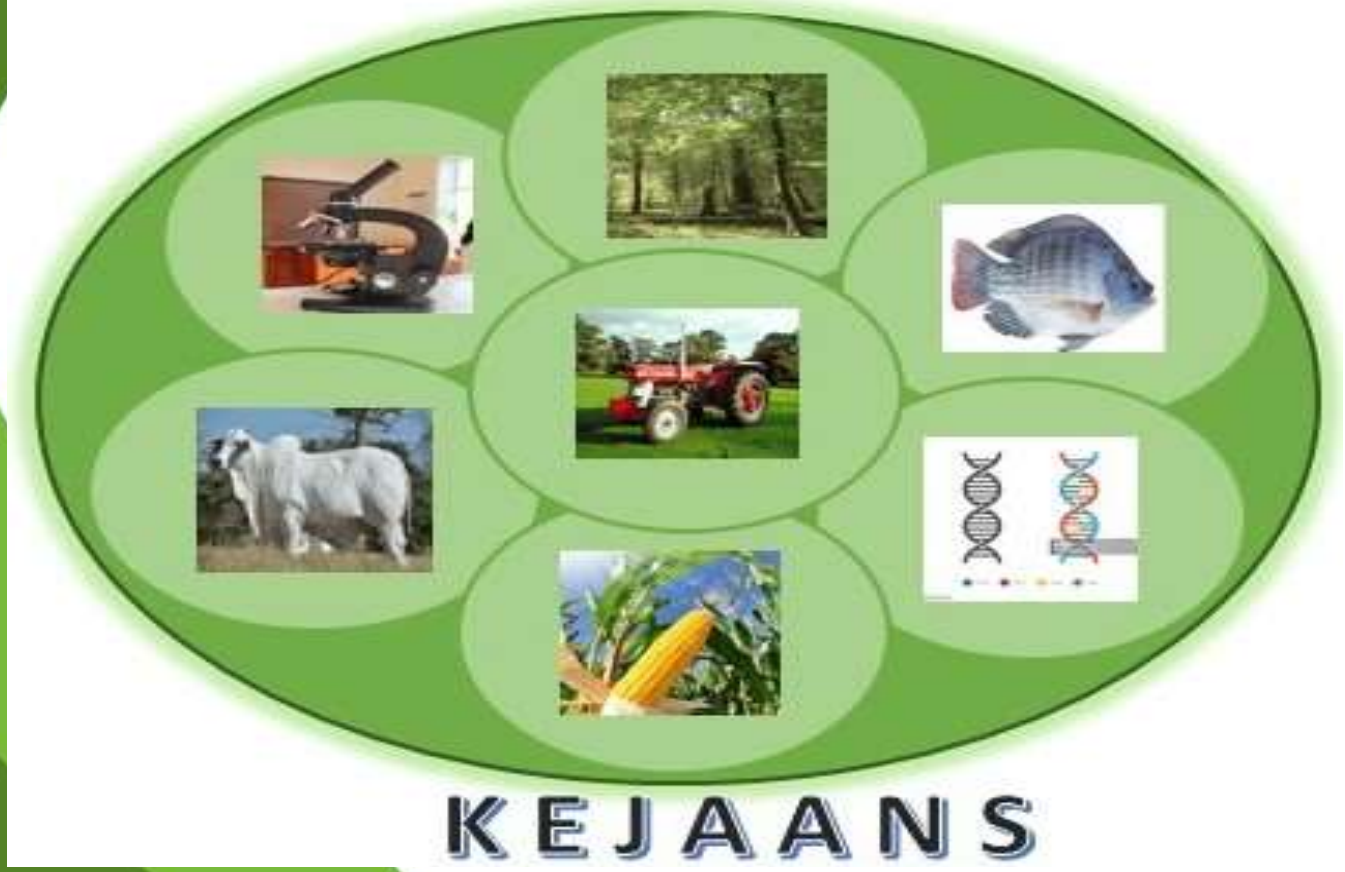
(KEJAANS)

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES

September, 2025, Vol. 1, issue 2



KEJAANS

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ISSN: 1595-5776

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)

September, 2025; Volume 1, Issue 2

OFFICIAL JOURNAL OF THE

FACULTY OF AGRICULTURE

ABDULLAHI FODIO UNIVERSITY OF SCIENCE AND TECHNOLOGY, ALIERO

ISSN: 1595-5776

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This official scientific publication of the Faculty of Agriculture, Abdullahi Fodio University of Science and Technology Aliero, is a non-profit, open access, double-blind peer-reviewed Journal publishing four issues (January, April, July and October) per annum. The Journal is a platform open to collaborations with researchers, authors, institutions, research agencies and private companies related to Agriculture. The Mission of the Journal is to disseminate scientific knowledge through the publication of original research articles, research notes, book reviews, letters to the editor and reviews of Literature, representing a contribution to scientific and technological knowledge in respective areas covered by the Journal. The Kebbi Journal of Agriculture and Natural Sciences seeks to validate and disseminate new knowledge, making it public in order to strengthen the human capacity, constitute a link in the scientific community to the society and encouraging the expansion of University and academic researches.

Scope of Kebbi Journal of Agriculture and Natural Sciences (KEJAANS)

The Kebbi Journal of Agriculture and Natural Sciences has the sole aim of providing an intellectual platform and ideas for scholars, by promoting interdisciplinary studies related to agriculture and natural science through publishing the latest scientific research findings that are of direct policy implications and beneficial to the research community. Consequently, the journal covers all aspects of Crop Science, Animal Science, Agricultural Economics, Agricultural Extension and Rural Development, Food Science, Fisheries and Aquaculture, Biotechnology, Soil Science and Agricultural Engineering, Forestry and Environment, Wildlife, Agricultural Education, Agro-allied Industries as well as all Natural Science researches related to Agriculture.

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
September, 2025: Volume 1, Issue 2 : 148-152
p-ISSN: 1595-5776

EVALUATION OF BARRIERS LIMITING THE UPTAKE OF CLIMATE-RESILIENT AGROFORESTRY PRACTICES BY SMALLHOLDER FARMERS IN KEBBI STATE, NORTHWESTERN NIGERIA.

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ABSTRACT

Climate-resilient agroforestry (CRA) is a proficient strategy for enhancing climate resilience and food security in semi-arid regions. Nevertheless, its execution remains constrained. This study assessed the awareness, beliefs, and constraints influencing the adoption of Climate-Smart Agriculture practices among 2750 farmers in Kebbi State, Nigeria. A standardized questionnaire was utilized to collect socio-demographic data and evaluate farmers' knowledge, attitudes, and perceived challenges. Descriptive statistics were employed for data analysis. The findings revealed a significant disparity: whereas a considerable majority of farmers (89%) acknowledged agroforestry and most (76%) observed climatic changes, awareness of specific climate-smart agriculture techniques was restricted (<31%). The primary constraints were considerable competition for resources between trees and crops (74-89% agreement) and major economic barriers, including labour costs and a prolonged gestation period. A notable finding was the nearly total lack of institutional support, with over 80% of farmers reporting inadequate access to extension services. Despite these challenges, 70% of participants expressed a willingness to adopt more practices, including training, affordable seedlings, and access to funding as critical support needs. The research suggests that closing the adoption gap in semi-arid Nigeria requires interventions that correct misconceptions via effective information dissemination, while simultaneously tackling economic obstacles through improved institutional support and customized incentives.

Keywords: Climate-resilient; Agroforestry; Adoption; Climate-Smart and Climatic change

Introduction

Climate change remains one of the most pressing environmental challenges globally, with adverse effects on agriculture, especially in the semi-arid regions of Sub-Saharan Africa. In Nigeria, the northern part, including Kebbi State, experiences recurrent droughts, land degradation, and desertification, all of which threaten agricultural productivity and rural livelihoods. Climate-Smart Agriculture (CSA) has emerged as an effective approach to improve resilience and sustainability in farming systems. Among the core CSA strategies, agroforestry stands out due to its ability to simultaneously enhance biodiversity, restore degraded lands, sequester carbon, and ensure sustainable energy and food supply.

Agroforestry involves the integration of trees and shrubs into traditional farming systems to optimize ecological and economic benefits. Despite its potential, the adoption of agroforestry practices among peasant farmers in many parts of Nigeria remains low. This study investigates the extent to which peasant farmers in Kebbi State are aware of, adopt, and benefit from climate-smart agroforestry

practices. It further identifies the key constraints that hinder widespread adoption and recommends strategic interventions to improve implementation.

Kebbi State, located in Nigeria's Northwestern region, is experiencing increasing environmental challenges, including desertification, declining soil fertility, and overreliance on fuelwood. These issues have been exacerbated by unsustainable land-use practices such as deforestation and overgrazing. Although agroforestry offers a promising climate-smart solution to these challenges, its adoption among peasant farmers in the state remains limited. Initial evidence suggests that barriers such as lack of awareness, poor access to inputs (e.g., seedlings), and minimal institutional support continue to hinder effective implementation. Without deliberate efforts to understand and address these constraints, the potential of agroforestry to build climate resilience and improve rural livelihoods will remain underutilized in Kebbi State. Therefore, this study seeks to fill the knowledge gap by systematically assessing the adoption level of agroforestry practices and identifying the key challenges faced by farmers across the state's three senatorial districts.

Methodology

Study Area

The study was conducted across Kebbi State, located in Northwestern Nigeria. The state lies within the Sudan savanna zone and is characterized by semi-arid climatic conditions, with low and erratic rainfall, high temperatures, and seasonal farming activities.

Sampling Technique and Sample Size

A multistage sampling technique was employed to ensure fair representation across the three senatorial districts of Kebbi State: Kebbi Central, Kebbi North, and Kebbi South. Each district contributed 900 respondents, making a total sample size of 2,700 peasant farmers. An additional 50 extension officers were also included, bringing the total sample size to 2,750 respondents.

Data Collection:

Data were collected using structured questionnaires that included both open- and close-ended questions. Section B of the questionnaire included multiple-response questions to capture diverse opinions and experiences. The data collected covered socio-economic characteristics, awareness and adoption levels of agroforestry, energy sources, types of agroforestry systems practiced, crops and tree species cultivated, benefits derived, and constraints encountered.

Results

Respondents' socio-demographic characteristics

The average respondents was a seasoned, middle-aged male farmers. Most were married (87%), had large family size (71% with 6–10 inhabitants), and had been in agriculture for more than 20 years (63%). 89% of their operations were small to medium-sized farms, with 1–5 hectares, mostly cultivating cash crops (41%), and cereals (59%). Strong tenure is shown by the fact that a sizable majority (69%), acquired their land through inheritance. The majority of people have at least a secondary education, indicating a fairly high level of educational achievement. With 69% of them earning more than ₦200,000 annually, their agricultural income ranged from modest to significant, and farming was frequently complemented by other occupations like trading or artisanal employment.

Consciousness on Climate-resilient Literacy Significantly more farmers (76%) said that the climate has changed, especially in

terms of precipitation patterns (56%). At 89%, the general understanding of the phrase "agroforestry" was extremely good. This concealed a significant lack of understanding of certain processes. While awareness was higher for basic applications such as live fences (31%), it was far lower for more intricate, advantageous methods like silvopasture (9%), and alley cropping (16%). Farmers greatly underestimated the long-term ecological benefits of trees, such as soil improvement (7%) and climate resistance (9%), in favour of their immediate economic benefits, such as fruit and lumber (47%), and their function as windbreaks (26%).

Identified Limitations and Obstacles

The obvious sense of rivalry between crops and trees was the main obstacle. Trees compete for water, sunshine, and nutrients, according to a large majority of farmers (89% agreement), and they also lower agricultural output (74% agreement). The long development time of trees (59%), limited access to money (54%), and significant labour needs (59% agreement) were the main economic restrictions. The majority of farmers reported uneven access to extension services (82% disagreement) and believed that government policies were ineffective (85% disagreement), indicating a clear lack of institutional support.

The Future Direction and the Willingness to Accept

A significant majority (70%) said that they would be open to using further agroforestry techniques in spite of the difficulties. The main drivers were immediate and financial: producing more revenue (50% agreement) and giving crops protection and shade (58% agreement). Effective training (31%), access to free or subsidised seedlings (29%), and improved financial facilities (23%), according to farmers, were their top three assistance needs. Agricultural radio broadcasts (87%) and other farmers (97%) were their primary information sources.

Discussion

The findings show that Kebbi State offers a wide range of adoption prospects. The heightened awareness of agroforestry, contrasting with inadequate comprehension of particular procedures, coincides with the findings of Mbow et al. (2014) in semi-arid West Africa, where farmers possess traditional knowledge but lack technical insight into modern systems. Amadu et al. (2020) also recognise the shortcomings of institutional knowledge routes, which are highlighted by the significant dependence on radio and peer-to-peer learning rather than formal extension.

Financial limitations and perceived rivalry are the two main obstacles, both of which have been extensively studied (Coe et al., 2014; Coulibaly et al., 2017). According to Sida et al. (2018), these views frequently result from a lack of understanding regarding species selection and spatial management that might reduce competition. As a previous research in northern Nigeria showed, the extension system's catastrophic collapse exacerbates the information gap, requiring farmers to rely on their own observations that are focused on imminent dangers (Akpan et al., 2022).

Due to established hereditary rights, which are a major benefit for long-term investment, land tenure did not provide a substantial impediment, in contrast to traditional narratives (Place, 2009) (Mwangi & Meinzen-Dick, 2009). Immediate financial benefits were the main drivers, highlighting the need for agroforestry to be financially appealing for successful adoption (Coulibaly et al., 2017).

Strong adoption tendencies combined with

targeted aid requests create a clear framework for intervention, supporting recommendations in the literature for helpful policies including financial access, input subsidies, and capacity building (Kpadonou et al., 2017).

Conclusions

The farmers of Kebbi State are eager yet limited. They have the land, expertise, and will to implement climate-smart agroforestry, but they are hampered by a convergence of ideologies and a significant dearth of support systems.

According to the report, reducing the adoption gap necessitates a concerted effort to:

1. Restore Institutional Support: Expand extension services to offer focused, hands-on instruction that dispels myths about competition and explains appropriate tree management techniques.
2. Offer Financial Incentives: Put in place initiatives to provide reasonably priced seedlings and develop lending options specifically for agroforestry businesses.
3. Initiate Awareness Campaigns: Use efficient media, such as radio and agricultural cooperatives, to spread knowledge about the financial and environmental advantages of agroforestry.

In order to fully realise the enormous potential of climate-resilient agroforestry in Nigeria's semi-arid regions and improve resilience and smallholder farmers' livelihoods, it is imperative that these institutional and perceptual impediments be addressed.

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