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Factors Affecting Production Hybrid Maize (*Zea mays* L.) Production in Morobea Village, Sawerigadi Sub-district, West Muna District

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Abstract

This research is based on the fact that the hybrid corn cultivated by the majority of people in Marobea Village, Sawerigadi District, West Muna Regency has the main objective of fulfilling the community's source of economic income. Therefore, hybrid corn production has great opportunities that can be exploited from an economic development perspective. This research aims to find out how much influence the use of inputs has on corn production in Marobea Village. The research location was determined with the consideration that the majority of people in Marobea Village still consistently planted hybrid corn. The total population is 240 heads of families. Based on the Slovin formula, the total sample of corn farmers selected was 38 people. The data analysis used is the Cobb-Douglas production function. The research results show that only the land area variable (X1) has a positive and significant effect on corn production (Y). Meanwhile, the variables number of seeds (X2), amount of fertilizer (X3), amount of pesticide (X4), and number of workers (X5) have no effect on corn production (Y).

Keywords: Hybrid Corn (Zea Mays L.) Farming, Production Factors

INTRODUCTION

Indonesia has abundant natural resources, making it one of the countries with enormous potential in the agricultural sector. For Indonesia as a developing country, the agricultural sector is the main livelihood for most of the population and is the target of rural development (Arifin, 2004).

One of the food crop commodities is corn. Maize is one of the main food crop

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commodities that has an important and strategic role in improving the Indonesian economy. This commodity has a multipurpose function, both for direct consumption, as the main raw material for the feed industry and food industry, and even in many countries corn has been used as a raw material for bioenergy. In addition, maize farming is still the main source of income for farming families (Sulaiman *et al,* 2018). Therefore, maize plays an important role in Indonesia. The demand for maize as food from year to year is getting higher along with the increase in population.

Southeast Sulawesi is one of the provinces in Indonesia where maize is a food crop and a widely traded commodity. The crop is also one of the dominant agricultural subsectors in Southeast Sulawesi. Some people use maize as their staple food. Maize in Southeast Sulawesi is the second food commodity cultivated after rice which is relatively stable and continues to increase every year (BAPPENAS, 2015). Data from the Central Bureau of Statistics (2020) shows that corn production in Southeast Sulawesi reached 279,170 tons in 2019, but in 2020 there began a decline of 167,817 tons. Some districts/cities in Southeast Sulawesi that produce maize can be seen in Table 1.

Table 1 Maize Production in 5 Districts/Cities of Southeast Sulawesi Province, 2020

No.	District/City	Maize Production (Ton)	Percentage (%)
1	North Kolaka	41.808	24,91
2	South Konawe	36.493	21,74
3	Muna	23.861	14,21
4	East Kolaka	15.025	8,95
5	West Muna	13.681	8,15
	Southeast Sulawesi	167.817	99,91

Source: Southeast Sulawesi Central Bureau of Statistics, 2020

Table 1 shows that maize production in Southeast Sulawesi in 2020 was 167,817 tons. The highest maize production is in North Kolaka Regency, followed by South Konawe Regency, Muna Regency, East Kolaka Regency and West Muna Regency. West Muna is one of the corn-producing regions in Southeast Sulawesi. Although not the highest, West Muna district is among the five districts with the highest maize production level at 13,681 tons. One of the sub-districts where many people grow corn is Sawerigadi sub-district. Data from the Central Bureau of Statistics (2020) shows that the harvest area for corn in Sawerigadi sub-district reached 553 ha.

Marobea Village, located in Sawerigadi Sub-district, West Muna Regency, is one of the

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corn-producing areas with the development of this commodity started in 2013, supported by a large enough land. Based on 2020 data, the village has 1,162 inhabitants from 317 households, with 240 of them working as farmers. Of the total area of 19.19 km², around 278 hectares are used as corn farmland, most of which is planted with yellow hybrid corn varieties. This type of maize has advantages such as pest resistance, fast harvest, high yield, and tolerance to various types and altitudes of land. The majority of the community grows maize for sale, but according to the head of Dandila farmer youth in Marobea Village, maize production has decreased. Therefore, it is important to identify the factors that affect maize production levels in order to find a solution to the problem.

In relation to agriculture, production factors determine the size of the production obtained. Physical production is produced by the operation of several production factors at once, including land, seeds, fertilizers, pest drugs and labor. A rational producer will certainly combine production factors in such a way as to achieve efficient farming and will not add inputs if the additional output produced is not profitable (Zaini, *et al*., 2019). Therefore, in this research, the factors of land area use, seeds, fertilizers, pesticides and labor used are factors that can affect corn production.

This study is very important because it focuses on yellow (hybrid) maize varieties and can see the effect of input use on the amount of production. Hybrid maize is one of the foodstuffs that serve as a source of carbohydrate for the community. In addition, hybrid maize is one of the most important agricultural commodities and its demand increases every year (Syamsia, 2019). If not, this can have an impact on the vulnerability of community food security and involves a lack of information on the effect of input use on corn production that has been cultivated by the Sawerigadi Sub-district community, especially in Marobea Village. On the one hand, in addition to having a role in fulfilling community food, maize is also used to fulfill animal feed, industrial raw materials and a source of increasing community economic growth. Therefore, the great potential and opportunities possessed by maize can be utilized in the perspective of economic development and food security.

METHOD

This research was conducted in Marobea Village, Sawerigadi Sub-district, West Muna Regency from May to August 2022. The determination of the research location was carried out *purposively* with the consideration that in Marobea Village, Sawerigadi Sub-district, West Muna Regency because the production of corn produced by farmers in Marobea Village has decreased (Information from the Secretary of Marobea Village). The population in this study were all maize

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farmers in Marobea Village which amounted to 240 family heads. The population was then drawn into a research sample using the Slovin formula so that 38 farmers were obtained. The technique used in this research is an interview on the topic under study. There are two variables used in this study, namely the dependent variable in this study is the yield of corn production (*Y*). While the independent variables in this study are land area ($X_{1)}$, number of seeds ($X_{2)}$, number of fertilizers ($X_{3)}$, number of pesticides ($X_{4)}$, and number of workers ($X_{5)}$.

The data analysis used in this research is the *Cobb-Douglas* production function. The mathematical form of the *Cobb-Douglas* production function analysis equation can be written as follows:

$$Y = b_{(0)}\, x(1)\,.^{(b1}) X(2)\,.^{(b2}) X(3)\,.^{(b3}) X(4)\,.^{(b4}) X(5)\,.^{(b5)}\, e(\mu)$$

In an effort to facilitate the estimation of the equation, it is done by changing it in the form of *Multiple Linear Regression* by logarithmizing the above equation. This is done to facilitate the calculation. The form of the equation for the multiple linear equation formula after being logarithmized is:

$$Ln\ Y = ln\ b_0 + b_1 ln\ X_1 + b_2 ln\ X_2 + b_3 ln\ X_3 + b_4 ln\ X_4 + b_5 ln\ X_5 + \mu$$

Description:

Y = Maize Production (Kg)
$X_{(1)}$ = Land Area (Ha)
$X_{(2)}$ = Number of Seeds (Kg)
$X_{(3)}$ = Amount of Fertilizer (Kg)
$X_{(4)}$ = Amount of Pesticide (L)
$X_{(5)}$ = Labor (HOK)
b_0 = Intercept (Constant)
b_1- $b_{(5)}$ = Regression Coefficient
μ = Confounding Error

In addition, the data was also analyzed using the *Ordinary Least Square* (OLS) based classical assumption test. There are two classic assumption tests that must be carried out on a regression model (Zuhroh and Amir, 2021), namely the Multicollinearity Test and the Heteroscedasticity Test.

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RESULTS AND DISCUSSION

Identity of Respondent Farmers

Identity is one of the indicators that describe the *performance of* human resources in an activity, especially in agriculture. Farmer identity is a farmer's condition that affects farmers in making decisions about their farming activities. The identity of this farmer includes age, gender and education (Syahza, 2021). Information regarding the identity of respondents can be seen below;

Table 2 Identity of Respondent Farmers in Marobea Village, Sawerigadi Subdistrict, West Muna Regency in 2022

Identity	Goals	Number (Person)	Percentage (%)
Age (Year)	15-35	9	23,6
	36-64	28	73,7
	> 65	1	2,7
Gender	Male	32	84,2
	Female	6	15,8
Education	Not in School	0	0
	SD	12	31,6
	SMP	11	29,0
	HIGH SCHOOL	15	39,4
	Bachelor	0	0
Total		38	100,0

Source: Processed Primary Data 2022

Based on table 2 above, the identity of respondent farmers of hybrid maize can be explained as follows;

1. Most maize farmers in Marobea Village are at a productive age and heading towards an unproductive age. This means that, in terms of age, these farmers should have started to reduce their work activities due to declining physical abilities. However, in reality, they are still able to run maize farms to fulfill their families' needs. Younger and healthier farmers generally have more physical energy and a more creative and technology-responsive mindset, which makes them more dynamic in farm management. In contrast, older farmers tend to be more cautious in making decisions, including in adopting technology (Syahza, 2021).

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2. The majority of maize farmers in Marobea Village are men. This is in line with the characteristics of maize farming activities that require large physical labor, where men generally have stronger physical abilities than women. Nevertheless, there are shared roles between men and women, especially in planting, caring for the plants, and harvesting.
3. Most of the maize farmer respondents in Marobea Village had a senior high school education level, which amounted to 39.4% or 15 people from the total respondents. A higher level of education makes it easier for a person to absorb information and apply it in life, including in farm management. Education can have a positive impact on farming activities because it plays a role in improving the quality of labor so that it can work more productively (Siahaan, 2004).

Hybrid Maize Farm Input Use

The use of inputs in this study includes land area, amount of seed, amount of fertilizer, amount of pesticide and amount of labor. The use of these production factors is part of some very important inputs in farming and can be a measure to determine the effect of inputs on hybrid corn production. Information on the amount of input use in hybrid maize farming can be seen in Table 4.8 below:

Table 3 Maximum, Minimum and Average Use of Hybrid Maize Farming Inputs in Marobea Village, Sawerigadi Sub-District, West Muna District in 2022

No.	Respondent Identity	Input Utilization of All Respondents	Max.	Min.	Average
1.	Land Area	33 ha	1 ha	0.5 ha	0,86
2.	Number of seeds	473 kg	15 kg	8 kg	12,44
3.	Fertilizer Quantity	1,690 kg	100 kg	30 kg	44,7
4.	Pesticide Quantity	170 liters	6 liters	3 liters	4,47
5.	Number of Workers	458.5 HOK	17 HOK	9 HOK	12,065

Source: Processed Primary Data 2022

Based on Table 3, the average amount of maize production input use in Marobea Village is presented. First, the amount of land area used by all respondents amounted to 33 ha with an average of 0.86 ha. Second, the amount of seed used was 473 kg with an average of 12.44 kg. Third, the amount of fertilizer used was 1,690 kg with an average of 44.47 kg. Fourth, the amount

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of pesticide use was 170 liters with an average of 4.47 liters. Fifth, the use of labor amounted to 458.5 HOK with an average of 12.06 HOK.

Table 4 Hybrid Maize Farming Input Use in Marobea Village, Sawerigadi Sub-District, West Muna Regency

Group	Description	Number (people)	Percentage (%)
Land Area (Ha)	0 - 0,5	10	26,3
	> 0,5 - 1	28	73,7
Seed Quantity (kg)	5-10	27	71,0
	> 10-15	11	29
Fertilizer Amount (kg)	30-40	19	50,0
	> 40-50	16	42,1
	> 50	3	7,9
Pesticide Quantity (ltr)	3-5	30	79,0
	> 5-7	8	21,0
Total Labor (HOK)	5-10	16	42,1
	>10-15	17	44,8
	>15	5	13,1
Total		38	100,0

Source: Processed Primary Data 2022

Based on Table 4 above, farmers' use of hybrid maize farming inputs can be described as follows;

1. Most farmers in Marobea Village, 73.7%, have a land area of more than 0.5 to 1 hectare, while only 26.3% of farmers have a land area between 0 and 0.5 hectares. This land area is considered adequate for hybrid maize cultivation, especially for small-scale or local market fulfillment.
2. 29% of respondents used more than 10 to 15 kg of maize seeds, while 71% used between 5 to 10 kg. This is low because according to the Directorate of Seeds (2019), the recommended use of hybrid maize seeds is 25 kg/ha with a spacing of 75×40 cm. Seeds play an important role in agriculture because they determine the level of productivity and quality of the yield (Wahyuni et al., 2021). In this context, the number of seeds refers to the number of seeds used by farmers in the maize cultivation process.
3. A total of 50% of respondents used between 30-40 kg of fertilizer, 42.1% used between more than 40-50 kg, and only 7.9% used more than 50 kg of fertilizer. This number shows

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that the use of fertilizer by farmers in Marobea Village is still relatively low, considering that the recommended use of fertilizer per hectare is 200 kg of urea and 300 kg of NPK (Widowati, 2021). The types of fertilizers used by farmers are inorganic fertilizers such as urea and NPK.

4. As many as 79% of farmers used 3-5 liters of pesticides, while 21% used more than 5 to 7 liters of pesticides. This amount is not in accordance with the recommended use of pesticides, which is 1.5-2 liters per hectare (Directorate of Fertilizers and Pesticides, 2018). The types of pesticides used on corn farms in Marobea Village include Gramaxone, Calaris, and Biowasil.
5. Only 13.1% of respondents or 5 farmers used more than 15 HOK (person days) of labor. This shows that the use of labor in Marobea Village is still low, when compared to the recommended use of HOK of 89 HOK per hectare in one growing season (Purwanto, 2015).

Factors Affecting Hybrid Maize Production

Factors affecting production in maize farming can be identified by using the Cobb-Douglas production function, where the dependent variable (*Y*) is maize production and the independent variable (*X*) consists of Land Area ($X_{1)}$), Number of Seeds ($X_{2)}$), Amount of Fertilizer ($X_{3)}$), Amount of Pesticides (X_4) and Amount of Labor ($X_{5)}$). Before data analysis is carried out, classical assumptions must be tested. If the classical assumptions are met, then parametric statistics are used to obtain a good regression model. A good regression model is a regression model that is free from multicollinearity and heteroscedasticity. Testing for classical assumption deviations is obtained with the help of the SPSS 22 program.

Table 5 Multicollinearity Test Results

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constanta)		
	LN_X1	0,341	2,931
	LN_X2	0,168	5,935
	LN_X3	0,344	2,903
	LN_X4	0,151	6,623
	LN_X5	0,267	3,744

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Table 5 explains that, multicollinearity test can be said not to occur multicollinearity, because the VIF value is less than 10 and the *Tolerance* value is more than 0.1. Land area (X_1) VIF value of 2.931, the number of seeds (X_2)VIF value of 5.935, the amount of fertilizer (X_3)VIF value of 2.903, the amount of pesticides (X_4)VIF value of 6.623 and the amount of labor (X_5) VIF value of 3.744. So it can be concluded that the data in this study does not occur multicollinearity because the VIF value is less than 10 so it can be stated that the model does not have multicollinearity symptoms.

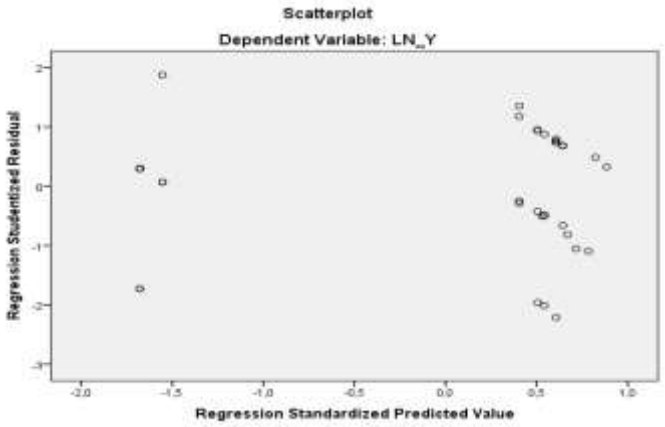


Figure 1 Heteroscedasticity Test Results with Scatterplot Graph Method

Figure 1 explains that the results of testing heteroscedasticity with the *Scatterplot* graph method can be seen that the points have spread both above and below the number 0 on the Y axis, not forming any pattern that collects. This can be explained that the regression model is indicated that there is no heteroscedasticity problem.

Table 6 Estimation Results of Multiple Regression Analysis Model of Hybrid Maize Farming in Marobea Village, Sawerigadi Subdistrict, West Muna Regency

No.	Variables	Regression Coefficient	Test t	
			T count	Sig
1.	Constant	6,574	22,514	0,000^{S}
2.	Land Area (X_1)	0,422	5,746	0,000^{S}
3.	Number of Seeds (X_2)	0,078	0,627	0.535 ^{TS}
4.	Amount of Fertilizer (X_3)	0,064	0,911	0.369 ^{TS}
5.	Amount of Pesticides (X_4)	-0,077	-0,649	0.521 ^{TS}
6.	Total Labor (X_5)	-0,022	-0,208	,837^{TS}

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	Coefficient of determination (R^2)	0,743		
	F-count		22,383	,000[S]
	Error Rate	0,05		

Source: Results of primary data processing 2022

Based on the results of data analysis as presented in Table 6, the multiple linear regression analysis equation that has been logarithmized can be obtained as follows:

$$Y = 6.574.X_{(1)}{}^{(0.422)} \cdot X_{(2)}{}^{(0.078)} \cdot X_{(3)}{}^{(0.064)} \cdot X_{(4)}{}^{(-0.077)} \cdot X_{(5)}{}^{(-0.022)}$$

Table 6 also shows that the parameter used for the t-test in this study is to compare the significance value with the 5 percent error rate. The F-count significance value of 0.000 < 0.05 means that there is a real influence (significant). Variables including land area ($X_{1)}$, seed ($X_{2)}$, fertilizer ($X_{3)}$, pesticide ($X_{4)}$, labor ($X_{5)}$ are simultaneously able to explain changes in the variable amount of production (Y). The regression equation above also has a constant value of 6.574. This shows that if the independent variables are considered zero, then the effect of land area ($X_{1)}$, seed ($X_{2)}$, fertilizer ($X_{3)}$, pesticide ($X_{4)}$, labor (X_5) on maize production is 6.574. This means that plants will still be able to produce even if they do not receive special treatment such as attention to seed spacing, fertilizer application, pesticide use and additional labor, because plants can utilize the nutrients available around their environment even though it takes a long time to grow and develop.

Variable Land Area (X_1)

The significance value of the land area variable = 0.000 < 0.05 (+), so the variable has a significant effect on the amount of corn production. The regression coefficient value obtained is b_1= 0.422, which means that $_{for}$ every 1% increase in land area, production will increase by 0.422. Thus, the variable has a positive and significant effect. Land area has a significant effect because in addition to the fertile land in Marobea Village, the land area there also supports mass production of maize. Thus, having a large area of land allows farmers to take advantage of economies of scale, which can reduce production costs per unit of maize. Land is one of the determinants of high and low production. The larger the area of land planted, of course, the greater the opportunity to produce greater production. In accordance with the opinion of Alim, (2022) states that the larger the land area planted, the greater the corn production that will be

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produced by appropriate processing. This is in accordance with research conducted by Saleh, (2022) found that the variable land area partially has a significant effect on the production of corn farmers.

Variable Number of Seeds (X_2)

The significance value of the variable number of seeds is 0.535 > 0.05 so the variable has an insignificant (negative) effect on the amount of maize production. The variable does not have a significant effect on production because the reality in the field shows that the use of seeds by respondent farmers is superior, but their use is not maximized. The amount of corn seed use is not a major concern and is not in accordance with the actual recommendations which can cause less than optimal plant growth. The success of a crop is highly dependent on the production input factors used, especially seeds. Seeds are the most important input for increasing production and productivity. The use of the wrong seeds will greatly affect the performance of production and the impact of using the wrong seeds causes a lot of losses (Wahyuni, 2021). This is different from the research conducted by Atika (2020) which found that the number of seeds partially had a significant effect on farmers' production.

Variable Amount of Fertilizer (X_3)

The significance value of the variable amount of fertilizer is 0.369 > 0.05, so the variable has an insignificant (negative) effect on the amount of hybrid maize production. The variable has no significant effect because based on the research data, the amount of fertilizer used by respondent farmers is still relatively low with an average of 44.47 Kg/ha, when compared to the recommended amount of 300-350 Kg/ha by Balitbangtan *in* Atman (2015). In addition, fertilization is done only once, namely before planting. Fertilizer is applied by spreading it on the land that will be planted with maize. Based on the nutrient content, fertilizers are divided into two, namely macro fertilizers (N, P, K) and micro fertilizers, namely Zn, Fe, Ca and others. The use of fertilizer must be in accordance with the right dose and time, if given in excess (*over dose*) fertilizer will have a negative impact on plants (Rauf, 2000). This is different from the research conducted by Tomy, (2013) found that the fertilizer variable (X2) partially had a significant effect on corn production.

Variable Amount of Pesticides (X_4)

The significance value of the variable number of pesticides is 0.521 > 0.05 so the variable has an insignificant (negative) effect on the amount of hybrid corn production. This has no real

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effect because based on field data the average use of pesticides in the study area is 4.47 Ltr/ha. The use of pesticides in their application, respondent farmers in Marobea Village did not pay much attention to the recommended dosage. Spraying is done by farmers only twice during the growing season while the recommended spraying is done once a week. Pesticides are one of the production facilities that are very important in plant protection efforts. Besides providing benefits, pesticides can also have a negative impact if not managed properly and wisely. The availability of pesticides is very diverse, so that farmers/users have the opportunity to choose according to their needs and the appropriate price (DITJEN Prasarana dan Sarana Pertanian, 2020). This is in accordance with research conducted by Habib, (2013) entitled "Analysis of Factors Affecting Corn Production" which states that land area, fertilizer, and labor have no significant effect on corn production". Ayadi (2019) found that pesticides partially had no effect or negative effect on corn production.

Variable Number of Labor (X_5)

The significance value of the total labor variable is 0.837 which is smaller than 0.05, then the variable has an insignificant (negative) effect on the amount of hybrid corn production. This happens because based on the field data, the average use of labor is still relatively low in the research area which is 12.06 HOK compared to the use of HOK recommended by Purwanto*, et al.* (2015) which is 89 HOK/ha during one planting season. The use of labor in Marobea Village is still relatively low due to the phenomenon of urbanization, where people immigrate to the city looking for work in the non-agricultural sector. This can lead to a lack of labor in the agricultural sector. This can result in low labor availability in villages, especially among the younger generation. The use of labor is a factor that must be met for the continuity of maize farming activities. The involvement of labor starts from the time of land cultivation until harvest. The labor used in this study comes from within the family.

The use of labor must of course be careful and truly calculated. The use of labor which is also excessive will certainly increase production costs, so that the income to be obtained will decrease and even potentially cause losses (Hernanto, 1989). This is in accordance with research conducted by Linda (2020) which found that the variable number of workers (X_3) partially had no significant effect.

CONCLUSION

Based on the results of this study, it can be concluded that jointly/simultaneously, the variables of land area ($X_{1)}$, seed amount ($X_{2)}$, fertilizer amount ($X_{3)}$, pesticide amount (X_4) and

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labor amount (X_5) significantly affect maize production (Y). Partially, the land area variable (X_1) has a positive and significant effect on maize production (Y). While the variables of seed amount (X_2), fertilizer amount (X_3), pesticide amount (X_4) and labor amount (X_5) have no significant effect on maize production (Y).

To increase maize production in Marobea Village, it is recommended that farmers increase the size of the planting area and use seeds, fertilizers, pesticides, and labor efficiently according to cultivation recommendations. The local government and the Agriculture Office of West Muna Regency are also expected to routinely conduct socialization on the use of appropriate inputs and provide facilities so that farmers can easily access their production needs. In addition, future researchers are expected to conduct further research by adding other variables that affect hybrid maize production.

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