F count	174		0,00***
10	R^2	0,889		
Description	*	Significant at 99% confidence level (alpha = 0.01)		

	**	Significant at 95% confidence level (alpha = 0.05)
	Ns	insignificant

Source: Data Processing

Based on table 3, it can be seen that the resulting regression model equation is as follows:

$Y = \alpha X1^{b1} , X2^{b2} , X3\ e^{b3}$

Where:

Y = corn production

a = intercept value

X1 = capital (Rp)

X2 = land area (Ha)

X3 = labor (Hok)

b1, b2, b3, b4= regression coefficients

u = error

e = natural logarithm, e = 2.718

To simplify the equation of the Cobb-Souglass function formulation, the equation is converted into the form of natural logarithm (Ln), so that the equation becomes as follows:

LnY = ln 6.631 + 0.077 ln X1 + 0.529 ln X2 + 0.227 ln X3

From the transformed form of the Cobb-Douglas production function above, the form is is converted back into the original form of the Cobb - Douglas production function, so that the equation becomes

$Y= 2.787\ X1^{0,312} X2^{0,184} X3^{0,589} X4^{0,118}$

Coefficient of Determination (R^2)

Based on table 3 above, relationship testing was carried out for the independent variable and the dependent variable. The R Square (R^2) value is 0.889. This shows that 88.9% of the corn production variable (Y) can be explained by the variables of capital (X1), land area (X2), and labor (X3) while the remaining 11.1% is influenced by other factors outside the model studied.

Simultaneous Test / F Test

Based on table 3, it is known that the significant level is 0.000 because 0.000 <0.05, it can be said that H0 is rejected H1 is accepted or it can be interpreted that capital (X1), land area (X2), labor (X3) simultaneously affect the production of hybrid corn.

Partial Test / t Test

Effect of Capital on Maize Production

Capital is wealth in the form of money or goods owned by a person that can be used to carry out the production process either directly or indirectly, thus further capital formation and to increase production and farm income. Based on table 3, the Sig t value for capital has a significance value of 0.380> 0.05, so Ho is rejected H1 is accepted. It can be stated that capital (X1) partially does not significantly affect the increase in hybrid corn production with a positive coefficient value. This research is supported by (Wulandari & Parameswara, 2020) and (Samsuddin & Gufran, 2020) which stated that capital has no significant effect with a positive coefficient on production. However, this research is not in line with research (Kamaluddin & Anwar, 2017) which states that capital has a positive effect on corn production in Tanah Towa Village.

Effect of Land Area on Maize Production

Land area refers to the size of the land used to grow maize. Based on table 3, the Sig t value for land area has a significance value of 0.00 <0.05, so Ho is rejected H1 is accepted. It can be stated that land area (X2) partially has a real effect on increasing corn production with a positive coefficient. This can be explained that the more land owned by maize farmers, the more maize production will be produced by farmers. This research is in line with (Santoso et al., 2013), (Kolik & Kune, 2019), (Supritiswendi et al., 2012) which states that the land area variable has a significant effect on increasing production. According to (Huda, 2023)(Huda, 2023), the owner and control of large agricultural land will be more effective and efficient than narrow land. This is because the more land that is cultivated, the more the number of plants so that production will increase.

Effect of Labor on Maize Production

Labor refers to individuals involved in agricultural activities to generate income. Based on table 3, the Sig t value for labor has a significance value of 0.006 <0.05 so Ho is rejected H1 is accepted. It can be stated that Labor (X3) partially has a real effect on increasing corn production. The positive coefficient indicates that the more labor used, the higher the production of hybrid corn. This is because labor has a role in driving and optimizing the entire process of hybrid maize cultivation. In this study, the amount of labor comes from in-family labor and out-of-family labor. The involvement of in-family labor in maize farming is in the maintenance process (fertilizing, spraying, weeding), while out-of-family labor is needed at the stages of land cultivation, planting, and harvesting. The results of this study are in line with research conducted by (Santoso et al., 2013) and (Huda, 2023)(Santoso et al., 2013) and (Huda, 2023), which state that labor has a significant and positive effect on the level of maize production. Labor in agriculture has characteristics that are different from labor in other fields, namely a limited amount, cannot be standardized, and has various patterns so that they cannot be separated from one another.

Production Risk Analysis

Agriculture is highly dependent on natural conditions, if the crop is planted in a suitable season, it will get maximum results, otherwise if the corn crop is planted in unfavorable natural conditions such as drought or flooding, the production will also not be optimal. In addition, the presence of Plant Disturbing Organisms (OPT) also affects maize production. In this study, the amount of production risk is calculated with the coefficient of variance. The amount of production risk of hybrid corn farming is based on the value of the Coefficient of Variance with the following details:

Table 4. Risk Analysis of Maize Production

No.	Description	Value
1	Average Production	3516,70
2	Standard Deviation	1158,73
3	Coefficient of Variance	0,33
4	Lower Limit	1199,23

Source: Data Processing

Based on Table 4, the average corn production in Sugihmanik Village, Tanggungharjo Subdistrict is 3,156.70 Kg with a standard deviation of 1,158.73. The coefficient value is 0.33 which means that every one kilogram of yield obtained has a risk or uncertainty faced of 0.33 or in every 100 Kg of hybrid corn production bears a risk or uncertainty of 33 Kg in each growing season. The KV value of 0.33 is below the KV value <0.5 which indicates that hybrid maize farming production is profitable. The lower limit value (L) is defined as the lowest production value received by farmers in hybrid maize farming which is 1,199.23 Kg. If the lower limit value of maize production (L) > 0, then the respondent farmers do not experience losses. In this study, there is a production risk of 0.33, meaning that farmers need to control risks in hybrid maize production to minimize losses due to crop failure. The results of this study are in line with (Mopangga et al., 2022) who stated that maize farming in Labanu Village, Tibawa Subdistrict has a production KV

value of 0.14 in maize cultivation with a land area > 1 ha and a production KV of 0.31 in maize cultivation with a land area > 2 ha, while the production KV in maize cultivation < 1 ha is actually high at 0.34, meaning that the larger the area of maize cultivated, the lower the production risk.

Uncertainty in hybrid maize farming in Sugihmanik Village, Tanggungharjo District is caused by erratic climate change. The current climate influence is the El Nino phenomenon, which results in a decrease in rainfall and an increase in air temperature. In the dry season, the water supply is often insufficient to meet the needs of the plants, while the pests that often attack are armyworms and the disease that is often found in corn plants is leaf blight caused by the fungus *Helminthosporium sp*.

CONCLUSIONS

Based on the results, it can be concluded that capital, land area, and labor simultaneously affect hybrid maize production. However, when analyzed partially, only land area and labor showed a significant effect on production, while capital had no significant effect. This suggests that to increase hybrid maize production, the main attention should be paid to optimizing land area and labour, as these two factors are shown to have a significant impact. On the other hand, the production risk analysis shows a Coefficient of Variation (CV) value of 0.33, which indicates that the risk of hybrid maize production in Sugihmanik Village, Tanggungharjo Subdistrict, Grobogan District is low. In other words, the fluctuation or uncertainty in hybrid maize yields is not too large compared to the average production, indicating good stability in the farm.

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