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Barrier to the Adoption of Climate-Smart Agricultural Practices by Small-Scale Farmers in Kebbi State, Nigeria.

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ABSTRACT *Original research paper*

The study examined the barriers smallholder farmers in Nigeria's Kebbi State faced while attempting to implement climate-smart farming methods. To choose 120 respondents for the study, a three-stage sampling technique was employed. The data was collected using a well-structured questionnaire schedule, and it was analyzed using frequency and percentage. Access to farmer-based insurance was cited by nearly half of the respondents (31.3%) as a very high economic barrier. Infertile soil (58.0%) and the prevalence of weeds, pests, and diseases (67.3%) were cited by a significant portion of respondents as major environmental limitations. Disputes between farmers and herders (62.0%) and tribal disputes (51.3%) were examples of sociocultural restrictions. Institutional restrictions included limited access to extension services (57.3%) and minimal government assistance for agricultural inputs (53.3%). Therefore, it is advised that budgetary support be provided and public-private partnerships be strengthened to leverage funding for the implementation of climate-smart activities.

Introduction

Several factors influence the growth and long-term viability of agriculture, encompassing social, economic, and environmental aspects (Toliatkashani, Najaf Abadi, and Lashgararal, 2019). Among these, climate, as an environmental factor, plays a crucial role by affecting the types of crops that can be grown and determining the duration of their growing seasons. Unfortunately, the world's climate is currently changing, hurting agriculture in a variety of ways. These factors include changes in average temperatures, rainfall patterns, other extreme weather events, insect and disease infestations, changes in atmospheric carbon levels, changes in ground-level ozone concentrations, and changes in

the nutritional content of specific crops (Abdulrahman et al., 2021).

These changes have a greater impact on smallholder farmers and developing nations. To ensure food security in the face of climate change, a systematic approach to sustainable agricultural growth must be developed that does not deplete the soil's natural state (Ukhurebor et al., 2021). Climate-smart agriculture methods are one example of such an intervention. It is a creative approach to guiding the essential changes to agricultural systems, particularly to address food security and climate change challenges, rather than a new agricultural system. Climate-smart agriculture (CSA) is a way of modifying and refocusing agricultural production in response to the new realities of climate change (Food and Agriculture Organization, 2022).

Climate change can affect all humans because of the severe threats it poses to the environment and agricultural harvests around the world. The climate influences the distribution and number of organisms. Enhancing carbon dioxide (CO2) accumulation has a wide range of possible consequences on plants, as well as indirect dangers to herbivores and other food chain members. Severe weather events like intense rainstorms, strong winds, and elevated temperatures greatly influence agricultural practices. Climate and agriculture are deeply interconnected global phenomena, meaning that changes in climate directly impact farming activities. One of the most significant risks associated with climate change is the increase in temperature, which is expected to threaten the environment and disrupt agriculture. This includes increased levels of CO2, higher average atmospheric temperatures, substantial glacial melting, altered rainfall patterns, and the combined effects of all these factors (Ekpa et al., 2021).

Mburu et al. (2014) demonstrated that climate variability and change severely undermine small-scale farmers' access to, availability of, and adequacy of food. According to Ani et al. (2022), nearly 80% of these farmers, who depend on agriculture for their livelihoods, face heightened food insecurity, slower economic progress, and increased poverty due to multiple interacting factors such as temporal and spatial climate variability, shifts in seasonal patterns, soil degradation, and uncertain future climate conditions.

The major purpose of the study was to investigate the problems experienced by smallholder farmers in Kebbi State, Nigeria, in implementing climate-smart agricultural methods.

Specifically, the research objective is:

1. Evaluated farmers' awareness of climate-smart agricultural practices.
2. Examined barriers to small-scale farmers adopting climate-smart agriculture techniques.

Methodology

The study was carry out in Nigeria's Kebbi State. The state is located in the northwest Sudan Savannah region, between latitudes 10° 051 and 13° 271N of the equator and longitudes 3° 351 and 6° 031E of Greenwich. According to the 2006 census, there are 3,351,831 people living in the state (NPC, 2006). Assuming a 3% growth rate, the population is expected to reach 4,351,067 by 2022. Over two-thirds of the population is engaged in agricultural production, predominantly arable crops and cash crops with animal rearing. A subset of Kebbi State's small-scale farmers made up the study's population.

A randomized selection process was used to select 120 small-scale farmers from three local governments in the state. Out of Kebbi State's three senatorial districts, one local government area was chosen at random. These include the Kebbi North, Central, and South Local Government Areas of Argungu, Bunza, and Zuru, respectively. Small-scale farmers were chosen at random from each of the two rural settlements that were chosen from each local government region. The small-scale farmers' information was gathered using a standardized questionnaire. The socioeconomic characteristics of the interviewees were described using descriptive statistics.

Results and Discussion

Awareness of Climate-Smart Agricultural Practices

Table 1 highlights the awareness levels of various climate-smart agricultural (CSA) practices among farmers. The highest awareness percentage (75.3%) is observed for agroforestry and fodder trees. Agroforestry integrates trees into farming systems providing benefits like improved soil fertility, enhanced biodiversity, and sustainable livelihoods. High awareness in this area indicates the potential for significant environmental and economic impacts if properly implemented. Odebode (2021), confirms the growing recognition of agroforestry's role in mitigating climate change and improving farm productivity. Improved fodder production also shows substantial awareness (74.0%). This practice enhances livestock nutrition and reduces dependency on overgrazing, which often leads to land degradation. The emphasis on improved fodder production aligns with the increasing focus on sustainable livestock management (Abdullahi and Ibrahim, 2020).

Weather prediction has an awareness rate of (70.7%), reflecting farmers' reliance on accurate forecasts for planting and harvesting decisions. The importance of this practice is underlined by Ayanlade et al. (2022), who emphasize the role of localized weather prediction tools in enhancing resilience to climate variability in Nigeria. Moderate awareness levels are seen in tree planting (64.0%) and climate change campaigns (60.7%), suggesting that these practices are gaining traction but require more targeted outreach programs.

Soil water conservation and better livestock management, with awareness levels of (46.0%) and (27.3%), respectively, indicate gaps that need to be addressed. Eze et al. (2019) emphasize the importance of educating farmers on water conservation techniques and sustainable livestock practices to ensure CSA's broader adoption.

Table 1: Awareness of climate-smart agricultural practices

Awareness of climate-smart agricultural practices	Aware %	NotAware %
Forecasting weather conditions	70.7	29.3
Conservation of soil moisture	46.0	54.0
Enhanced production of animal fodder	74.0	26.0
Integration of trees and fodder plants (agroforestry)	75.3	24.7
Improved management of livestock	27.3	72.7
Educational campaigns on climate change	60.7	39.3
Initiatives for planting trees	64.0	36.0

Source: Field survey 2024

Limitations to the Use of Climate-Smart Agricultural Practices

Table 2 outlines the limitations to adopting CSA practices, with a focus on economic, environmental, socio-cultural, and institutional factors. The most significant constraint is the experience of weeds and pests, with a very high constraint percentage of (67.3%). This issue is a critical challenge in Nigerian agriculture, as noted by Okpala et al. (2023). The prevalence of weeds and pests reduces crop yields and raises production costs, discouraging the adoption of CSA practices. Farmers/herders' conflicts are another major barrier, with (62.0%) of respondents identifying them as a very high constraint. These conflicts often arise over land use, undermining agricultural productivity and rural stability. According to Adisa and Adekunle (2021) highlight the urgent need for conflict resolution mechanisms to address these recurring issues and facilitate sustainable farming. Infertile soil (58.0%) and limited access to extension services (57.3%) also rank high as constraints. Infertile soils hinder productivity making it challenging for farmers to adopt CSA practices that require healthy soil conditions. Meanwhile, limited access to extension services restricts farmers' knowledge and technical support, a gap frequently cited in Nigerian agricultural studies (Oladele et al., 2020).

Institutional obstacles, such as inadequate government assistance for agriculture inputs (53.3%) and the land tenure system (50.7%), complicate CSA adoption. Access to inputs such as fertilizers and seeds is critical for implementing CSA practices, but inefficiencies in distribution remain a persistent problem. Similarly, the land tenure system in Nigeria often limits farmers' ability to make long-term investments in sustainable agricultural practices. Drought occurrence (55.3%) also poses significant challenges, as unpredictable rainfall patterns exacerbate water scarcity. This issue is particularly relevant in Nigeria's semi-arid regions, where climate change has intensified drought conditions, according to Ajibade et al. (2022).

Finally, socio-cultural constraints like community taboos (39.3%) and institutional challenges such as government policy on CSA (38.0%) highlight the need for awareness campaigns and policy reforms. Addressing these limits would need coordination across stakeholders, including government entities, research institutions, and local people.

Table 2: Constraints to the Use of Climate-Smart Agricultural Practices

Specific Constraint Category	Very High Constraint %	Low Constraint %	Not a Constraint %
Economic Constraints			
Demand for agricultural products	49.3	11.3	38.0
Availability of farmer-based insurance	31.3	40.0	28.7
Availability of labor	39.3	29.3	29.3
Access to sustainable agricultural technologies	41.3	32.7	26.0

Low prices for farm produce	31.3	24.7	44.0
Environmental Constraints			
Incidence of bush or forest fires	42.0	25.3	32.7
Soil infertility	58.0	30.0	12.0
Occurrence of drought	55.3	44.7	-
Presence of pests and diseases	67.3	19.3	13.3
Socio-cultural Constraints			
Community taboos and values	39.3	25.3	35.3
Tribal conflicts	51.3	18.7	30.0
Farmland encroachment	30.0	56.0	14.0
Land ownership system	50.7	44.0	5.3
Conflicts between farmers and herders	62.0	18.0	20.0
Institutional Constraints			
Government provision of farm inputs	53.3	24.0	22.7
Access to agricultural extension services	57.3	30.7	12.0
Availability of government funds for CSA	40.7	46.7	12.7
Access to roads and markets	49.3	32.0	18.7
Government policies on climate-smart agriculture	38.0	36.7	25.3

Source: Field Survey 2024

Conclusion and Recommendations

The analysis of awareness and constraints related to CSA practices underscores both opportunities and challenges in achieving sustainable agriculture in Nigeria. High awareness of practices like agroforestry and fodder production suggests a foundation for further development, while constraints such as weeds, pests, and institutional barriers highlight areas requiring urgent attention. To maximize the potential of CSA practices, policymakers and stakeholders should prioritize investment in extension services, conflict resolution, and policy support, as suggested by recent Nigerian studies.

The degree of farmers' knowledge influences how effectively and efficiently climate-smart agriculture is used, and the difficulties smallholder farmers face have an impact on how much climate-smart agriculture is used. To encourage CSA integration more quickly and easily, the idea of agriculture expansion should be reinforced. With their upscaling at all levels, including financial and intangible support, the government should reexamine the idea and concentrate on making it easier for CSA methods to be widely accepted and adopted. CSA blueprints should appropriately incorporate sociocultural considerations.

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