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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

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. A well-structured questionnaire schedule was used to collect the data, and frequency and percentage were used for analysis. 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 socio-cultural 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.

KEY WORDS: *Climate-Smart Agriculture*; *Small-scale farmers*; *Kebbi state*; *Nigeria*

1. Introduction

There are factors affecting the development and sustainability of agriculture which include social, economic and environmental factors (Toliatkashani *et al.*, 2019). Climate is an environmental component that has a significant impact on agriculture; it impacts the sorts of crops that can be cultivated as well as the length of each crop's growth season. Unfortunately, the world's climate is currently changing, hurting agriculture in a variety of ways. These include variations in average temperatures, rainfall, other climate extremes, insect and disease infestation, changes in atmospheric carbon, ground-level ozone concentration, and changes in the nutritional value of some crops (Abdulrahman *et al*., 2021).

These changes have a greater impact on smallholder farmers and developing nations. To

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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 novel method of guiding the necessary adjustments to agricultural systems, especially to address the issues of food security and climate change, rather than a new agricultural system. A method for changing and refocusing agricultural development in light of the new realities of climate change is known as climate-smart agriculture (CSA) (Food and Agricultural 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 (CO_2) accumulation has a wide range of possible consequences on plants, as well as indirect dangers to herbivores and other food chain members. Extreme weather conditions such as heavy rainstorms, high wind pressures, and high temperatures have a significant impact on agricultural activity. Climate and agriculture are inextricably linked universal processes, and hence climate variations affect agricultural activity. A large climate change risk is due to a temperature rise (global warming) which is predicted to pose major threats to the environment disturbing agriculture, with higher CO_2 quantities, increase in atmospheric average temperature, large glacial overflow, varied rainfall sequence and the interrelation of all the above factors (Ekpa *et al.*, 2021).

The severe and negative consequences on small-scale farmers' access, availability, and sufficiency of food were confirmed by Mburu *et al.* (2014) in their study on the effects of climate variability and change on food security. Nearly 80% of small-scale farmers who rely on agriculture for their livelihood will experience increased food insecurity, slower economic growth, and poverty as a result of the interplay of multiple factors, including temporal and spatial climate variability, seasonal pattern changes, degraded soil, and uncertain future climate scenarios (Ani *et al.*, 2022). The general objective of the study was to ascertain constraints to the use of climate-smart agricultural practices among smallholder farmers in Kebbi State, Nigeria. Specifically, the research

1. Assessed farmers' level of awareness of climate-smart agricultural practices
2. Examined the constraints to the use of climate-smart agriculture practices among small-scale farmers

2. Material and Methods

The study was carried out in Kebbi State, Nigeria. The State lies in the northwest Sudan Savannah region between latitudes 10° 051 and 13° 271N of the equator and between longitudes 3° 351 and 6° 031E of the Greenwich. The State has a population of 3,351,831 (NPC, 2006) according to the 2006 census. Projecting this population to the year 2022 at 3% growth rate reveals the population as 4,351,067. Over two-thirds of the population is engaged in agricultural production, mainly arable crops alongside cash crops with livestock production.The population of this study comprised selected small-scale farmers in Kebbi State.

A randomized selection was used to select 120 small-scale farmers from three local governments in the state. One local government area was randomly selected from each of the three senatorial districts of Kebbi State. These include Argungu, Bunza and Zuru Local Government Areas from Kebbi North, Central and South respectively. Two rural communities were selected from each of the local government areas and small-scale farmers were selected from each community randomly. A well-structured questionnaire was used to collect data from the small-scale farmers. Descriptive statistics were used to describe the socioeconomic characteristics of respondents.

3. Results and Discussion

3.1 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 %	Not Aware %
Weather prediction	70.7	29.3
Soil water conservation	46.0	54.0
Improved fodder productions	74.0	26.0
Agroforestry and fodder trees	75.3	24.7
Better livestock management	27.3	72.7
Awareness campaigns on climate change	60.7	39.3
Establishment of tree planting	64.0	36.0

Source: Field survey 2024

3.2 Constraints to the Use of Climate-Smart Agricultural Practices

Table 2 outlines the constraints 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 constraints like inadequate government support with farm inputs (53.3%) and the land tenure system (50.7%) further complicate

Table 2: Constraints to the use of climate-smart agricultural practices

Economic constraints	Very high constraint %	Low constraint %	Not a constraint %
There is demand for farm produce	49.3	11.3	38.0
Access to farmer-based insurance companies	31.3	40.0	28.7
Access to labour	39.3	29.3	29.3
Access to sustainable agriculture technologies	41.3	32.7	26.0
Poor pricing of agricultural produce	31.3	24.7	44.0
Environmental issues			
Experience of bush/forest fires	42.0	25.3	32.7
Infertile soil	58.0	30.0	12.0
Drought occurrence	55.3	44.7	-
Pests and diseases	67.3	19.3	13.3
Socio-cultural constraints			
Taboos and values of community	39.3	25.3	35.3
Occurrence of tribal conflicts	51.3	18.7	30.0
Encroachment of farmlands	30.0	56.0	14.0
Land tenure system	50.7	44.0	5.3
Farmers/herders' conflicts	62.0	18.0	20.0
Institutional constraints			
Government support with farm inputs	53.3	24.0	22.7
Access to extension services	57.3	30.7	12.0
Availability of Climate Smart Agriculture funds by the government	40.7	46.7	12.7
Access to roads and markets	49.3	32.0	18.7
Government Policy on Climate Smart Agriculture	38.0	36.7	25.3

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 constraints will require collaboration between stakeholders, including government bodies, research institutions, and local communities.

4. Conclusion

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 farmers' level of knowledge contributes to the efficient and effective usage of climate-smart agriculture, and challenges encountered by the smallholder farmers affect the level of climate-smart agriculture usage. The concept of agriculture extension should be strengthened to promote easier and faster assimilation of CSA. The government should revisit the concept and prioritize their focus to facilitate general acceptance and easy adoption of CSA practices with their up-scaling at all levels including financial and intuitional support. The socio-cultural factors should be properly integrated into CSA blueprints.

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