

Analysis of Corn Farmers Household Resslerence in Watodiri Village, Ile Ape District, Lembata Regency

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Abstract. Household food security is a crucial indicator of community welfare, particularly in agricultural regions. This study aims to: (1) analyze farmers' income, as well as household food and non-food consumption expenditures, (2) assess the Food Expenditure Share (FES), and (3) examine the influence of household income and the education level of the household head on the food security of maize farmers in Watodiri Village, Ile Ape District, Lembata Regency. The research employs a quantitative approach, with data collected through surveys of maize farmers. The results indicate that the average income from maize farming is IDR.1.237.333/year, while additional income from other farming activities amounts to IDR.1.776.678/month and non-farming income averages IDR.2.311.111/month, resulting in a total household family income of IDR.4.190.900/month. Household food expenditures reach IDR.2.260.793/month, while non-food expenditures amount to IDR.1.449.110/month. An FES value of 61% suggests that maize-farming households in Watodiri Village fall into the food-insecure category. Factor analysis reveals that household income and the education level of the household head significantly influence food security, with higher-income and better-educated households tending to have better food security. These findings provide empirical evidence on the importance of increasing income and knowledge capacity in promoting food stability. Policy recommendations include economic empowerment programs and sustainable agricultural training to enhance food security in Watodiri Village.

Keywords: *Household food security; corn farming; Food Share Expenditure (FSE); household income*

1. Introduction

Indonesia, a country with a large population, faces complex challenges in meeting the food needs of its people. Food is a vital and strategic commodity for Indonesian society as it is a basic human necessity that must be fulfilled [1]. This situation makes food security a crucial aspect of national development, particularly in the agricultural sector, which serves as an economic pillar and the primary source of income for rural households. As a fundamental human need, food must be available in sufficient quantities, be of good quality, safe, and sustainable, in accordance with the mandate of Article 27 of the 1945 Constitution on the right to food and nutrition. Food security reflects a community's ability to access adequate food, both in quantity and quality, which is a prerequisite for a healthy and productive life.

The threat of food insecurity remains a serious challenge, especially in rural areas. Rural agriculture often fails to provide adequate levels of income and welfare for its communities. This structural rural poverty is linked to the limited access rural populations have to land ownership [2]. Data shows that rural households are more vulnerable to food instability than urban ones [3]. This is due to their dependence on the agrarian sector, limited infrastructure, and low farmers' terms of trade. According to Law No. 18 of 2012, food security encompasses not only availability but also affordability, stability, and compatibility with local cultural values. These three pillars—availability, accessibility, and stability—must be fulfilled to ensure sustainable food security.

Lembata Regency, an agricultural area with corn as its main commodity, faces significant food security challenges. Based on the 2022 Food Security Index (IKP), Lembata ranks 312th out of 416 regencies with a score of 66.98%, indicating high vulnerability. The prevalence of undernourishment (PoU) in Lembata in 2023 reached 15.85%, far above the national average (8.53%) [4]. Contributing factors include dependence on external food supplies, climate change, and less diverse consumption patterns. Prolonged dry seasons (July– October) and unpredictable rainfall exacerbate this condition, threatening the production of local staple foods like corn, which is the community's mainstay.

Watodiri Village, in the Ile Ape District, is a prime example of these challenges. With its dry tropical climate (rainfall only 3-4 months/year) and dependence on corn and local foods such as sweet potatoes and palm sap, farming households in Watodiri are vulnerable to harvest and price fluctuations. A study by Ref. [5] confirmed that low farmer income impacts their limited access to nutritious food. Furthermore, the high allocation of household expenditure for food reflects economic vulnerability that has the potential to disrupt food stability.

Based on the aforementioned background, this research aims to: (1) Analyze farmers' income and household food and non-food consumption expenditures in Watodiri Village. (2) Measure the Food Share of Expenditure (FSE) as an indicator of food security in Watodiri Village. (3) Identify the factors of income and the education level of the head of the household that influence food security in Watodiri Village.

2. Research Methods

2.1 Population and Sample

The research population consisted of all 217 heads of households in Watodiri Village. The sample was determined using a purposive sampling technique, resulting in 30 respondents deemed representative given the homogeneity of the population's occupations and main commodities.

2.2 Type and Source of Data

Primary Data was obtained, including income data from corn farming and other sources, household expenditure data (for both food and non-food items), respondents' socio-economic characteristics, and the corn cultivation practices applied. This data was gathered through various collection methods, including structured interviews using questionnaires, direct field observation, and a Focus Group Discussion (FGD) conducted with a farmers' group. Through this multi-dimensional approach, the study aimed to gain a comprehensive understanding of the dynamics of corn farming and the conditions of farming households.

Secondary Data in this study included village monographic data, agricultural production data from relevant government agencies, reports from the Central Statistics Agency (BPS) on food security, and relevant findings from previous research. This data was obtained from various sources, including the Village Office and local Agricultural Office for official administrative and statistical data, libraries for book references and printed reports, and online

scientific journals for previous studies. By utilizing these sources, the study strengthened its analysis through accurate and reliable secondary data.

2.3 Data Collection Techniques

Structured Interviews

Conducted using questionnaires that had been tested for validity and reliability. Interviews were carried out face-to-face with the assistance of local community members.

2.4 Observation

Participatory observation of corn farming activities was conducted to understand the cultivation process directly. Furthermore, observation of farming household conditions was also carried out, including their food storage facilities. The researcher also performed visual documentation through photographs to record farmland conditions, cultivation techniques applied, and the harvest yields.

Document Study: Analysis of secondary data from various written sources was used to complement the primary data.

2.5 Data Analysis Tool

This study used a survey method with a descriptive and analytical quantitative approach. According to Ref. [6], the survey method is a technique for collecting primary data from a population sample to describe the characteristics of that population. The quantitative approach was chosen because it is suitable for analyzing the relationships between farming household variables and food security.

Household

In this study, a household is defined as the smallest social unit consisting of an individual or group of individuals living together in one building, sharing food consumption from the same kitchen, and managing their affairs independently. The specific criterion was that the head of the household worked in the agricultural sector or other related fields. This unit of analysis was chosen because it reflects the primary economic decision-making unit concerning food.

Household Income

Household income is defined as all financial receipts in Rupiah/month received by all family members from various economic activities. The emergence of new income sources signifies new labor absorption, which also means a reduction in rural unemployment. The village economic wheel turns with the growth of rural MSMEs (*Usaha Rumah Tangga*). Furthermore, it will increase the income level of rural farming households, enhance purchasing power, guarantee food security and sovereignty, and lead to greater prosperity. If the rural economy grows, the regional economy will also increase [7]. This concept is differentiated into four main components.

First, on-farm income derived directly from corn farming activities. Second, other on-farm income originating from agricultural diversification such as livestock or fisheries. Third, off-farm income from activities related to agriculture but not direct cultivation, such as wages from agricultural labor. Fourth, non-farm income obtained from sectors outside agriculture, such as trade or services. All these components are calculated on a gross basis before deducting production costs. Total household income is calculated using the formula:

$$THI = OFI + OOI + OFFI + NFI$$

Description:

THI = Total Household Income (IDR/month) OFI = Income from Corn Farming (On-Farm Income) (IDR/month)

OOI = Income from Other Farming Activities (Other On-Farm Income) (IDR/month)

OFFI = Income from Off-Farm Activities (Off-Farm Income) (IDR/month)
 NFI = Income from Non-Farm Activities (Non-Farm Income) (IDR/month)

2.5.1 Household Food Consumption Expenditure

This is the value of spending undertaken by the household to purchase various types of food needs over a specific period. Household food consumption expenditure can also be defined as expenditure on goods and services by the household for consumption purposes [8]. Expenditure classification is divided into two main groups.

The first group is food expenditure, which includes all forms of spending on staple food and beverages such as rice, side dishes, vegetables, spices, and other additives. The second group is non-food expenditure, covering costs for education, health, transportation, communication, and other household needs.

Food consumption is understood as the physical quantity of food and beverages consumed by household members to meet daily nutritional needs. This consumption pattern varies based on the age, gender, and physical activity of each individual in the household. Non-food consumption refers to financial expenditure for goods and services outside basic food needs. It is calculated using the formula:

$$TTE = FE + NFE$$

Description:

TTE = Total Household Expenditure (IDR/month) FE = Food Expenditure (IDR/month)

NFE = Non-Food Expenditure (IDR/month)

2.5.2 Household Food Security

In this study, food security is measured through an economic approach focusing on the aspect of accessibility. This concept is operationalized using the Food Share Expenditure (FSE) indicator, which calculates the proportion of food expenditure to total household expenditure. FSE is a crucial indicator as it reflects the level of a household's economic independence in meeting basic food needs. The higher the proportion spent on food, the more vulnerable the household's food security condition. Household food security is measured by the Food Share Expenditure (FSE) using the formula:

$$FSE = \frac{FE}{TTE} \times 100\%$$

Description:

FSE = Food Share Expenditure (%)

FE = Expenditure on food (IDR/month)

TTE = Total household expenditure (food+non- food).(IDR/month)

Assessment Category:

FSE < 60% = Food Secure FSE ≥ 60% = Food Insecure

2.6 Statistical Analysis

The analysis employs a multiple linear regression approach to test the relationship between independent variables (family income and education of the head of the household) and the dependent variable (food security). This model was chosen because it can explain the contribution of each socio-economic factor to food security conditions. Variable measurement was conducted through direct surveys using questionnaires tested for validity and reliability. The quantitative data obtained were then processed using statistical software to gain a comprehensive overview of the food security dynamics of corn farming households in the research location. Testing the influence of family income (X₁) and education

of the head of the household (X_2) on food security (Y): $Y = b_0 + b_1X_1 + b_2X_2 + \mu$

Description:

- Y = Level of Household Food Security
- b_0 = Constant/Intercept
- b_1, b_2 = Regression Coefficients
- X_1 = Family Income
- X_2 = Education of the Head of the Household
- μ = Error Term

Classical Assumption Tests

- 1) Normality Test
Using the Shapiro-Wilk test Criterion: $p\text{-value} > 0.05$
- 2) Multicollinearity Test
Based on the VIF (Variance Inflation Factor) value
Criterion: $VIF < 10$
- 3) Heteroscedasticity Test
Using the Glejser test Criterion: $p\text{-value} > 0.05$

Hypothesis Model Testing

- 1) F-test
Tests the significance of the model simultaneously. Criterion: $p\text{-value} < 0.05$
- 2) T-test
Tests the significance of the partial influence of independent variables. Criterion: $p\text{-value} < 0.05$.

3. Results and Discussion

3.1 Analysis of Farmer Income and Amount of Food and Non-Food Consumption Expenditure

3.1.1 Analysis of Farming Household Income

This research reveals the income structure of corn farming households in Watodiri Village, which comes from three main sectors (Table 1). Income from corn farming contributed only an average of IDR.103.111/month or 3% of total income when accumulated monthly, while income from other farming activities reached IDR.1.776.678/month or 42%. The non-agricultural sector provided the largest contribution at 55%, with an average of IDR.2.311.111/month. The total household income reached IDR.4.190.900/month, indicating a high dependence on income sources outside of corn farming.

Table 1. Average Monthly Income of Farming Households

Description		Amount (IDR/Month)	Percentage (%)
Household Income	On-Farm Income (Corn Farming)	103.111	3
	Other On-Farm Income	1.776.678	42
	Non-Farm Income	2.311.111	55
Total		4.190.900	100

Source: Primary Data, processed 2025

3.1.2 Analysis of Farming Household Expenditure

Household expenditure, encompassing both food and non-food items, is a crucial indicator for analyzing food security. According to Ref. [9], the smaller the Food Share of Expenditure (FSE), the better the level of a household's food security.

3.2 Food and Non-Food Expenditure Structure

3.2.1 Food Expenditure

The structure of household food expenditure reveals a notable pattern (Table 2). Total food expenditure reached IDR.2.260.793/month, with the largest allocations for cigarettes (23%), rice (18%), and fish (14%). This finding aligns with the report from BPS (2022) on the dominance of cigarette expenditure in rural communities. Meanwhile, non-food expenditure amounted to IDR.1.449.110/month and was dominated by education costs (38%) and transportation (20.8%).

Table 2. Average Monthly Household Food Expenditure

Category	Detail	Value (IDR/Month)	Percentage (%)
(1)	(2)	(3)	(4)
(a) Consumption	1. Rice	412.533	18,2
	2. Corn	35.417	1,6
	3. Fish	320.000	14,2
	4. Meat	133.333	5,9
	5. Eggs	73.091	3,2
	6. Tempeh/Tofu	62.391	2,8
	7. Vegetables	136.480	6
	8. Spices and Seasonings	93.343	4,1
	9. Fruit	60.000	2,7
	10. Cooking Oil	100.100	4,4
	11. Noodles and Snacks	81.400	3,6
	12. Milk	105.211	4,7
	13. Coffee, Tea, and Sugar	75.310	3,3
(b)	14. Cigarettes and Tobacco	519.583	23
Other Food and Provisions	15. Betel Nut and Lime	52.600	2,3
Total Average Food Expenditure		2.260.793	100

Source: Primary Data, processed 2025

3.2.2 Non-Food Expenditure

The research results detailing household non-food expenditures are presented in Table 3. The total household non-food expenditure was IDR.1.449.110/month. The largest non-food expenditure for households in Watodiri Village was the cost of children's education, with an average expenditure of IDR 550.000/month, accounting for 38% of the total. Education costs represent an investment in children, contributing to improved food security for the next generation. Data analysis shows that the structure of non-food expenditure is dominated by several key components, reflecting the priorities and lifestyle patterns of the local community

Table 3. Average Monthly Household Non-Food Expenditure

Category	Detail	Value (IDR/Month)	Percentage (%)
1.	Transportation Costs	300.909	20,8
2.	Healthcare Costs	73.600	5,1
3.	Education Costs	550.000	38
4.	Communication Costs	115.000	7,9
5.	Social Costs	209.773	14,5
6.	Electricity Costs	80.833	5,6
7.	Kerosene Costs	46.929	3,2
8.	Soap and Detergents	72.067	5
Total Average Non-Food Expenditure		1.449.110	100

Source: Primary Data, processed 2025

3.3 Household Food Security

The analysis of the Food Share of Expenditure (FSE) from the research conducted on respondents cultivating corn in Watodiri Village, Ile Ape District, Lembata Regency, reveals that the average household food expenditure IDR.2.260.793/month, and the total expenditure was IDR.3.709.903/month. Food security analysis was performed by applying the formula for calculating the household's Food Share Expenditure [9]:

$$FSE = \frac{F E}{T T E} \times 100 \%$$

$$FSE = \frac{2.260.793}{3.709.903} \times 100 \%$$

$$FSE = 61\%$$

The average food security percentage for corn- farming households in Watodiri Village reached 61%, which places them in the food insecure category. The distribution of food security among respondent households can be seen in Table 4.

Table 4. Distribution of Food Security among Corn-Farming Households

Food Security Category	Food Expenditure share (%)	Number of Households	Percentage (%)
Food Expenditure Share < 60% (Food secure)	52	11	37
Food Expenditure Share > 60% (Food Insecure)	74	19	63

Source: Primary Data, processed 2025

This result aligns with the criteria set by Ref. [4], which defines the threshold for food security at an FSE of $\leq 60\%$. This condition is exacerbated by the dependence on rice supplies from outside the region, which are relatively high-priced, and a disproportionate allocation of expenditure for cigarettes.

The distribution of food security status shows that 37% of households were classified as food secure ($FSE < 60\%$), while 63% were food insecure ($FSE \geq 60\%$). This finding confirms the research by Ref. [10] on the food vulnerability of households dependent on a single type of farming. This pattern reflects the vulnerability of the local food system to price fluctuations and productivity changes.

3.2 Analysis of Factors Influencing Food Security Levels

Classical assumption tests confirmed the model's feasibility:

- Normality test
Shapiro-Wilk test result ($p=0.120$).
- Multicollinearity test
All VIF values were <10 (indicating no multicollinearity).
- Heteroscedasticity test
Glejser test result ($p>0.05$) indicated homoscedasticity.

Model Testing (Multiple Linear Regression Test) This analysis technique predicts the relationship between the independent variables (X) and the dependent variable (Y). The results of the multiple linear regression analysis, obtained using Jamovi software, are presented in Table 5 below.

Table 5. Regression Analysis Results

Predictor	Coefficients	Standard Error	T Stat	P-value
Constant	0,931	0,041	22,5	<0,001
X1 (Household Income)	-0,051	0,021	-2,38	0,025
X2 (Head's Education Level)	-0,078	0,023	-3,35	0,002

Source: Primary Data, processed 2025

Multiple linear regression analysis produced the model $Y = 0.931 - 0.051X_1 - 0.078X_2 + e$, with a coefficient of determination (R^2) of 67%. The constant value of 0.931 indicates the baseline level of food security when the independent variables are zero. The coefficient for the household income variable (X_1) of -0.051 indicates that every increase in income will decrease the Food Expenditure Share (FES), which implies an improvement in food security. Similarly, the coefficient for the education level of the head of household (X_2) of -0.078 shows that a higher level of education leads to a lower FES and, consequently, stronger household food security. Thus, both variables have a positive influence on improving food security [11], [12].

The statistical test results show that both tested hypotheses are significant. The calculated F-value was 28.3, which is considerably larger than the F- table value of 3.354. The significance value (p-value) of 0.00000024 is also far below the alpha level of 0.05. These results prove that the variables of household income (X_1) and education of the head of household (X_2) collectively (simultaneously) have a significant and very strong influence on the food security variable (Y).

The household income variable (X_1) has a significant effect on food security (Y), with a calculated T-value of $|2.38| > T\text{-table} (2.052)$ and a significance of $0.025 < 0.05$. This indicates that an increase in household income significantly strengthens the food security of farming households. The education variable of the head of household (X_2) also has a significant effect, with a calculated T-value of $|3.35| > T\text{-table}$ and a significance of $0.002 < 0.05$. This suggests that a higher education level contributes to improved food security, presumably through increased nutritional awareness and better household financial management [13], [14]. This finding is consistent with the research by Ref. [15], which stated that both variables have a positive and significant influence on the food security of farming households.

4. Conclusions

Based on a comprehensive analysis of the food security conditions of corn-farming households in Watodiri Village, this study concludes that the household economy relies heavily on non-farm income (55% of IDR 4,190,900/month), while corn farming contributes only 3%. Food expenditure dominates household spending (61%), with cigarettes (23%) and rice (18%) as the largest items, indicating systemic vulnerability. Food security status, measured by FES, shows that 63% of households are food-insecure ($FES > 60\%$), worsened by reliance on external rice supplies and low corn productivity (0.25 tons/year). Regression analysis confirms that household income ($p = 0.025$) and education level of the household head ($p = 0.002$) significantly influence food security, with both variables negatively correlated with FES, underscoring the need for integrated economic and educational interventions.

5. Suggestions

To improve food security based on local wisdom, several intervention strategies are suggested, encompassing research expansion, economic empowerment, educational initiatives, and infrastructure development. Future research should expand sample size and coverage to include various sub-districts and livelihood types for more representative findings. Economic capacity strengthening should focus on income diversification through agricultural product

processing businesses, family financial management training using local cultural approaches, and reallocation of cigarette expenditure into productive enterprise capital. Education and nutritional literacy programs should integrate local food-based nutrition education into school curricula, provide home garden cultivation training for consumption diversification, and optimize highly nutritious local food sources such as moringa. Strengthening food infrastructure requires developing a village food barn system based on communal cooperation (gotong royong), rehabilitating traditional irrigation systems, and constructing pest-resistant food storage units. Future research agendas include longitudinal studies on climate change impacts on corn productivity and evaluation of digital food barn program effectiveness. The implementation of these recommendations is expected to reduce the Food Expenditure Share (FES) to below 60% within three years while strengthening food self-reliance based on the local potential of Watodiri Village. Synergy between the government, academics, and the community is essential to create a sustainable transformation of the food system.

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