

Factors Affecting Cashew Nut (*Anacardium occidentale* L.) Production in Lamorende Village, Tongkuno District, Muna Regency

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Abstract

This study aims to: (1) determine the factors that influence cashew production in Lamorende Village, Tongkuno District, Muna Regency, (2) determine the production elasticity of each input on cashew production in Lamorende Village, Tongkuno District, Muna Regency. The types and sources of data in this study use primary data and secondary data with data collection techniques through observation, interviews, and literature studies. The data analysis used is the Cobb-Douglas analysis, which is transformed into a linear form by applying the natural logarithm (ln). The results of the analysis show that of the four input variables studied, namely land area, number of trees, labor, and plant age, only two variables have a significant effect on cashew production, namely land area and number of trees. These two variables have a positive and real effect on increasing cashew production, while labor and plant age do not have a significant effect on production. The results of the production elasticity analysis show that the variable number of trees has an elasticity value of more than one (elastic), while land area, labor, and plant age have an elasticity value of less than one (inelastic). This indicates that increasing the number of trees has a greater impact on production than other variables. Furthermore, the returns to scale (RTS) of cashew farming in Lamorende Village are in a state of increasing returns to scale, with a total elasticity value of 1.467.

Keywords: *Cashew production, production factors, production elasticity, Cobb-Douglas production function*



INTRODUCTION

Indonesia is an agrarian country with most of its population relying on the agricultural sector as their primary source of livelihood. Silitonga (2019) states that the role of the agricultural sector in economic development includes providing food surpluses for the growing population, generating additional foreign exchange through agricultural exports, increasing community income, and improving overall welfare. According to data from the Central Statistics Agency (BPS) in 2024, the agricultural sector contributed 23.02% to the economy of Southeast Sulawesi Province in 2023. Although this contribution has decreased by 5.37% over the past 14 years, the agricultural sector remains the backbone of the regional economy. The three sub-sectors dominating the Regional Domestic Product (RDP) of Southeast Sulawesi are fisheries, plantations, and livestock, with the plantation sub-sector playing a crucial role in labor absorption and income generation for rural communities (BPS Southeast Sulawesi, 2024).

One of the plantation commodities with significant economic value is cashew (*Anacardium occidentale* L). This commodity is a priority for plantation development, particularly in the Eastern Indonesia Region (KTI), due to its high economic potential and continuously increasing market prospects, both domestically and internationally (Haryanto, 2022). However, cashew productivity in Indonesia remains low due to suboptimal cultivation techniques, the use of unsuitable varieties, and planting locations that are not fully suited to the plant's growth requirements (Ihsan et al., 2023).

According to data from the Indonesian Plantation Statistics for 2018–2020, six provinces are the main producers of cashew nuts, contributing 93.27% of the national total production. East Nusa Tenggara Province ranks first with an average production of 49,042 tons, followed by Southeast Sulawesi with an average production of 27,955 tons or 35.3% of total production. Muna Regency, as one of the districts in Southeast Sulawesi, has great potential for cashew development. Since 1970, cashew has been developed as a reforestation crop; however, its management remains traditional and suboptimal (Kaharuddin et al., 2019).

Tongkuno Subdistrict in Muna Regency is one of the main production centers for cashew nuts. According to data from the Central Statistics Agency (BPS) of Muna Regency (2023–2024), the area of cashew nut plantations in this subdistrict remained at 4,681 hectares during the 2020–2023 period, but production has fluctuated, with 3,770.6 tons (2020), 3,470.6 tons (2021), 3,770.6 tons (2022), and 3,970.6 tons (2023). This phenomenon indicates that land area is not the sole factor influencing production, necessitating further study of other variables such as labor, number of trees, plant age, and the use of cultivation technology.

Lamorende Village, one of the villages in Tongkuno Sub-district, has significant potential





for cashew cultivation. Despite being widely cultivated, cashews have not become the primary income source for the community due to traditional management practices. Most farmers only harvest the fruit without pruning, fertilizing, or renewing the trees, while most of the plants are already old, which naturally reduces productivity (Suryadi, 2018; Hadad et al., 2016).

Based on preliminary surveys, production per farmer varies between 50–500 kg per harvest season, with an average of 250 kg per hectare—a figure that is relatively low and uneven. To optimize production, it is necessary to understand the most influential production factors. A relevant approach is production elasticity analysis, which measures the sensitivity of output to changes in specific inputs (Soekartawi, 2002). This information can help farmers allocate resources efficiently.

Previous studies have extensively discussed modern cultivation techniques, post-harvest processing, or marketing of cashew nuts in other regions. However, studies focusing on the analysis of production factors in areas with old trees and low levels of cultivation, such as in Lamorende Village, are still limited. Therefore, this study was conducted to identify the factors influencing cashew production in Lamorende Village, Tongkuno Sub-district, Muna District, thereby providing a basis for strategies to enhance productivity and farmer welfare.

METHOD

This study was conducted in Lamorende Village, Tongkuno Sub-district, Muna Regency. The research location was selected *purposively*, considering that Lamorende Village is one of the main cashew-producing areas. The study was carried out from June to August 2025. The study population consisted of all cashew farmers in Lamorende Village, Tongkuno Sub-district, totaling 106 individuals. A sample of 50% of the population (53 respondents) was selected using *proportional stratified random sampling*.

The data collection techniques used in this study include observation, which involves directly observing activities and conditions at the research site; interviews, which involve directly asking farmer respondents using a prepared questionnaire; and literature review, which involves gathering information from various sources such as books, journals, reports, and other documents relevant to the research topic.

The first objective of this study uses the Cobb-Douglas production function to identify the factors influencing cashew production with the equation:

$$Y = a \cdot X_{(1)}^{b(1)} \cdot X_{(2)}^{b(2)} \cdot X_{(3)}^{b(3)} \cdot X_{(4)}^{b(4)} \cdot e^u$$





Notes:

Y = Production (kg)

X_1 = Land area (Ha)

X_2 = Number of Trees (Trees)

X_3 = Labor (Hok)

X_4 = Plant Age (Years)

a, b = Variable to be estimated

u = Error

e = Natural logarithm

The data was transformed into natural logarithms and analyzed using multiple linear regression, along with R^2 tests, F tests, t-tests, and classical assumption tests (normality, multicollinearity, and heteroscedasticity). The second objective was to calculate production elasticity based on the Cobb-Douglas regression coefficient using the formula:

$$Y = a \cdot X_{(1)}^{b(1)} \cdot X_{(2)}^{b(2)} \cdot X_{(3)}^{b(3)} \cdot X_{(4)}^{b(4)} \cdot e^u$$

Notes:

Y = Cashew production (kg)

X_1 = Land area (Ha)

X_2 = Number of trees (trees)

X_3 = Labor (Hours)

X_4 = Plant Age (Years)

a, b = Variable to be estimated

u = Error

e = Natural logarithm

For each input, the effect of land area, number of trees, labor, and plant age on production can be determined, whether it is elastic (>1), unitary elastic ($=1$), or inelastic (<1).

RESULTS AND DISCUSSION

Characteristics of Cashew Farming

The characteristics of cashew farming are variables related to cashew farming observed in this study. These characteristics include land area, number of trees, labor, and plant age.



Table 1. Farming Characteristics Based on Land Area, Number of Trees, and Plant Age

Variable	Sub-Variable	Number (People)	Percentage
Land Area (ha)	<0,5	11	20,75
	0,5-2	41	77,36
	>2	1	1,89
Number of Trees	<20	7	13,21
	20-49	35	66,04
	>50	11	20,75
Plant Age	4-10	18	33,96
	11-20	18	33,96
	>20	17	32,08
Total		53	10

Based on Table 1 above, the characteristics of farming based on land area, number of trees, and age of plants can be explained as follows;

1. Land area, based on 53 respondents, the majority (77.36%) cultivate cashew on medium-sized land (0.5–2 ha), followed by small land (<0.5 ha) at 20.75% and large land (>2 ha) at 1.89%. However, land area does not always correlate directly with the number of trees or productivity. There are farmers with 1 ha of land who only plant 10–20 trees, while other farmers with 0.5 ha are able to plant up to 40 trees. However, according to the technical guidelines of the Directorate General of Plantations (2006), the ideal planting distance of 10 × 10 m allows for approximately 100 trees to be planted on 1 ha. The low land utilization is attributed to a shift in farmers' preferences toward other crops, resulting in cashew orchards being managed less intensively and trees being allowed to grow naturally, which impacts productivity. Therefore, while land area significantly influences production, increasing yields requires optimal management through the application of ideal planting distances, intensive maintenance, and tree renewal.
2. Number of trees, 53 farmer respondents in Lamorende Village, most of whom have a medium-scale number of cashew trees (20–49 trees), accounting for 35 people (66.04%), followed by 11 people (20.75%) with a large-scale number (>50 trees) and 7 people (13.21%) with a small-scale number (<20 trees). However, the number of trees does not always correspond to the size of the land; for example, there are farmers with 1 ha of land who only plant 10 trees, even though the land could accommodate around 100 trees with a planting distance of 10 × 10 meters, while others plant up to 130 trees on 1.5 ha of land.

This inconsistency indicates that cashew management is not yet optimal, as some farmers allow their land to grow naturally without planting patterns or regular replanting. Based on the respondents' identities, most have primary occupations outside the cashew sector, such as rice farming, livestock raising, government employment, or trading, so cashews are not the primary commodity managed intensively. As a result, despite the relatively high number of trees, their contribution to production remains low due to the absence of cultivation intensification and crop renewal.

3. The age of cashew trees in Lamorende Village is relatively evenly distributed across three age groups, namely 4–10 years (33.96%), 11–20 years (33.96%), and over 20 years (32.08%). However, despite the percentage of the 4–10-year-old group being equal to the other groups, young trees in this age stratum are rarely found in the field because most are the result of new plantings facilitated by the village head in previous periods as part of efforts to regenerate older trees. The 11–20 years age group reflects the peak productivity phase, while the >20 years age group is dominated by old plants that require renewal or pruning to maintain optimal productivity. Thus, although statistical data indicate a balanced distribution, field conditions suggest a shortage of young plants, which poses a challenge for the sustainable development of cashew cultivation in this village.

Table 2. Characteristics of Farming Based on Labor Use and Production

	Number	
	Labor Use (HOK)	Production (kg)
Lowest	16	22
Highest	239	2000
Average	94	219

Based on Table 2 above, the characteristics of farming based on labor use and production can be explained as follows

1. The use of labor in cashew farming in Lamorende Village ranges from 16 to 239 HOK, with an average of 94 HOK per planting season. Labor is dominated by family members—husbands, wives, and children—for land clearing, planting, and harvesting because it is more efficient and does not incur additional costs, while non-family labor is only used for tasks that require extra manpower, such as pruning large trees or weeding before harvest. Variations in the number of HOK do not reflect optimal management because cashew is not the primary livelihood for most farmers, so orchard maintenance is done part-time

without regular upkeep. As a result, labor use has not significantly impacted production, necessitating labor optimization and intensive, sustainable improvements in cultivation skills.

2. Cashew production in Lamorende Village varies between 22 kg and 2,000 kg per growing season, with an average of 219 kg. This variation is due to differences in cultivation techniques, plant density, tree age, and the use of production inputs such as fertilizers and labor. Some farmers have high potential yields due to large land areas and a high number of trees; however, the lack of intensification—such as not pruning or applying fertilizer regularly—results in suboptimal harvests. Conversely, farmers with limited land and trees but who intensively maintain their crops can achieve better yields. This aligns with Rohman's (2018) assertion that cashew production is highly influenced by the application of appropriate cultivation technologies, where intensification practices such as tree renewal and regular weed management are key to increasing harvest yields.

Factors Influencing the Production of Jambu Mete

An analysis of the use of production factors was conducted using a multiple linear regression function. The results of this analysis were then converted into a Cobb-Douglas production function. In this model, the dependent variable (Y) is cashew production, while the independent variables include various factors that are thought to influence production, namely land area (X1), number of trees (X2), labor (X3), and plant age (X4). All input variables are measured based on their use in one growing season per hectare, thereby enabling an efficient and measurable representation of each factor's contribution to production output.

Table 3. Estimation Results of Factors Influencing Cashew Nut Production in Lamorende Village with Determination Coefficient (R^2), F-Test, and T-Test.

Variable	Regression Coefficient B	Partial t-test	Sig.
Constant	151.922	2.175	.035
Land Area	.422	2,312	.025
Number of Trees	1,004	6,597	.000
Labor Force	0.012	.328	.745
Plant Age	.029	.305	.762
F (Simultaneous Test)	43.37		.000 ^b
Coefficient of Determination (R^2)	.783		
R Value	.885 ^a		

The table above shows that the SPSS output results can be seen from the significant values of the constant, land area, number of trees, labor, and plant age. Therefore, the regression model equation can be formulated from the values in column *B* in the study with the model formed as follows.

$$Y=151.922.X_1^{.422}.X_2^{1.004}.X_3^{.012}.X_4^{.029}$$

The magnitude of the coefficient of determination is indicated by the R^2 value in the regression model. The results of the coefficient of determination analysis (R^2) are 0.783, while the *R* value is 0.885 for the factors influencing cashew production. This indicates that 78.3% of the mango production variable can be explained by the variables of land area (X_1), number of trees (X_2), labor (X_3), and plant age (X_4). The table above shows that the $F_{(calculated)}$ value is 43.370 with a significance level of $0.000 < \alpha 0.05$ (5%). Therefore, it can be concluded that the variables of land area (X_1), number of trees (X_2), labor (X_3), and plant age (X_4) together have a significant effect on cashew production in Lamorende Village.

The production factors that influence and do not influence the level of cashew farming production in Lamorende Village are as follows:

1. Land area (X_1), with a regression coefficient of 0.422 and significance of $0.025 < \alpha 0.05$, indicating that the larger the land area, the higher the cashew production, where each 1% increase in land area increases production by 0.422%. This finding aligns with field observations and is supported by research conducted by Haryanto (2022) and Munawaroh (2021), which confirm that land area has a positive and significant impact on the production of plantation crops.
2. Number of Trees, the regression coefficient for the number of trees is 1.004 with a significance level of $0.000 < \alpha 0.05$, indicating that every 1% increase in the number of trees increases jambu mete production by 1.004%. This finding aligns with field conditions and the research by Haryanto (2022) and Rustiawati et al. (2020), which confirm that the number of trees has a positive and significant impact on harvest volume, as each tree is a productive unit that directly contributes to the total production output.
3. Labor, with a labor regression coefficient of 0.012 and a significance value of $0.745 > \alpha 0.05$, indicates that this variable does not significantly affect cashew production, although the positive direction of the coefficient suggests that additional labor has the potential to increase production. This insignificance is related to the simple, small-scale management practices in Lamorende Village, which rely on seasonal family labor, resulting in a relatively

small contribution to total output. This finding aligns with Rustiawati et al. (2020) and Haryanto (2022), who stated that the role of labor in cashew farming is positive but not dominant compared to other production factors such as land area or number of trees.

4. Plant age, with a regression coefficient of 0.029 and a significance value of $0.762 > \alpha 0.05$, indicates that this variable does not significantly affect cashew production, although the positive direction of the coefficient suggests the potential for increased production with increasing plant age. This insignificance is likely due to the dominance of old trees aged >20 years in Lamorende Village, which have passed their peak productivity without being supported by renewal programs or intensive maintenance, resulting in declining canopy quality, many dry branches, and a drastic reduction in flower and fruit formation. This finding aligns with Junaedi et al. (2021), who stated that plant age does not always significantly affect production if not supported by adequate care. However, this differs from the results of Tampubolon et al. (2016), who found a significant effect of plant age on the productive lifespan of , indicating that the impact of age on production is highly dependent on plant condition, environment, and maintenance intensity.

Elasticity of Production of Each Input

Production elasticity is a measure that indicates the level of response or sensitivity of output (cashew production) to changes in each input (land area, number of trees, labor, and plant age). In the Cobb-Douglas production function model, the regression coefficient values of each input variable can be directly interpreted as the production elasticity values. The regression estimation results show the production elasticity values of each input, as presented in Table 4.

Table 4. Regression Coefficients and Production Elasticity of Each Cashew Nut Input Variable

Input Variable	Regression Coefficient (B)	Production Elasticity (%)	Description
Land Area	.422	0,422	Inelastic
Number of Trees	1.004	1,004	Elastic
Labor	.012	0,012	Inelastic
Plant Age	.029	0,029	Inelastic

Table 4 shows that the number of trees (X2) has the greatest influence on cashew production, with an elasticity of 1.004. This means that a 1% increase in the number of trees will increase production by 1.004%, indicating elasticity and placing the number of trees as the most dominant production factor. This finding aligns with Rosihan's (2018) research, which states that

plant density plays a crucial role in enhancing cashew production. Meanwhile, land area has an elasticity of 0.422, meaning that a 1% increase in land area will increase production by 0.422%. Although inelastic (value < 1), its influence is significant and consistent with Soekartawi's (2003) theory, which emphasizes land area as one of the most influential production factors in agriculture.

Conversely, the labor and crop age variables have very low elasticities, at 0.012 and 0.029, respectively, and are not statistically significant. This indicates that neither variable has a significant effect on cashew production, possibly due to suboptimal labor efficiency and the dominance of less productive older trees. These findings align with Rustiawati et al. (2020), who noted that in some plantation commodities, labor does not always contribute significantly to yield increases, especially when cultivation systems remain traditional. Additionally, an analysis of the Return to Scale (RTS) was conducted to measure the scale of production output, specifically how simultaneous changes in all inputs affect output changes.

In the Cobb-Douglas production function, RTS is calculated by summing all regression coefficients (β) of input variables, namely:

$$RTS=0,422+1,004+0,012+0,029=1, 1,467$$

An RTS value of $1.467 > 1$ indicates that cashew farming in Lamorende Village is in a state of *increasing returns to scale*. This means that if all production inputs are increased proportionally (for example, each by 1%), cashew production will increase by more than 1%. This condition indicates that there are opportunities for efficiency and promising potential for business scale expansion. According to Soekartawi (2003), *Increasing Return to Scale* reflects the existence of production capacity that has not been fully utilized optimally by farmers. In this context, cashew farmers can still increase their production.

CONCLUSION

Based on the research findings, it can be concluded that of the four input variables studied, namely land area, number of trees, labor, and plant age, only two variables have a significant effect on cashew production, namely land area and number of trees. These two variables have a positive and significant effect on increasing cashew production, while labor and plant age do not have a significant effect on production.

The results of the production elasticity analysis show that the number of trees has an elasticity value of more than one (elastic), while land area, labor, and plant age have elasticity



values of less than one (inelastic). This indicates that an increase in the number of trees has a greater impact on production increase compared to other variables. Additionally, the scale of production output (Return to Scale) in cashew farming in Lamorende Village is in a condition of *increasing returns to scale*, with a total total s value of 1.467, meaning that an increase in all inputs proportionally results in a greater increase in output than their proportion.

Based on the study of factors influencing cashew production in Lamorende Village, several recommendations can be made. For the government, it is recommended to provide practical and easily implementable recommendations for farmers, such as strategies to improve input efficiency through proper planting distance, tree density management, subsidies for high-quality seeds, land support, and structured training in the management of old trees. For farmers, it is recommended to optimize land use and increase the number of productive trees according to agronomic standards, utilize farmer groups or cooperatives to reduce production costs through joint purchases of seeds, fertilizers, and equipment, and facilitate programs for the renewal of old trees. Meanwhile, for future researchers, it is recommended to conduct further studies with a broader geographical scope, a more representative sample size, and a longer harvest observation period, while considering additional variables such as seed quality, post-harvest management, microclimate, and post-harvest economic value to produce more comprehensive recommendations.

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