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# Climate Smart Agriculture and Food Security among Rural Farmers in Nasarawa State, Nigeria

Abdullahi Yusuf Agwai; Falalu Mohommed Mohammmed ; A. S. Ogah
Department of Geography, Federal University Lafia, Nasarawa State,
&
Department of Geography, Nasarawa State University Keffi.

**Abstract**
Climate change continues to threaten agricultural productivity and household food security, particularly among rural farmers who depend on rain-fed agriculture. This study examined climate smart agriculture and food security among rural farmers in Nasarawa State, Nigeria. Specifically, it assessed the extent of adoption of climate-smart agricultural practices and examined their influence on household food security. A mixed-methods descriptive survey design was adopted. Data were collected from 372 rural farming households using structured questionnaires, while Key Informant Interviews were conducted with agricultural extension officers and community leaders. Secondary data were obtained from relevant journal articles, government publications, and reports. Quantitative data were analyzed using frequency tables and percentages and presented with bar charts, while qualitative data were transcribed, interpreted, and integrated with the quantitative findings. The study found that climate-smart agricultural practices significantly enhanced household food security, with 86% of the respondents indicating that the practices strengthened their resilience to climate change, while 85% reported improved household food availability. The study concludes that climate-smart agriculture is an effective approach for improving the livelihoods and food security of rural farming households in Nasarawa State. The study recommends that the Nasarawa State Agricultural Development Programme (NADP), in collaboration with the State Ministry of Agriculture and agricultural extension agencies, should strengthen extension services by providing regular farmer training, climate information, and access to climate-smart agricultural technologies to promote wider adoption and enhance household food security.

**Keywords:**
Agricultural Productivity, Climate Change Adaptation, Climate Smart Agriculture, Food Security, and Rural Farmers**.**

## Introduction

Agriculture remains the backbone of rural livelihoods and food production worldwide, providing employment, income, and food for billions of people. However, climate change has emerged as one of the greatest threats to sustainable agricultural production due to rising temperatures, erratic rainfall, prolonged droughts, floods, land degradation, and increasing incidences of pests and diseases (Balogun et al., 2024; Omotoso & Omotayo, 2025). These climate-induced challenges have reduced agricultural productivity and exacerbated food insecurity, particularly among rural households that depend largely on rain-fed agriculture in developing countries (Kogo et al., 2021; Lipper et al., 2022). 2023). In response to these challenges, the Food and Agriculture Organization (FAO, 2013) introduced Climate-Smart Agriculture (CSA) as an integrated approach aimed at sustainably increasing agricultural productivity, enhancing resilience and adaptation to climate change, reducing

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greenhouse gas emissions where feasible, and improving food security. Climate-smart agriculture comprises a range of sustainable farming practices, including conservation agriculture, agroforestry, crop diversification, integrated soil fertility management, efficient water-use technologies, climate-resilient crop varieties, and weather advisory services, all of which are designed to enhance agricultural productivity, strengthen farmers' resilience to climate change, and promote sustainable food production systems (Aryal et al., 2022; Lipper et al., 2022).

Food security remains one of the major global development challenges despite improvements in agricultural technology and productivity. According to FAO (2023), food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Several studies have shown that the adoption of climate-smart agricultural practices significantly improves crop productivity, household income, dietary diversity, and overall food security among smallholder farming households compared with non-adopters (Makate et al., 2023). Sub-Saharan Africa is among the regions most vulnerable to climate change because agriculture contributes significantly to employment and economic growth while depending predominantly on rainfall. Increasing occurrences of droughts, floods, declining soil fertility, and erratic rainfall have significantly constrained agricultural production and threatened food availability across Sub-Saharan Africa (Mango et al., 2023; Mutenje et al., 2022). Consequently, many African countries have incorporated climate-smart agricultural practices into their agricultural development policies to strengthen farmers' resilience, enhance adaptive capacity, and promote sustainable food systems. Empirical studies conducted across Africa have shown that agroforestry, conservation agriculture, integrated soil fertility management, crop diversification, water harvesting, and the use of improved crop varieties significantly enhance agricultural productivity, increase household incomes, and improve food security among smallholder farming households (Kurgat et al., 2023; Mutenje et al., 2022).

Nigeria is highly vulnerable to the impacts of climate change because agriculture contributes substantially to national food production and employs a significant proportion of the rural labor force. The increasing frequency of droughts, flooding, rising temperatures, and erratic rainfall has adversely affected crop production, livestock management, and rural livelihoods across Nigeria, leading to declining agricultural productivity and worsening household food insecurity (IPCC, 2023; World Bank, 2022; Kogo et al., 2021). The Federal Government of Nigeria, in collaboration with development partners, has therefore promoted several climate-smart agricultural interventions including conservation farming, drought-tolerant crop varieties, agroforestry, improved irrigation technologies, integrated soil fertility management, and climate advisory services to improve farmers' adaptive capacity (Gabriel et al., 2023).

Nasarawa State is one of Nigeria's major agricultural-producing states, with most rural households depending on farming for their livelihoods. Major crops cultivated in the state include maize, rice, yam, cassava, millet, sorghum, soybean, and vegetables. Despite its considerable agricultural potential, farming activities in the state have increasingly been threatened by climate variability characterized by delayed rainfall onset, shortened growing seasons, flooding, prolonged dry spells, declining soil fertility, and increased pest infestations. These challenges have adversely affected agricultural productivity and household food security among rural farmers who rely primarily on rain-fed agriculture (Sylvester et al., 2024). Consequently, climate-smart agricultural practices have become increasingly important as practical adaptation strategies for improving productivity, strengthening resilience, and ensuring sustainable food production within the state.

Although several empirical studies have investigated climate-smart agriculture in Nigeria, most have focused on determinants of adoption, adaptation strategies, agricultural productivity, or the effects of specific climate-smart practices in selected regions (Gabriel et al., 2023; Omotoso & Omotayo, 2025; Ume et al., 2024). Likewise, the few studies conducted in Nasarawa State have primarily examined the effects of climate-smart agricultural practices on food security without providing a broader assessment of how different climate-smart agricultural practices collectively influence the various dimensions of household food security among rural farmers across the state. This study therefore examines Climate-Smart Agriculture and Food Security among Rural Farmers in Nasarawa State, Nigeria**.**

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**Research Objectives**

The broad objective of this study is to examine Climate-Smart Agriculture and Food Security among Rural Farmers in Nasarawa State, Nigeria. While the specific objectives are to:

i. Assess the extent of adoption of climate-smart agricultural practices among rural farmers in Nasarawa State.
ii. Examine the influence of climate-smart agricultural practices on household food security among rural farmers in Nasarawa State.

**Empirical Literature Review**

Gabriel, I., Olajuwon, F., Klauser, D., Michael, B., Ojo, T. O., & Kikulwe, E. (2023) assessed the state of climate-smart agriculture practices in the North Central and Northwest geopolitical zones of Nigeria. The study employed a cross-sectional survey involving farming households across selected states and analyzed the data using descriptive and inferential statistics. The findings revealed that conservation agriculture, agroforestry, crop diversification, and improved seed varieties were among the most commonly adopted CSA practices. The study further established that access to extension services, farmers' education, institutional support, and membership in farmers' associations significantly influenced CSA adoption. Nevertheless, the research concentrated mainly on adoption patterns and determinants without examining how these practices affect household food security outcomes. This leaves an important knowledge gap regarding the direct contribution of CSA to food security among rural households.

Omotoso, A. B., & Omotayo, A., O., (2025) investigated the effect of climate-smart agricultural practices on household dietary diversity and food security in Nigeria. Using nationally representative household survey data and econometric techniques, the study found that households adopting CSA practices recorded significantly higher dietary diversity scores, food consumption levels, and food security status than non-adopters. The study concluded that promoting climate-smart agricultural technologies could substantially reduce food insecurity among rural households. However, because the study relied on national-level data, it did not adequately capture the socioeconomic and ecological characteristics unique to Nasarawa State.

Ume, C., Nnadi, F. N., Chukwuone, N. A., & Agwu, N. M. (2024) examined climate-smart agricultural practices among crop farmers in Southeast Nigeria using a multistage sampling technique and structured questionnaires administered to crop farmers. The study identified improved crop varieties, conservation tillage, mulching, agroforestry, crop rotation, and integrated nutrient management as the dominant climate-smart practices adopted by farmers. The results indicated that farmers with better access to extension services, education, and agricultural information were significantly more likely to adopt CSA technologies. Despite providing valuable evidence on adoption behaviour, the study focused primarily on southeastern Nigeria and did not assess the implications of CSA adoption for household food security.

Sylvester, C. L., Umar, H. S., and Galadima, O. E. (2024) investigated the effects of climate-smart agricultural practices on the food security status of farming households. Primary data were collected from farmers through structured questionnaires and analyzed using factor analysis and regression techniques. The findings showed that comprehensive field management, agroforestry, soil conservation, crop and livestock management, and on-farm risk reduction practices significantly improved household food security. The study further identified inadequate access to climate information, financial constraints, and weak institutional support as major barriers to CSA adoption. While the study established the positive relationship between CSA and food security, it focused mainly on the effects of selected practices and did not provide a comprehensive assessment of the overall level of CSA adoption among rural farmers across Nasarawa State.

**Theoretical Framework: Diffusion of Innovations (DOI) Theory**

The study is anchored on the Diffusion of Innovations (DOI) Theory developed by Rogers (1962) and subsequently revised in its fifth edition (Rogers, 2003). The theory explains how new ideas, technologies, or practices are communicated and adopted over time within a social system. It posits that the rate and extent of adoption of an innovation depend on individuals' perceptions of its characteristics, communication channels, time, and the prevailing social system.

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According to Rogers (2003), the adoption of an innovation is influenced by five major attributes: relative advantage**,** compatibility**,** complexity**,** trialability, and observability**.** Relative advantage refers to the degree to which an innovation is perceived as better than existing practices. Compatibility describes how well the innovation aligns with users' values, experiences, and needs. Complexity relates to the ease or difficulty of understanding and using the innovation. Trialability refers to the opportunity to test the innovation before full adoption, while observability concerns the visibility of the innovation's benefits to others.

In the context of this study, climate-smart agricultural practices such as conservation agriculture, agroforestry, crop diversification, integrated soil fertility management, climate-resilient crop varieties, efficient water management, and climate information services are regarded as agricultural innovations. Their adoption by rural farmers depends on how farmers perceive their benefits, affordability, ease of implementation, and compatibility with existing farming systems. Farmers who perceive CSA practices as beneficial and receive adequate extension support, training, and information are more likely to adopt them, thereby improving agricultural productivity, resilience to climate change, and household food security.

The Diffusion of Innovations Theory is therefore appropriate for this study because it explains the process through which rural farmers become aware of, evaluate, adopt, and utilize climate-smart agricultural practices. It also provides a useful framework for understanding how the adoption of these innovations contributes to improved food security among rural farming households in Nasarawa State.

## Methodology

The study was conducted in Nasarawa State, Nigeria, comprising 13 Local Government Areas (LGAs), where agriculture is the dominant livelihood activity. A mixed-methods descriptive survey design was adopted. The target population comprised the estimated 2,886,274 inhabitants of Nasarawa State based on the National Population Commission (NPC) 2022 population projection, from which rural farming households constituted the study respondents. Using the Krejcie and Morgan (1970) sample size determination table, a sample size of 384 rural farming households was selected. In addition, agricultural extension officers and community leaders were purposively selected as key informants based on their knowledge and experience in climate-smart agriculture. A multistage sampling technique was employed, involving the random selection of rural communities across the State, followed by the simple random selection of farming households. Primary data were collected through structured questionnaires and Key Informant Interviews (KIIs), while secondary data were obtained from journal articles, FAO reports, and government publications. Quantitative data were analyzed using frequency tables and percentages and presented with bar charts, whereas interview responses were transcribed verbatim, interpreted, and integrated with the quantitative findings to provide a comprehensive understanding of climate-smart agriculture and food security among rural farmers in Nasarawa State.

## Data Presentation and Analysis

**Table 1: Questionnaire Administration**

| Questionnaire | Frequency | Percentage (%) |
|---|---|---|
| Administered | 384 | 100 (%) |
| Retrieved | 372 | 97 (%) |
| Not Retrieved | 12 | 3 (%) |
| **Total** | **384** | **100 (%)** |

A total of 384 questionnaires were administered to rural farming households across Nasarawa State. Of these, 372 questionnaires (97%) were successfully retrieved and found suitable for analysis, while 12 questionnaires (3%) were either incomplete or not returned.

**Table 2: Extent of Adoption of Climate-Smart Agricultural Practices among Rural Farmers in Nasarawa State (n = 372)**

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| Climate-Smart Agricultural Practice | Adopted | Percentage (%) | Not Adopted | Percentage (%) | Total |
|---|---|---|---|---|---|
| Crop Diversification | 316 | 85 (%) | 56 | 15 (%) | 372 |
| Improved Seed Varieties | 298 | 80 (%) | 74 | 20 (%) | 372 |
| Agroforestry | 276 | 74 (%) | 96 | 26 (%) | 372 |
| Mulching | 249 | 67 (%) | 123 | 33 (%) | 372 |
| Crop Rotation | 285 | 77 (%) | 87 | 23 (%) | 372 |
| Organic Manure Application | 304 | 82 (%) | 68 | 18 (%) | 372 |
| Conservation Tillage | 214 | 58 (%) | 158 | 42 (%) | 372 |
| Rainwater Harvesting | 163 | 44 (%) | 209 | 56 (%) | 372 |
| Climate Information Services | 120 | 32 (%) | 252 | 68 (%) | 372 |

Table 2 presents the extent of adoption of climate-smart agricultural (CSA) practices among rural farmers in Nasarawa State. The findings reveal varying levels of adoption across the different CSA practices. Crop diversification recorded the highest level of adoption, with 316 respondents (85%) indicating that they practiced it, while 56 respondents (15%) had not adopted the practice. Similarly**,** organic manure application was widely adopted by 304 respondents (82%)**,** followed by the use of improved seed varieties, adopted by 298 respondents (80%)**.** This suggests that farmers largely prefer low-cost and readily accessible practices that improve soil fertility, enhance crop productivity, and reduce the risks associated with climate variability. The findings further show that crop rotation was adopted by 285 respondents (77%)**,** while agroforestry was practiced by 276 respondents (74%)**.** Likewise, mulching recorded a relatively high adoption rate, with 249 respondents (67%) adopting the practice compared to 123 respondents (33%) who had not. These results indicate that a substantial proportion of rural farmers recognize the importance of sustainable land management practices in enhancing agricultural productivity and adapting to climate variability. Conversely, conservation tillage recorded a moderate adoption level, with 214 respondents (58%) adopting the practice, while 158 respondents (42%) had not. The relatively moderate adoption suggests that some farmers may face challenges such as inadequate technical knowledge, limited access to appropriate equipment, or insufficient extension support. The least adopted climate-smart agricultural practices were rainwater harvesting and climate information services**.** Only 163 respondents (44%) reported adopting rainwater harvesting, whereas 209 respondents (56%) had not. Similarly, climate information services recorded the lowest adoption level, with only 120 respondents (32%) utilizing weather and climate advisory information, while 252 respondents (68%) had not adopted the practice. The low adoption of these practices may be attributed to inadequate access to reliable weather information, poor dissemination of climate advisory services, limited infrastructure, and financial constraints. Overall, the findings indicate that rural farmers in Nasarawa State have embraced relatively simple and affordable climate-smart agricultural practices, whereas the adoption of information- and technology-based practices remains comparatively low.

The result are consistent with those of Gabriel et al. (2023)**,** who reported that crop diversification, improved seed varieties, agroforestry, and conservation agriculture were among the most commonly adopted climate-smart agricultural practices by farmers in North Central and Northwest Nigeria. Their study further established that farmers tend to adopt practices that are cost-effective, easy to implement, and capable of improving productivity under changing climatic conditions.

The findings reflect what we observe during our field visits across rural communities in Nasarawa State. Most farmers have readily adopted climate-smart practices such as crop diversification, improved seed varieties, organic manure application, crop rotation, and agroforestry because they are affordable, easy to implement, and farmers can quickly see improvements in crop yields. However, the adoption of rainwater harvesting and climate information services remains relatively low. Many rural farmers lack access to weather forecast information, while the cost of constructing water harvesting facilities and limited awareness continue to discourage their adoption. Strengthening extension

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services, improving access to climate information, and providing government support will encourage more farmers to adopt these important climate-smart technologies" *(KII/Female/40/EA/Oct./2026).* This interview complements the findings in Table 2**,** particularly the high adoption of crop diversification (85%)**,** organic manure application (82%)**,** and improved seed varieties (80%), as well as the relatively low adoption of rainwater harvesting (44%) and climate information services (32%)**.** It provides practical explanations for the observed adoption patterns from the perspective of an extension professional.

**Figure 1: Percentage of rural farmers in Nasarawa State who adopted each climate-smart agricultural practice Based on responses from 372 rural farmers in Nasarawa State (n = 372).**

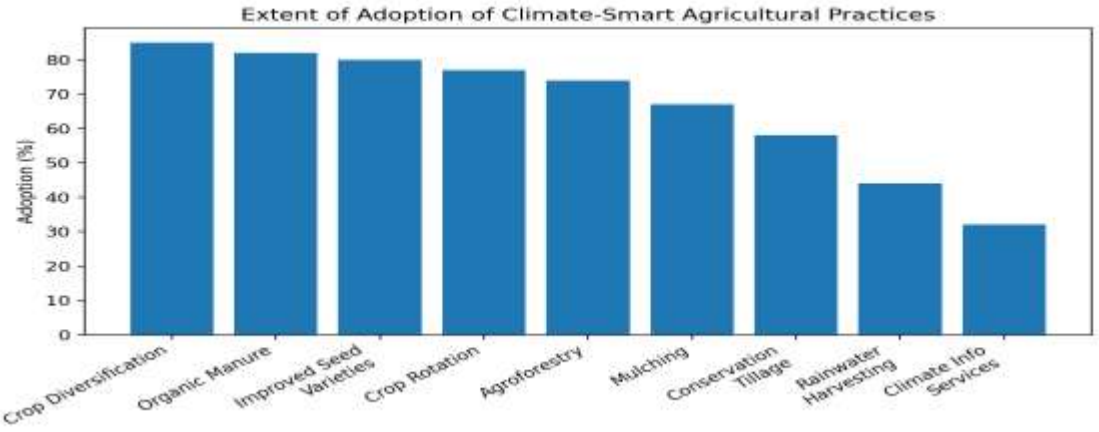


**Table 3: Influence of Climate-Smart Agricultural Practices on Household Food Security among Rural Farmers in Nasarawa State (n = 372)**

| Statement | Yes | Percentage (%) | No | Percentage (%) | Total |
|---|---|---|---|---|---|
| CSA increased crop yield | 309 | 83 (%) | 63 | 17 **(%)** | 372 |
| CSA improved household income | 287 | 77 (%) | 85 | 23 (%) | 372 |
| CSA improved food availability | 315 | 85 (%) | 57 | 15 (%) | 372 |
| CSA reduced food shortages | 281 | 75 (%) | 91 | 25 (%) | 372 |
| CSA improved dietary diversity | 274 | 74 (%) | 98 | 26 (%) | 372 |
| CSA strengthened resilience to climate change | 321 | 86 (%) | 51 | 14 (%) | 372 |

Table 3 presents the influence of climate-smart agricultural (CSA) practices on household food security among rural farmers in Nasarawa State. The findings indicate that the majority of the respondents acknowledged the positive contribution of climate-smart agricultural practices to various dimensions of household food security. Specifically, 321 respondents (86%) agreed that CSA practices have strengthened their resilience to climate change, while only 51 respondents (14%) disagreed. Similarly**,** 315 respondents (85%) indicated that CSA practices have improved household food availability, compared to 57 respondents (15%) who reported otherwise. This suggests that the adoption of climate-smart agricultural practices has enhanced farmers' ability to sustain food production despite the challenges posed by climate variability. The results further reveal that 309 respondents (83%) agreed that climate-smart agricultural practices have increased crop yields, while 63 respondents (17%) disagreed. Likewise, 287 respondents (77%) reported that CSA practices have improved their household income, whereas 85 respondents (23%) indicated otherwise. The increase in crop productivity and household income implies that climate-smart agricultural practices contribute significantly to improving the economic well-being of rural farming households. Furthermore, 281 respondents (75%) agreed that the adoption of climate-smart agricultural practices has reduced household food shortages, while 91 respondents (25%) disagreed. Similarly, 274 respondents (74%) indicated that CSA practices have improved household dietary diversity, whereas 98 respondents (26%) did not share this view. These findings demonstrate that climate-smart agricultural practices

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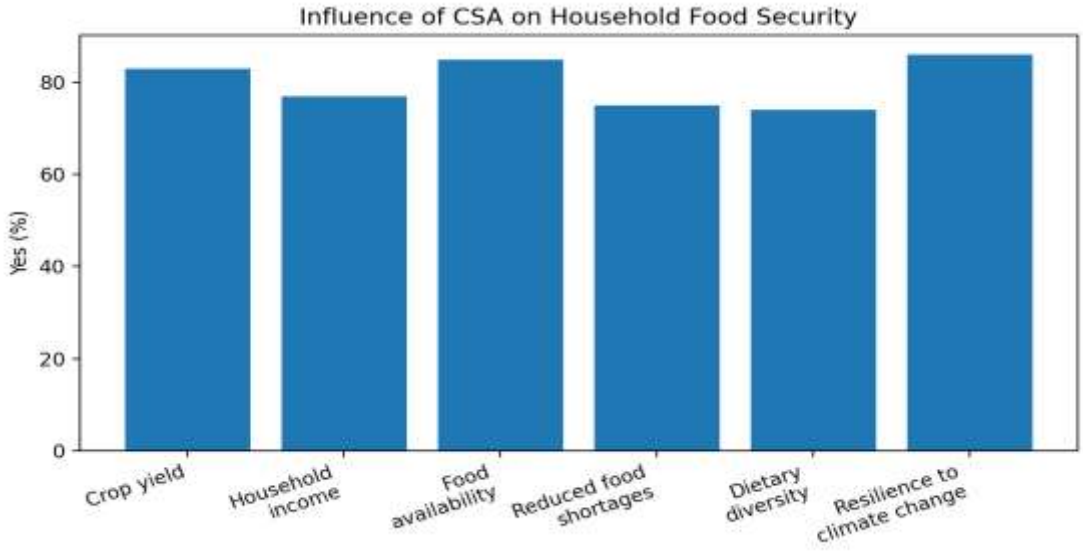
not only enhance agricultural productivity but also improve access to a wider variety of nutritious foods, thereby contributing to better household food security. Overall, the findings indicate that climate-smart agricultural practices have made substantial contributions to household food security among rural farmers in Nasarawa State through increased crop yields, improved household income, enhanced food availability, reduced food shortages, improved dietary diversity, and strengthened resilience to climate change.

The findings are consistent with the study of Omotoso and Omotayo (2025)**,** who found that households adopting climate-smart agricultural practices in Nigeria recorded significantly higher crop productivity, improved household income, better dietary diversity, and enhanced food security than non-adopting households. The authors concluded that climate-smart agriculture plays a critical role in strengthening the resilience of rural households to climate change while improving sustainable food production and household welfare. The present study reinforces this conclusion by demonstrating that the widespread adoption of climate-smart agricultural practices among rural farmers in Nasarawa State has positively influenced multiple dimensions of household food security, particularly food availability, crop productivity, income generation, and resilience to climate-related shocks.

**Figure 2: Influence of Climate-Smart Agricultural Practices on Household Food Security Based on 372 rural farmers in Nasarawa State.**




From my experience working with farmers across different communities in Nasarawa State, those who have adopted climate-smart agricultural practices such as improved seed varieties, crop rotation, organic manure application, and agroforestry are harvesting better yields than before. These practices have helped farmers cope with irregular rainfall and declining soil fertility. Consequently, many households now have more food available throughout the year and are able to generate additional income from the sale of surplus produce. "

(KII/Male/33/EA/Nov./2026).

"In our community, farming has become more difficult because of changes in rainfall patterns. However, farmers who practice crop diversification, use improved seeds, and apply organic manure have continued to produce enough food for their families despite these challenges. Compared to previous years, fewer households experience food shortages during the dry season, and many families now cultivate different crops, which has improved the variety of food they consume." (KII/Male/53/TL/Oct./2026).

The views expressed by both the agricultural extension officer and the traditional leader corroborate the quantitative findings presented in Table 3. They affirm that climate-smart agricultural practices have contributed to increased crop yields, improved household income, enhanced food availability, reduced food shortages, greater dietary diversity, and strengthened farmers' resilience to climate variability.

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These qualitative insights provide further evidence that the adoption of climate-smart agriculture is an effective strategy for improving household food security among rural farmers in Nasarawa State.

## Findings

i. The study found that the adoption of climate-smart agricultural (CSA) practices among rural farmers in Nasarawa State is generally high, although the level of adoption varies across different practices. The findings revealed that crop diversification **(**85%**)**, organic manure application **(**82%**)**, improved seed varieties **(**80%**)**, crop rotation **(**77%**),** and agroforestry **(**74%**)** were the most widely adopted climate-smart agricultural practices. In contrast, conservation tillage **(**58%**),** rainwater harvesting **(**44%**)**, and climate information services **(**32%**)** recorded relatively lower adoption rates. This indicates that farmers are more willing to adopt climate-smart practices that are affordable, compatible with their existing farming systems, and capable of delivering immediate improvements in productivity. The Key Informant Interview with the Agricultural Extension Agent further confirmed that the low adoption of climate information services and rainwater harvesting is largely due to inadequate extension support, poor access to weather information, financial constraints, and limited awareness among rural farmers. These findings are consistent with Gabriel et al. (2023) and Ume et al. (2024)**,** who reported that access to extension services and institutional support significantly influences the adoption of climate-smart agricultural technologies. The findings also support the Diffusion of Innovations (DOI) Theory (Rogers, 2003), which explains that innovations perceived as beneficial, simple, and compatible with existing practices are more readily adopted than those requiring higher technical skills or financial investment.

ii. The study further found that climate-smart agricultural practices have significantly improved household food security among rural farmers in Nasarawa State. The results showed that 86% of the respondents agreed that CSA practices strengthened their resilience to climate change, 85% reported improved household food availability, 83% experienced increased crop yields, 77% reported higher household income, 75% observed reduced food shortages, and 74% indicated improved dietary diversity. These findings demonstrate that climate-smart agriculture contributes substantially to agricultural productivity, household income, food availability, nutrition, and resilience against climate-related shocks. The Key Informant Interviews with the Agricultural Extension Agent and the Traditional Leader further corroborated these findings, noting that farmers who adopted crop diversification, improved seed varieties, agroforestry, crop rotation, and organic manure application consistently recorded better harvests, generated higher incomes, and experienced fewer food shortages despite changing climatic conditions. These findings agree with Omotoso and Omotayo (2025) and Sylvester et al. (2024)**,** who found that climate-smart agricultural practices significantly enhance household food security through improved productivity, income, dietary diversity, and resilience. The findings equally validate the Diffusion of Innovations (DOI) Theory by demonstrating that the successful adoption of agricultural innovations results in improved livelihoods and sustainable food security among rural farming households. Overall, the study establishes that expanding access to climate-smart agricultural technologies, strengthening extension services, and improving climate information delivery are critical for enhancing food security and promoting sustainable agricultural development in Nasarawa State.

## Conclusion

The study concludes that climate-smart agriculture plays a significant role in enhancing food security among rural farmers in Nasarawa State by promoting sustainable agricultural production and strengthening resilience to climate change. The widespread adoption of practices such as crop diversification, improved seed varieties, organic manure application, crop rotation, and agroforestry has contributed to increased crop yields, improved household income, enhanced food availability, reduced food shortages, and improved dietary diversity. However, the relatively low adoption of rainwater harvesting and climate information services highlights the need for improved access to climate information, strengthened extension services, and greater institutional support. Overall, the findings demonstrate that expanding the adoption of climate-smart agricultural practices is essential for improving rural livelihoods, building resilient farming systems, and achieving sustainable food security in Nasarawa State.

**Recommendations**

i. The Nasarawa State Agricultural Development Program (NADP), in collaboration with the State Ministry of Agriculture and agricultural extension agencies, should support rural farmers to expand the adoption of climate smart agricultural practices such as crop diversification, improved seed varieties, agroforestry, organic manure application, and crop rotation through regular extension training, farmer field schools, and demonstration farms. This will enhance farmers' knowledge and technical skills, promote the widespread adoption of climate-smart technologies, and improve agricultural productivity and household food security.

ii. The Nasarawa State Government, through the Nasarawa State Agricultural Development Program (NADP), the Nigerian Meteorological Agency (NiMet), and other relevant stakeholders, should provide farmers with timely climate information and affordable climate smart technologies, including weather advisory services, rainwater harvesting facilities, and drought resilient crop varieties. This will strengthen farmers' decision-making, improve their capacity to adapt to climate variability, enhance resilience, and ensure sustainable food production and food security among rural households.

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