



## ORIGINAL RESEARCH ARTICLE

## OPEN ACCESS

**FACTORS INFLUENCING LOCAL FARMERS' INVOLVEMENT IN THE CULTIVATION OF *SYZYGium AROMATICUM* (CLOVE) IN BALIBAR VILLAGE, CRISTO REI POST ADMINISTRATIVE, DILI MUNICIPALITY, TIMOR-LESTE**<sup>1</sup>Adelino da Costa Ximenes, <sup>2</sup>Jaquelina Guterres Correia, <sup>3</sup>Domingos CBB Gomes

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September, 2025Key Words: Utilize sustainable  
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Clove cultivation (*Syzygium aromaticum*) is an essential agricultural activity in Timor-Leste, particularly in Balibar Village, Dili District, where it holds significant economic value due to its diverse applications in culinary, medicinal, and cosmetic industries; however, despite favorable agro-climatic conditions, clove farming faces several challenges, such as fluctuating market prices, the impacts of climate change, and the need for more sustainable farming practices, prompting this research to examine the factors influencing local farmers' involvement in clove cultivation and their effect on the sector's sustainability and productivity. The primary objective of the study is to investigate how land area, labor availability, education level, and participation in decision-making processes impact the sustainability and productivity of clove farming in Balibar Village, providing insights into how these factors interact to shape the farming practices and livelihoods of local farmers. The study employed a quantitative research design, incorporating structured surveys, field observations, and semi-structured interviews to collect both qualitative and quantitative data, with a sample of 95 clove farmers from Balibar Village selected using the Slovin formula to ensure representativeness. The collected data were analyzed using multiple linear regression, descriptive statistics, and ANOVA, which allowed for an in-depth examination of the relationships between key factors such as land area, education, labor, and farming productivity. The results revealed that 91.6% of farmers cultivated less than 1 hectare of land, which constrained their production capacity, while larger landholdings were associated with higher yields; additionally, 53.7% of farmers worked full-time in clove farming, and 73.7% had attended agricultural training, yet labor costs remained low, with most workers earning less than \$5 per day; furthermore, 80% of farmers processed their clove harvest independently, and 87.4% sold their produce directly to the market, with farmer participation in decision-making significantly higher among those with higher education.

Key words: Clove, *Syzygium aromaticum*, Farmer Involvement, Agricultural Productivity, Community Participation, Land Area, Education, Timor-Leste

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## 1. Introduction

### 1.1 Background

Clove cultivation (*Syzygium aromaticum*) holds significant economic and cultural value both globally and within Timor-Leste. Native to the Maluku Islands in Indonesia, cloves have been widely used across various industries, including culinary, medicinal, and cosmetic sectors. Cloves are particularly prized for their aromatic buds, which contain essential oils with various medicinal properties, such as being an antiseptic, carminative, and antiemetic. In addition to their diverse uses, the clove tree has a long-standing tradition in the agricultural economy, with significant contributions to rural livelihoods. Clove cultivation in Timor-Leste, especially in Balibar Village of Dili District, has grown due to favorable agro-climatic conditions. Despite its potential, the cultivation faces challenges like fluctuating market prices, climate change impacts, and the need for more sustainable farming practices.

### 1.2 Problem Statement

While clove farming remains a critical agricultural activity in Balibar Village, there is a noticeable lack of research on the factors influencing local farmer participation in this sector. This knowledge gap limits the formulation of effective agricultural policies aimed at enhancing productivity and ensuring the sustainability of clove farming. Local farmers, though integral to the sector, face numerous challenges, such as limited access to modern farming practices, insufficient training, and constraints on land resources. These factors not only hinder their productivity but also affect the broader agricultural economy. As the demand for cloves grows globally, understanding these factors is essential to address the challenges and improve the livelihoods of farmers in the region.

### 1.3 Research Objectives

The primary objective of this study is to identify and analyze the factors influencing local farmers' involvement in the cultivation of *Syzygium aromaticum* in Balibar Village, Dili District, Timor-Leste. Specifically, the study aims to examine the impact of land area, labor availability, education level, and participation in decision-making on the sustainability and productivity of clove farming. By exploring these factors, the research seeks to offer insights into the key elements that can enhance the efficiency and effectiveness of clove farming in the region. These findings will not only benefit farmers but also contribute to broader agricultural development efforts in Timor-Leste.

### 1.4 Research Significance

This research holds substantial significance for multiple stakeholders, including farmers, academics, and policymakers. For farmers, the study provides evidence-based recommendations on best practices that can increase clove yields, improve sustainability, and boost income generation. For the academic community, the research contributes to a deeper understanding of

agricultural development, community participation, and the role of local knowledge in enhancing crop productivity. Furthermore, for policymakers, the study offers a comprehensive look at the challenges and opportunities within the clove farming sector, enabling them to create more effective agricultural policies that foster long-term sustainability and support rural economic development.

### 1.5 Research Gap

Despite the growing importance of clove cultivation in Timor-Leste, there is limited research focusing on the socio-economic factors that influence local farmers' participation in this industry. The lack of data on how factors such as land size, education, labor, and farmer decision-making impact productivity has hindered the development of targeted interventions. Previous studies have generally focused on individual aspects of farming practices or have been limited to broader agricultural analyses, leaving a gap in understanding the holistic approach needed for sustainable clove farming. This study aims to fill this gap by providing a comprehensive analysis of the multiple variables that affect the cultivation of cloves in Balibar Village.

### 1.6 Expected Impact

The results of this study are expected to have a transformative impact on the clove farming community in Balibar Village and beyond. By identifying the key factors that enhance or hinder local farmers' participation, the research will enable the development of tailored solutions that address the unique challenges faced by smallholder farmers. In turn, this can improve clove cultivation practices, increase market access, and ensure environmental sustainability. Ultimately, the research aims to contribute to the creation of policies that promote community-based agricultural development, fostering a more resilient and productive agricultural sector in Timor-Leste.

## 2. Method

### 2.1 Research Design

This study employed a quantitative research design to systematically investigate the factors influencing local farmers' involvement in the cultivation of *Syzygium aromaticum* (clove) in Balibar Village, Timor-Leste. The research utilized structured surveys to collect standardized data, field observations to provide contextual understanding, and semi-structured interviews to gather in-depth qualitative insights. This mixed-method approach allowed for the triangulation of data, ensuring a comprehensive analysis of the factors affecting clove cultivation, such as land area, labor, education, and decision-making. The combination of qualitative and quantitative methods provided a robust framework for analyzing the relationship between these factors and their impact on productivity and sustainability.

### 2.2 Population and Sample

A total of 95 clove farmers from Balibar Village participated in the study. The sample size was determined using the Slovin formula, which ensures that the sample is statistically representative of the population. The Slovin formula is designed to calculate an appropriate sample size with a specified margin of error, ensuring that the findings can be generalized to the broader population of clove farmers in the region. The respondents were selected through random sampling, ensuring a diverse group that reflects various landholding sizes, education levels, and farming experiences. This sampling method minimized bias and ensured that the data accurately represents the experiences and perspectives of the farming community.

### 2.3 Data Collection

Primary data collection was conducted through a combination of interviews, structured questionnaires, and field observations. Interviews were carried out with a selected group of farmers, local authorities, and agricultural extension workers to gain qualitative insights into the challenges, opportunities, and practices related to clove cultivation. The questionnaires were designed to collect quantitative data on variables such as land area, labor availability, and education level, while field observations provided a first-hand understanding of farming practices and environmental conditions. Secondary data was also collected from agricultural records and government reports, providing historical context and additional insights into clove production trends, market access, and policies affecting the farming sector.

### 2.4 Data Analysis

The collected data were analyzed using multiple linear regression, descriptive statistics, and ANOVA to examine the relationships between key variables. Multiple linear regression was employed to assess how land area, education level, labor availability, and other factors influence clove productivity. Descriptive statistics were used to summarize the data, providing a clear picture of the demographic characteristics of the sample, including land size, education, and farming experience. ANOVA was used to test for significant differences in productivity across different groups of farmers based on factors such as land area and educational background. These statistical methods allowed for a detailed analysis of the factors contributing to clove cultivation outcomes, ensuring that the findings were both reliable and valid.

## 3.0 Results

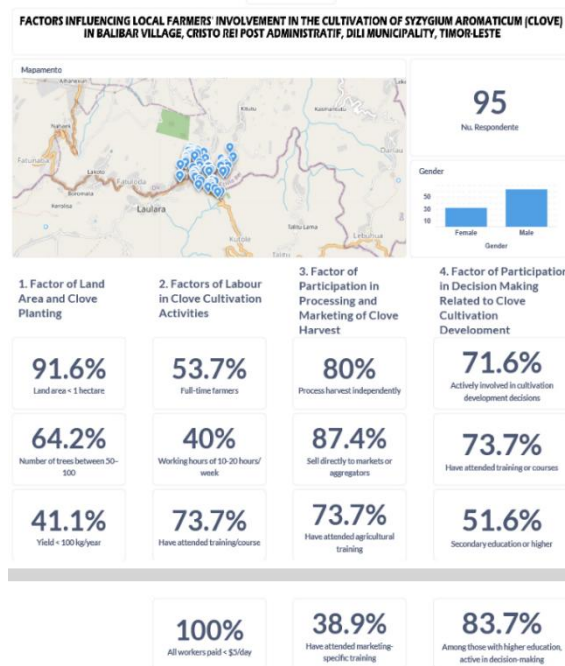
### Result finding

#### 3.1 Hypotheses Testing

This study employs two types of hypotheses as part of the quantitative research framework: the Null Hypothesis (H0) and the Alternative Hypothesis (H1).

- Null Hypothesis (H0): Land area, education level, farming experience, labor availability, training participation, and

involvement in farmer organizations have no significant effect



on farmers' involvement in clove cultivation.

- Alternative Hypothesis (H1): These variables significantly affect farmers' involvement in clove cultivation.

Hypothesis testing was conducted using multiple linear regression with a significance threshold of 0.05. If the p-value is < 0.05, H0 is rejected and H1 is accepted.

The specific hypotheses are as follows:

- H1a: Land area has a significant effect on farmers' involvement in clove cultivation.
- H1b: Labor availability has a significant effect on farmers' involvement in clove cultivation.
- H1c: Education level significantly influences farmers' participation in decision-making regarding clove farming.
- H1d: Farming experience significantly affects farmers' involvement in clove cultivation.
- H1e: Participation in agricultural training and extension services significantly influences farmers' involvement.
- H1f: Farmers' involvement in cooperatives or farmer groups significantly increases participation in clove cultivation.

#### 3.2 Land Area and Clove Planting

The results show that the majority of farmers in Balibar cultivate relatively small plots of land. Approximately 91.6% of respondents manage clove plantations of less than one hectare. Regarding the number of trees, 64.2% of farmers own between 50 and 100 clove trees. In terms of production output, 41.1% of farmers reported an annual yield of less than 100 kilograms.

#### 3.3 Labor Factors

In relation to labor, 53.7% of respondents reported working as full-time clove farmers, while the rest combine clove farming with

other livelihood activities. The majority of farmers (40%) spend between 10–20 hours per week on clove-related activities. Regarding wages, most hired laborers receive payments of less than USD 5 per day. In terms of training participation, 73.7% of respondents indicated that they had attended at least one agricultural training session.

### 3.4 Processing and Marketing Participation

With respect to processing, 80% of respondents process their clove harvest independently using traditional methods. In terms of marketing, the majority (87.4%) sell their produce directly to local markets or intermediaries, while only a small proportion engage in collective marketing systems such as cooperatives or farmer groups.

### 3.5 Decision-Making Participation

The findings indicate that 71.6% of farmers are actively involved in decision-making related to clove farming. Education plays a role in this participation, as 83.7% of respondents with secondary education or higher reported being directly involved in decision-making processes regarding farm management and development.

## 4.0 Discussion

The findings of this study highlight several critical factors influencing farmers' involvement in clove (*Syzygium aromaticum*) cultivation in Balibar. Land size emerged as one of the main constraints, with most farmers managing very limited areas. This condition reduces their capacity to increase production and affects their competitiveness in the market. Similar patterns have been observed in other clove-producing regions, where land fragmentation is a key factor limiting productivity (Bolaang et al., 2024). Thus, optimizing land use and introducing more intensive cultivation practices are essential strategies for enhancing output (Michel et al., 2021).

Labor availability also plays a significant role in clove farming. Although many farmers are engaged full-time, the relatively low number of working hours dedicated to clove farming reflects the fact that it is not always prioritized as the main livelihood activity. Limited reliance on hired labor, combined with low wages, demonstrates that clove farming has not yet achieved strong economic viability for rural households. These conditions reinforce the need for institutional support to improve labor efficiency and provide incentives for farmers to allocate more time to clove cultivation (Rosada et al., 2024).

Education was found to be a strong determinant of farmers' participation in decision-making. Farmers with higher education are more capable of adopting innovations, evaluating risks, and planning long-term strategies. This finding aligns with community participation theories, which argue that education strengthens critical thinking and managerial capacity (Setiyowati et al., 2022). Therefore, policies that expand educational opportunities and continuous training for farmers are crucial in

promoting more active involvement and sustainable farming practices (Cortés-Rojas et al., 2014).

Another important issue relates to processing and marketing. Most farmers still rely on traditional processing methods and sell directly to markets or intermediaries, which weakens their bargaining power and reduces potential profit margins. This situation indicates a lack of institutional support for collective marketing. Establishing and strengthening cooperatives or farmer associations could provide greater access to better markets, stabilize prices, and create opportunities for value-added products such as clove oil (Nurdjannah, 2004; Batiha et al., 2020). Such initiatives would significantly improve farmers' incomes and reduce dependency on intermediaries.

In summary, this study shows that farmers' involvement in clove cultivation is shaped by the interaction of technical (land, labor), socio-economic (education, training), and institutional (market and cooperatives) factors. Addressing these issues requires a multidimensional approach that combines policy interventions, capacity building, and structural reforms in rural agricultural systems (Tarmizi et al., 2025; World Bank, 2017).

## 5.0 Conclusion and Recommendations

### 5.1 Conclusion

This study concludes that clove farming in Balibar Village is primarily influenced by a combination of technical, socio-economic, and institutional factors. Among them, land area and education level emerge as the most critical determinants of productivity and farmer participation. Limited land size restricts the potential to increase output, while higher levels of education enhance farmers' ability to adopt innovations, engage in decision-making, and manage their farms strategically.

Furthermore, while most farmers are engaged in processing and marketing independently, the lack of collective structures limits their bargaining power and market access. Strengthening cooperatives, providing advanced training, and improving access to capital and technology are essential steps to enhance sustainability and competitiveness in the clove sector.

Ultimately, promoting farmer-centered policies that integrate training, institutional support, and equitable access to resources will not only increase clove productivity but also improve rural livelihoods and contribute to long-term agricultural development in Timor-Leste.

### 5.2 Recommendations

#### 1. Strengthening Farmer Cooperatives

Encourage the formation and empowerment of cooperatives to improve farmers' bargaining power, facilitate access to broader markets, and stabilize clove prices.

#### 2. Capacity Building through Education and Training

Expand training programs focused on sustainable clove farming techniques, agribusiness management, and marketing

strategies to enhance farmers' skills and decision-making capacity.

### 3. Optimizing Land Use and Productivity

Promote intensive cultivation methods, intercropping, and improved seed varieties to maximize output from limited landholdings.

### 4. Labor and Wage Improvements

Introduce government or NGO-led initiatives that ensure fair wages for farm laborers and provide incentives for younger generations to engage in agriculture.

### 5. Market Diversification and Value Addition

Support the development of value-added clove products, such as essential oils and spices for export, to increase income and reduce dependency on raw commodity sales.

### 6. Policy and Institutional Support

Recommend that local and national governments integrate clove farming into rural development policies, including access to affordable credit, technology adoption, and infrastructure for processing and storage.

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