**RESEARCH ARTICLE**

**Perception and Adoption of Coconut Palm as a High-Value Crop for Agroforestry in Atiba Local Government Area, Oyo State**

**Abstract**

Coconut (*Cocos nucifera* L.) has emerged as a high-value crop for agroforestry, particularly in regions facing climate change challenges and food insecurity. This study investigates the perception and adoption of coconut palm cultivation among farmers in Atiba Local Government Area, Oyo State, Nigeria, aiming to identify socio-economic factors influencing adoption and the constraints faced by farmers. A cross-sectional survey design was employed with 100 questionnaires distributed to farmers selected through random and purposive sampling techniques. Data were analyzed using descriptive statistics and a binary logistic regression model.

Results indicated a gender disparity among respondents, with 71% being male and 29% female. The majority of respondents were aged between 48-57 years, and 63% engaged primarily in farming. Awareness of the economic benefits of coconut cultivation was relatively high (mean score 4.29) but knowledge of cultivation techniques was lower (mean score 3.01). The logistic regression analysis identified key determinants influencing the adoption of coconut as an agroforestry crop, including access to extension services (B = 0.771, *p* = 0.005) and level of education (B = 0.620, *p* = 0.016). Economic constraints were significant barriers with financial resources and availability of quality seedlings being major concerns (mean scores 3.96 and 3.71 respectively). While farmers recognize the potential of coconut palms for enhancing food security and economic resilience, significant gaps in knowledge and access to resources hinder widespread adoption. The results highlight the pressing need for tailored educational programs and enhanced availability of agricultural support services to encourage coconut palm cultivation. Strengthening these aspects can drive the adoption of sustainable agroforestry systems, fostering long-term ecological and economic benefits within the study region and extending their impact to broader landscapes.

**Keywords**: Adoption, Climate Change, Resilience, Coconut-based agroforestry system, Bio-products

1. **INTRODUCTION**

Coconut (*Cocos nucifera* L.) is a versatile and economically significant crop widely cultivated in tropical regions. Often referred to as the "tree of life", it provides a multitude of products that contribute to food security, economic development, and cultural practices (Henrietta et al., 2022). The coconut palm can grow up to 30 meters tall producing between 30 to 75 fruits annually, depending on the variety and growing conditions. The fruit, botanically classified as a drupe, contains a hard shell encasing the edible endosperm and coconut water, both of which are commercially valuable (Wikipedia, 2023). Coconut trees thrive in humid tropical climates with well-drained soil and ample sunlight. They are resilient, capable of growing in poor sandy soils, and can even tolerate saline conditions, making them ideal for coastal cultivation (Henrietta et al., 2022). Beyond fruit production, various parts of the tree are utilized for different purposes such as coir fibre for ropes and mats, leaves for traditional crafts and trunk for construction (Agricdemy, 2018). The economic potential of coconut cultivation is significant, particularly in countries like Indonesia, the Philippines, and India, where it serves as a primary source of livelihood for millions. The global demand for coconut-based products, including coconut oil, milk, and coconut water, has driven industry growth (Kenya Agricultural and Livestock Research Organization, 2021; Henrietta et al., 2022). Beyond food production, coconut trees play an essential role in sustainable practices by providing bio-products, fuel, and building materials (Loomba and Jothi, 2013). Coconut-based agroforestry systems offer ecological benefits such as improved soil health, increased biodiversity, and additional income streams for farmers (Mohan & Kunhamu, 2022). The crop's resilience to climate change makes it suitable for areas with variable wet and dry seasons (Kumar & Kunhamu, 2022). However, farmers' perceptions and knowledge levels influence its adoption. Studies have shown that economic benefits drive agroforestry adoption, but challenges like lack of technical knowledge, initial investment costs, and concerns about reduced yields hinder widespread uptake (Mohan & Kunhamu, 2022). Cultural factors and local wisdom also play a crucial role in shaping adoption decisions (Lewerissa & Hardiwinoto, 2023).

Despite its recognized potential, coconut farming faces adoption barriers, including limited access to extension services, financial constraints, and inadequate infrastructure for processing and marketing (Okoroji et al., 2020). This study aims to assess the farmers’ perception and adoption of coconut palm as a high-value crop for agroforestry in Atiba Local Government Area, Oyo State. The study aims to achieve several specific objectives, including determining the socio-economic characteristics of farmers in the study area and assessing their level of awareness and knowledge regarding the potential of coconut palm as an agroforestry crop. Additionally, it seeks to identify the factors that influence farmers' perception and adoption of coconut palm within agroforestry systems, as well as to examine the key constraints hindering its adoption in the study area. Given the increasing global demand for coconut products, understanding adoption factors is crucial for targeted interventions that promote its cultivation, optimize land use, and enhance biodiversity. This study provides insights to guide policy decisions aimed at improving agricultural practices and increasing the profitability of coconut farming in Oyo State (Sarangi et al., 2020; Nair, 1993).

1. **MATERIALS AND METHODS**

The study was carried out in Atiba Local Government Area in Oyo State, Nigeria. This area is situated at a geographic coordinate of 7° 50' 30" latitude and 3° 57' 00" longitude, encompassing a total land area of approximately 2,197.53 square kilometres (Alamu, 2014). Atiba LGA is known for its diverse communities and agricultural activities, contributing significantly to the local economy. A cross-sectional survey design was employed and 100 questionnaires were distributed to farmers selected through random and purposive sampling methods. The questionnaire included closed-ended questions capturing demographic details, farmers' awareness of the benefits of coconut palm, attitudes towards its cultivation, participation in agroforestry, and perceived adoption barriers (Ibrahim et al., 2019). A pre-test was conducted to ensure clarity and validity before full-scale data collection.

**Data Analysis**

The data analysis was conducted using both descriptive and inferential statistical techniques. Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were applied to summarize the socio-economic characteristics of the farmers, as well as their levels of awareness and knowledge regarding the potential of coconut palm as an agroforestry crop. A 5-point Likert scale was used to evaluate farmers' attitudes and perceptions, where a score of 1 represented "strongly disagree" and a score of 5 represented "strongly agree." The mean scores were calculated to determine the attitudes of farmers towards adopting coconut cultivation. Additionally, the analysis identified factors influencing adoption and constraints faced by farmers. The findings were presented in tables for improved clarity and ease of comparison.

**Binary Logistic Regression Model**

To explore the factors that influence the perception and adoption of coconut palm as an agroforestry crop in the study area, a binary logistic regression model was employed. This statistical method is particularly effective for analysing dichotomous dependent variables, enabling the prediction of the likelihood of adoption based on a range of predictor variables (Borooah, 2002).

The logistic regression model used in the analysis can be expressed as:

$$Log \left(\frac{p}{1-p}\right)=β0​+β1​gender+β2​age+β3​level of education + β4access to credit + β5extension services + β6land tenure + β7market access $$

Where:

p is the probability of a farmer adopting coconut palm as an agroforestry crop

*β*0 is the intercept term

*β*1, *β*2, *β*3, *β*4, *β*5, *β*6 and *β*7 are the regression coefficients for gender, age, level of education, access to credit, access to extension services, land tenure and market access respectively

This model estimates the log odds (logit) of adopting coconut cultivation as a linear function of these predictor variables. Each coefficient reflects the change in the log odds associated with a one-unit increase in the corresponding predictor variable, while controlling for the effects of other variables in the model.

1. **RESULTS**

**Socio-economic status**

**Table 1: Descriptive Distribution of Respondents’ Socio-economic Characteristics**

|  |  |  |
| --- | --- | --- |
| **VARIABLES** | **FREQUENCY** | **PERCENTAGE (%)** |
| **GENDER** FemaleMale**Total** | 2971**100** | 29.071.0**100.0** |
| **AGE (YEARS)**18-2728-3738-4748-5758 or older**Total** | 1823142520**100** | 18.023.014.025.020.0**100.0** |
| **LEVEL OF EDUCATION** No formal educationPrimarySecondaryTertiary**Total** | 20263420**100** | 20.026.034.020.0**100.0** |
| **PRIMARY OCCUPATION** FarmingTradingCivil servantArtisanOthers**Total** | 6314041108**100** | 63.014.004.011.008.0**100.0** |
| **HOUSEHOLD SIZE** 0-56-10>10**Total** | 334819**100** | 33.048.019.0**100.0** |
| **METHOD OF LAND OWNERSHIP**LeaseholdRentPurchaseInheritanceCommunal**Total** | 2927033110**100** | 29.027.003.031.010.0**100.0** |
| **ACCESS TO CREDIT FACILITIES** YesNo**Total** | 3961**100** | 39.061.0**100.0** |
| **ACCESS TO EXTENSION SERVICES**YesNo**Total** | 4258**100** | 42.058.0**100.0** |
| **ACCESS TO MARKET**YesNo**Total** | 9307**100** | 93.007.0**100.0** |

**Source: Field Survey (2024)**

The study revealed a significant gender disparity among respondents, with 71% male and 29% female participants. This disparity highlights the underrepresentation of women in the study area. Age distribution indicates a relatively mature workforce; with 25% of respondents aged 48-57 years and 23% aged 28-37 years. Regarding educational attainment, 34% of respondents possess secondary education, while 20% have no formal education. Agriculture emerged as the primary occupation, with 63% of respondents engaged in farming. Household size data shows that 48% of respondents belong to households with 6-10 members. Land ownership patterns reveal that 31% of respondents inherited their land, while 29% lease it. Access to credit facilities is limited, with only 39% of respondents reporting access, whereas extension services are available to 42%. Finally, market access is widespread, with 93% of respondents indicating they can sell their produce.

**Farmers’ awareness and knowledge**

**Table 2: Assessment of awareness level of farmers regarding the potential of coconut palm as an agroforestry crop**

|  |  |  |  |
| --- | --- | --- | --- |
| **S/N** | **ITEMS** | **MEAN** | **St. D** |
| 1 | I am aware of the economic benefits of cultivating the coconut palm as an agroforestry crop. | 3.59 | 1.35 |
| 2 | I have sufficient knowledge about the cultivation techniques for the coconut palm in agroforestry systems. | 3.01 | 1.50 |
| 3 | Coconut palm can enhance biodiversity in agroforestry practices. | 2.95 | 1.30 |
| 4 | I understand the potential environmental benefits of integrating the coconut palm into my farming system. | 3.19 | 1.40 |
| 5 | I am familiar with the various products that can be obtained from the coconut palm (e.g., coconut oil, water, husk). | 4.29 | 0.80 |
| 6 | I have received information or training about the coconut palm as a high-value crop for agroforestry. | 2.54 | 1.60 |
| 7 | I am confident in my ability to market products derived from the coconut palm. | 4.18 | 1.10 |
| 8 | Coconut palm can provide a sustainable source of income for farmers in agroforestry systems. | 4.36 | 0.70 |
| 9 | I am aware of the nutritional benefits of coconut products for local communities. | 4.21 | 0.90 |
| 10 | I understand the role of the coconut palm in providing shade for other crops in agroforestry practices. | 3.88 | 1.20 |

**Source: Field Survey (2024)**

The study reveals that farmers generally have a positive awareness and knowledge of the potential of coconut as an agroforestry crop. The highest mean score of 4.29 was recorded for familiarity with various coconut products, such as coconut oil, water, and husk. Additionally, the mean score of 4.36 for the statement regarding the coconut palm's ability to provide a sustainable income source highlights its viability as a cash crop in agroforestry systems. However, lower mean scores were observed for knowledge about cultivation techniques (3.01) and training received (2.54), indicating gaps in education and support for farmers.

**Farmers’ perception and adoption of coconut palm as an agroforestry crop**

**Table 3: Logistic Regression Analysis of Factors Influencing the Adoption of Coconut Palm as an Agroforestry Crop Among Farmers**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | ***β*** | **S.E.** | **Sig.** | **Exp(*β*)** |
| **Gender** | 0.108 | 0.246 | 0.463 | 1.114 |
| **Age** | 0.654 | 0.209 | 0.071 | 2.124 |
| **Level of Education** | 0.620 | 0.157 | 0.016 | 1.860 |
| **Access to Credit** | 0.597 | 0.137 | 0.126 | 2.338 |
| **Access to Extension Services** | 0.771 | 0.155 | 0.005 | 1.854 |
| **Land Tenure** | 0.565 | 0.208 | 0.001 | 1.266 |
| **Market Access** | 0.635 | 0.195 | 0.013 | 1.391 |
| **Constant** | **-1.139** | **0.512** | **0.010** | **0.112** |

**Source: Authors’ Computation (2024)**

The logistic regression analysis identified key determinants influencing the adoption of coconut palm as an agroforestry crop among farmers. "Access to Extension Services" emerged as a significant positive factor, with a coefficient (β) of 0.771 and a significance level of 0.005, indicating that farmers with access to extension services are more likely to adopt coconut cultivation practices. "Level of Education" also showed a significant positive influence (β = 0.620, p = 0.016), suggesting that higher educational attainment correlates with increased likelihood of adoption. Similarly, "Market Access" (β = 0.635, *p* = 0.013) was found to play an important role, as farmers with better access to markets are more inclined to adopt coconut farming due to perceived economic opportunities. The variable "Age" (β = 0.654, *p* = 0.071) demonstrated a positive influence on adoption; however, its relatively high *p*-value indicates that the relationship is not statistically significant at conventional levels.

**Constraints in adoption of coconut palm as an agroforestry crop**

**Table 4: Constraints to the adoption of coconut palm as an agroforestry crop in the study area.**

|  |  |  |  |
| --- | --- | --- | --- |
| **S/N** | **ITEMS** | **MEAN** | **St. D** |
| 1 | I lack sufficient financial resources to invest in the cultivation of the coconut palm as an agroforestry crop. | 3.96 | 0.63 |
| 2 | Quality coconut seedlings are not available or affordable in my area, hindering my ability to adopt this crop. | 3.71 | 1.12 |
| 3 | I do not have adequate knowledge or training on best practices for cultivating the coconut palm in agroforestry systems. | 2.99 | 1.08 |
| 4 | Agricultural extension services related to coconut cultivation are insufficient in my community. | 2.06 | 0.75 |
| 5 | I believe that the market for coconut products is unstable, which discourages me from adopting the coconut palm as a crop. | 3.69 | 1.28 |
| 6 | I face significant challenges from pests and diseases that affect coconut palms, making adoption risky. | 1.56 | 0.66 |
| 7 | The climatic conditions in my region are not suitable for the successful growth of the coconut palm. | 1.13 | 0.74 |
| 8 | I am concerned about the competition between the coconut palm and other crops for resources like water and nutrients. | 4.08 | 0.96 |
| 9 | There is a lack of government support or incentives for farmers to adopt the coconut palm as an agroforestry crop. | 3.96 | 1.10 |
| 10 | There is cultural and or traditional barrier to coconut farming in my community  | 1.54 | 0.82 |

**Source: Field Survey (2024)**

Table 4 identifies several barriers faced by farmers in adopting coconut palm as an agroforestry crop. The highest mean score of 4.08 was recorded for concerns about competition between the coconut palm and other crops for resources such as water and nutrients. This reflects a common challenge in agroforestry systems, where resource allocation is a major determinant of the success of multiple crops. The lack of sufficient financial resources was another significant barrier, with a mean score of 3.96, highlighting economic constraints that prevent farmers from investing in necessary inputs like quality seedlings. Additionally, barriers related to the availability and affordability of quality coconut seedlings (mean score of 3.71) and the perceived instability of the market for coconut products (mean score of 3.69) further underscore the economic challenges faced by farmers.

1. **DISCUSSION**

The gender disparity observed aligns with prior studies that emphasize the economic implications of gender inequality. Okoroji et al. (2021) suggest that such disparities can hinder growth by limiting women’s participation in productive sectors, thereby affecting industries reliant on female employment. The mature age profile of respondents underscores the importance of experience in agricultural productivity but also raises concerns about resistance to adopting new technologies due to risk aversion associated with age (Okonya-Chukwu et al., 2022). Education plays an important role in enhancing agricultural outcomes. The relatively low levels of formal education among respondents may limit access to resources and information necessary for improving productivity (Ahmad et al., 2023). Household size has dual implications: while larger households provide labor for farming activities, they may strain resources and restrict access to essential services like education and healthcare (Amonum et al., 2009; Sarvade et al., 2020). Land tenure practices reflect common rural patterns where inheritance and leasing dominate. Secure land tenure is necessary for encouraging investment in agriculture, particularly permanent crops (Okonkwo, 2010). Limited access to credit facilities poses a significant challenge for small-scale farmers, as it restricts their ability to invest in inputs and technologies that enhance productivity. The positive awareness and knowledge of coconut products among farmers align with studies emphasizing the diverse uses and economic value of coconut products in both local and international markets (Loomba and Jothi, 2013). The high mean score for the coconut palm's ability to provide a sustainable income source underscores its importance as a cash crop in agroforestry systems, which is crucial for enhancing rural livelihoods (Sarvade et al., 2014; Sarvade and Singh, 2014; Singh et al., 2015; Kenya Agricultural and Livestock Research Organization, 2021; Henrietta et al., 2022). However, the lower mean scores for knowledge about cultivation techniques and training received highlight significant gaps in education and support for farmers. Targeted interventions in training and extension services are essential to improve farmers' skills and knowledge, enabling them to fully harness the potential of coconut palm in agroforestry practices (Okonkwo, 2010).

The findings also highlight the importance of extension services in promoting the adoption of coconut palm as an agroforestry crop. Farmers with access to extension services are better equipped with knowledge and skills necessary for implementing new agricultural practices, consistent with studies emphasizing the role of agricultural extension in enhancing adoption rates (Kebede et al., 1990). Market access was another significant determinant, underscoring the importance of infrastructure and market connectivity in agricultural development. Farmers who can easily access markets are more likely to perceive coconut farming as a viable economic opportunity, which is consistent with studies emphasizing the role of market infrastructure in fostering agricultural innovation (Meijer et al., 2015). While age showed a positive influence on adoption, its statistical insignificance suggests that other factors may play a more prominent role in shaping farmers' decisions.

The concern regarding resource competition between coconut palms and other crops aligns with broader challenges observed in agroforestry systems. While intercropping can enhance overall productivity, it requires careful management to ensure adequate resource allocation for all plants (Perera, 2020). Economic constraints, particularly the lack of financial resources, represent a significant barrier to adoption. Farmers often struggle to invest in quality seedlings, which are essential for successful coconut farming. Poor planting materials can lead to reduced yields and profitability, as noted by Moreno et al. (2020). Market instability further discourages investment in coconut farming. Fluctuating prices and limited market access create uncertainty for farmers, making it difficult to recover production costs or generate consistent income. This finding is consistent with studies highlighting price volatility as a major challenge in the coconut industry (Alouw and Wulandari, 2020). Addressing these market-related issues through improved infrastructure and stable pricing mechanisms could encourage greater adoption.

1. **CONCLUSION AND RECOMMENDATIONS**

This study has revealed a moderate level of awareness towards the adoption of coconut palm as an agroforestry crop among farmers in Atiba Local Government Area, Oyo State. While farmers exhibit a generally positive perception of the potential benefits of coconut cultivation, significant gaps exist in terms of knowledge, access to resources, and economic constraints. The study also identified some factors influencing the adoption of coconut as an agroforestry crop, including access to extension services, level of education, and market access. Farmers with better access to extension services and higher educational attainment were more likely to adopt coconut cultivation practices. Additionally, farmers with improved market access were more inclined to perceive coconut farming as a high-value crop. However, the study also revealed several barriers to the adoption of coconut palms in agroforestry systems. Economic constraints, such as lack of financial resources and unavailability of quality seedlings, emerged as major hindrances. Farmers also expressed concerns about the competition between coconut palms and other crops for resources like water and nutrients, highlighting the need for careful management in agroforestry systems. Based on the findings of this study, the following recommendations are made:

1. Number of extension agents should be increased and they should be provided with adequate training on coconut cultivation techniques. This will help improve farmers' knowledge and skills, enabling them to adopt coconut palms more effectively in agroforestry systems.
2. Coconut nurseries should be established and there should be collaboration with research institutions to ensure a steady supply of high-quality seedlings at affordable prices. This will address the constraint of unavailability of quality planting materials and encourage farmers to adopt coconut cultivation.
3. Access to credit facilities, subsidies, or other financial incentives should be facilitated for farmers interested in adopting coconut palms. This will help alleviate the burden of initial investment costs and encourage more farmers to integrate coconut into their agroforestry practices.
4. Workshops, demonstrations, and field days should be organised to educate farmers about the diverse benefits and best practices of coconut-based agroforestry systems. These campaigns should target both younger and older farmers to ensure widespread awareness and adoption.

**Disclaimer (Artificial Intelligence)**

 We declare that no generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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