**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 significant high-value crop for agroforestry, particularly in regions facing climate change 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. Utilizing a cross-sectional survey design, 100 questionnaires were distributed to farmers selected through random and purposive sampling techniques. Descriptive statistics and a binary logistic regression model were used to analyze the data. Results indicated a gender imbalance among respondents, with 71% male and 29% female. The majority of respondents were aged between 48-57 years, and a significant portion (63%) engaged primarily in farming. Awareness levels regarding the economic benefits of coconut cultivation were relatively high, with a mean score of 4.29 for familiarity with coconut products, while knowledge about cultivation techniques was notably lower (mean score of 3.01). The logistic regression analysis identified several 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 emerged as significant barriers; with mean scores indicating that financial resources and availability of quality seedlings were major concerns (mean scores of 3.96 and 3.71, respectively). Finally, while farmers in the study area 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.) has emerged as a high-value crop for agroforestry in various regions. The coconut tree is a versatile and economically significant crop widely cultivated in tropical regions. Often referred to as the "tree of life," it provides a myriad 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 and features a smooth, grey trunk topped with a crown of long, pinnate leaves. Each tree can produce between 30 to 75 fruits annually, depending on the variety and growing conditions. The coconut fruit, botanically classified as a drupe, contains a hard shell that encases the edible endosperm and coconut water, both of which are integral to its culinary and commercial uses (Wikipedia, 2023). Coconut trees thrive in humid tropical climates, requiring well-drained soil and ample sunlight. They are remarkably resilient, capable of growing in poor sandy soils, and can even tolerate saline conditions, making them ideal for coastal cultivation (Henrietta et al., 2022). The cultivation of coconut palms is not only limited to their fruit; various parts of the tree are utilised for different purposes. For instance, the husk can be processed into coir fibre, which is used for making ropes, mats, and other products. The leaves are often employed in traditional crafts and construction, while the trunk can be used for building materials and furniture (Agricdemy, 2018).

The economic potential of coconut cultivation is immense, particularly in countries like Indonesia, the Philippines, and India, where it serves as a primary source of livelihood for millions. The coconut industry has seen rapid growth due to the increasing global demand for coconut-based products, including coconut oil, milk, and other derivatives. Coconut oil, extracted from the copra (dried coconut flesh), is widely used in cooking, cosmetics, and pharmaceuticals. Furthermore, coconut water has gained popularity as a health drink, rich in electrolytes and nutrients, appealing to health-conscious consumers (Kenya Agricultural and Livestock Research Organization, 2021; Henrietta et al., 2022). In addition to food products, coconuts have a significant role in traditional medicine and cultural practices. In many tropical cultures, coconuts are used in rituals and ceremonies, symbolizing fertility and prosperity. The sap from coconut flowers can be fermented into a beverage known as "toddy" or processed into sugar, adding to the tree's value. The versatility of the coconut tree extends beyond its fruit; it serves as a source of fuel, building materials, and even bio-products, which are increasingly important in sustainable practices (Loomba and Jothi, 2013). The coconut palm's resilience and adaptability make it an excellent crop for smallholder farmers, especially in areas where other crops may struggle.

The perception and adoption of this versatile crop are influenced by its economic potential, ecological benefits, and cultural significance. Coconut is recognized for its multifaceted utility, providing not only food and raw materials but also contributing to the socio-economic fabric of rural communities (Sarangi et al., 2020). In areas where agriculture is a primary economic activity, the integration of coconut into agroforestry systems can enhance productivity and sustainability. Coconut-based agroforestry systems can improve soil health, increase biodiversity, and provide additional income sources for farmers through the sale of coconut products and associated crops (Mohan and Kunhamu, 2022). The adoption of coconut as an agroforestry crop is also linked to its resilience to climate change. Studies have shown that coconut palms can thrive in diverse climatic conditions, making them suitable for cultivation in areas which experience distinct wet and dry seasons (Kumar and Kunhamu, 2022). The ability of coconut trees to withstand drought and their adaptability to various soil types further supports their integration into agroforestry practices, providing a stable source of income for farmers in the face of climate variability (Dissanayaka et al., 2023).

Farmers' perceptions play an important role in the adoption of coconut as an agroforestry crop. A study conducted in Bangladesh revealed that farmers who recognized the economic benefits of agroforestry were more likely to adopt such practices (Saha et al., 2018). Similarly, understanding the perceived benefits such as increased family income and improved food security can drive the adoption of coconut cultivation. However, challenges such as lack of knowledge, initial investment costs, and concerns about reduced crop yields when integrating trees with crops can hinder adoption (Mohan and Kunhamu, 2022). Cultural factors also influence the perception of coconut cultivation. Historically, coconut has been a part of traditional farming systems in many tropical regions. The integration of coconut into local agroforestry practices can enhance cultural identity and community cohesion, as it aligns with traditional agricultural practices. Furthermore, local wisdom regarding coconut cultivation and processing can empower farmers, providing them with the knowledge needed to maximize the benefits of this crop (Lewerissa and Hardiwinoto, 2023)

Despite the recognized potential of coconut cultivation to provide food, raw materials, and income, many farmers remain hesitant to adopt this crop due to various socio-economic factors. Studies indicate that perceptions about the profitability and management of coconut farming significantly influence farmers' decisions to engage in its cultivation (Okoroji et al., 2020). Additionally, the lack of awareness regarding the diverse uses of coconut products, such as coconut oil, coir, and other derivatives, further hampers the adoption of coconut as a viable agroforestry option (Uwubanmwen et al., 2011). This situation is exacerbated by inadequate access to extension services and technical support, which are essential for educating farmers about best practices in coconut cultivation and agroforestry systems (Nair, 1993; Adekoya, 1997). Moreover, the challenges faced by farmers include limited access to quality planting materials, financial constraints, and inadequate infrastructure for processing and marketing coconut products. These barriers contribute to low productivity levels and discourage farmers from investing in coconut cultivation, despite its potential to generate significant income (Oloyede, 2020). This study therefore aims to assess the 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, this study is not only timely but essential for equipping farmers with the knowledge and resources needed to capitalize on this lucrative market. Understanding farmers' perceptions and the factors influencing the adoption of coconut as an agroforestry crop is vital for developing targeted interventions that can promote its cultivation, optimize land use, and enhance biodiversity. Furthermore, this study could inform policy decisions aimed at improving agricultural practices and increasing the profitability of coconut farming, ultimately contributing to the socio-economic improvement of communities in Oyo State (Sarangi et al., 2020; Nair, 1993).

**2.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.

This study employed a cross-sectional survey design to investigate the perception and adoption of coconut palm as an agroforestry crop in the study area. A total of 100 questionnaires were distributed to participants selected through a mix of random and purposive sampling methods, ensuring a diverse representation across different age groups, experiences, locations and socio-economic statuses. The questionnaire included closed-ended questions designed to collect data on demographic details, farmers' awareness of the benefits of coconut palm, their attitudes towards its cultivation, their participation in agroforestry, and the barriers they perceive to adoption. Before the main data collection, the questionnaire was pre-tested with a smaller group to verify the clarity and validity of the questions, allowing for adjustments to enhance the reliability of the data gathered.

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.

**3.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 results reveal a gender distribution of 71% male and 29% female respondents. This disparity indicates a significant gender imbalance in the study area, which is consistent with findings of Okoroji et al. (2021) which indicated that gender inequality can hinder economic growth by limiting the allocation of female labor to more productive uses, thereby affecting overall productivity in industries with a higher female employment share. The age distribution indicates that the majority of respondents fall within the 48-57 and 28-37 age brackets, with 25% and 23%, respectively. This suggests a relatively mature workforce, which is crucial for agricultural productivity and economic stability. Older farmers also tend to have more experience, which can positively influence productivity, but they may also face challenges in adopting new technologies due to risk aversion associated with age (Okonya-Chukwu et al., 2022). The educational attainment of respondents shows that 34% have secondary education, while 20% possess no formal education. Education plays a critical role in enhancing agricultural productivity and economic development. Higher education levels among farmers are associated with better access to information, resources, and credit facilities, which can lead to improved agricultural practices and outcomes (Ahmad et al., 2023).

With 63% of respondents engaged in farming, it is evident that agriculture is the primary occupation for this population (Table 1). The household size data indicates that 48% of respondents belong to households with 6-10 members. Larger household sizes can have both positive and negative implications. On one hand, they may provide labor for agricultural activities; on the other hand, they can strain resources and limit individual members' access to education and health services, which are necessary for improving overall socioeconomic conditions (Amonum et al., 2009; Sarvade et al., 2020).

Result also shows varied methods of land ownership, with 31% inheriting land and 29% leasing it. The reliance on inheritance and leasehold arrangements reflects common practices in many rural areas, where land tenure security is important for investment in agricultural productivity. Secure land tenure can enhance farmers' willingness to invest in permanent crops and increase productivity (Okonkwo, 2010). Access to credit facilities is a significant concern, with only 39% of respondents indicating they have access. Access to credit is essential for small-scale farmers to invest in inputs and technologies that can enhance productivity. Limited access to credit can severely restrict farmers' ability to improve their operations, leading to lower productivity and income levels. The data shows that 42% of respondents have access to extension services, which are vital for providing farmers with the knowledge and skills necessary to improve agricultural practices (Table 1). Access to extension services can significantly enhance agricultural productivity by facilitating the adoption of new technologies and practices. It was also found that 93% of respondents have access to markets (Table 1), which is essential for selling agricultural produce and generating income. Improved market access has been linked to increased agricultural productivity, as it allows farmers to specialize and exchange goods more efficiently.

**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 results indicate that farmers have a generally 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 the various products that can be obtained from the coconut palm, such as coconut oil, water, and husk. This aligns with studies highlighting the diverse uses and economic value of coconut products in both local and international markets (Loomba and Jothi, 2013). Furthermore, the mean score of 4.36 for the statement regarding the coconut palm's ability to provide a sustainable income source for farmers underscores its viability as a cash crop in agroforestry systems. This is essential for enhancing rural livelihoods, as coconut farming can serve as a reliable source of income for smallholder farmers (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 (3.01) and training received (2.54) suggest 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).

**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 findings from the logistic regression analysis of factors influencing the adoption of coconut palm as agroforestry crop among farmers reveal several critical determinants. The variable "Access to Extension Services" shows a significant positive influence on adoption, with a coefficient (β) of 0.771 and a significance level of 0.005. This indicates that farmers who have access to extension services are more likely to adopt coconut cultivation practices. This finding is consistent with the study that emphasizes the role of agricultural extension in enhancing farmers' knowledge and skills, which is essential for the successful adoption of new agricultural practices (Kebede et al., 1990). Furthermore, "Level of Education" also significantly influences adoption (β = 0.620, p = 0.016), suggesting that higher educational attainment correlates with a greater likelihood of adopting coconut as an agroforestry crop. This aligns with studies indicating that educated farmers are more open to adopting innovative agricultural practices due to better understanding and access to information (Jha et al., 2021). Additionally, "Market Access" (β = 0.635, p = 0.013) plays an important role in the adoption of coconut cultivation. Farmers who can easily access markets are more likely to perceive coconut farming as a viable economic opportunity, reinforcing the importance of market infrastructure in agricultural development (Meijer et al., 2015). The positive influence of "Age" (β = 0.654, p = 0.071) suggests that older farmers may be more inclined to adopt coconut cultivation, potentially due to accumulated experience and knowledge. However, the relatively high p-value indicates that this relationship is not statistically significant at the conventional levels. These findings emphasize the need for targeted interventions in education, extension services, and market access to enhance adoption rates among farmers.

**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 highlights several barriers faced by farmers in the adoption of coconut palm as an agroforestry crop in the study area. The highest mean score of 4.08 was recorded for the concern regarding 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 can be critical to the success of multiple crops. A study by Perera (2020) indicated that intercropping coconut palms with other crops can enhance the productivity of the entire agroforestry system, but it requires careful management to ensure that all plants receive adequate resources. Furthermore, the mean score of 3.96 for the lack of sufficient financial resources indicates that economic constraints are a major barrier to adopting coconut cultivation. Financial limitations can prevent farmers from investing in necessary inputs such as quality seedlings which are essential for successful coconut farming (Okoroji et al., 2021). Additionally, the constraints 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. The lack of quality seedlings is a critical issue, as poor planting materials can lead to lower yields and reduced profitability (Moreno et al., 2020). Moreover, the concern about market instability can discourage investment in coconut farming, as farmers may fear that fluctuating prices will not cover their production costs. This finding aligns with the broader context of the coconut industry, where price volatility and market access remain significant challenges for smallholder farmers (Alouw and Wulandari, 2020).

4. Discussion

**5.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.

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