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RESEARCH ARTICLE

Climate Change among Yam and Cassava Farmers in Anambra State, Nigeria: Adaptation for Sustainable Agricultural Yield and Food Security Index

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ABSTRACT

This study assessed the impact of climate change on yam and cassava production in Anambra State, Nigeria, and examined farmers' adaptation strategies for sustainable yield and food security. Specifically, the objectives were to examine farmers' perceived causes of climate change, identify its effects on yam and cassava production, determine the adaptation strategies adopted, and identify constraints to effective adaptation. A multistage sampling procedure was used to select 120 farmers from four local government areas. Data were collected using structured questionnaires and analyzed using percentages and mean scores. The findings showed that flooding and excessive rainfall were the major perceived climate-related challenges. The most serious effects included rotting of root and tuber crops, reduced yields, increased food insecurity, and declining market value. Major adaptation strategies adopted were the use of early maturing varieties, adjustment of planting and harvesting dates, livelihood diversification, and cultivation on ridges and mounds. However, adoption of advanced measures, such as reliance on weather forecasts, planting drought-resistant crops, application of minimum tillage, and planting trees, was low due to inadequate climate information, expensive improved varieties, and weak early warning systems. The study recommends strengthening extension services and climate education, improving dissemination of timely weather information, subsidizing improved and flood-tolerant varieties, promoting affordable community-based irrigation, providing access to agricultural credit, and implementing effective flood control and climate-smart agricultural policies.

Key words: Adaptation strategies, climate change, flooding, food security, yam and cassava

INTRODUCTION

Climate change is one of the most significant environmental hazards to the entire world's population, which has a relevant impact on agriculture and allied sectors. Changes in the most significant climate parameters of rainfall and temperature might have an adverse impact on crop yields. However, catastrophic occurrences such as storms, floods, and droughts are becoming more frequent and variable due to climate change (Samiappan *et al.*, 2025). Moreover, climate change is very likely to affect food security at the global, regional, and local levels by disrupting food availability, accessibility, and affordability.

Climate change and extreme events are a major concern for agriculture as crop production and output exhibit a high degree of variability due to changes in temperature and rainfall. Agricultural productivity is largely determined by climate, and climate variability in rainfall and temperature is believed to affect global crop production and yields. Temperature and rainfall are becoming more varied on a daily basis as projections indicate that the trend

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would continue if proper care were not taken to caution the effect.

In some cases, flooding may result from spillover effects, as observed during recent flood events in Nigeria (Benue, Edo, Kogi, Anambra, Delta, Bayelsa, Taraba, and Rivers States). These floods were caused by a combination of torrential rainfall and the sudden release of water from dams in Cameroon, with the impacts further intensified by Nigeria's north-to-south elevation gradient, where the northern region lies at a higher elevation than the southern region (Udemezue, 2017). This makes the country a sloping geomorphic entity with most of its hydrological resources trickling down toward the South from the North. This orientation should be expected to affect how climate change events impact the country, particularly heavy rainfall and flooding in the North, which may find their way into the rivers Niger and Benue, with possible spillover effects on the surrounding lands bordering the two rivers. This horror was seen in the 2012 and 2022 flooding of over 19 states in Nigeria, with the destruction of properties and crops, cutting off roads, and wiping out farmland (Udemezue *et al*., 2023).

Yam and cassava yields in Anambra State are already experiencing gigantic pressure from weather and climate variability. Rural farmers have poor knowledge regarding weather variability because of climate change, as well as its adaptation (Ekemini *et al*., 2019; Giweze *et al*., 2025). Local knowledge of climate change causes and adaptation should be made available through all forms of media, such as outreach visits, field tours, radio, television, newspapers, magazines, seminars, workshops, and handbooks, to facilitate sustainable and equitable agricultural development and productivity among rural farm families in Anambra State, Nigeria (Anabaraonye *et al*., 2019). Climate change adaptation, therefore, means actions that reduce the vulnerability to actual or expected impacts of climate change, such as extreme weather/hazards, loss of biodiversity, food and water scarcity, and sea-level rise (Giweze *et al*., 2025).

Climate change adaptation is a broad set of actions to minimize vulnerability to the impacts of climate change. Adaptation measures have been found to reduce the impacts of climate change on crop production, and these include farming of alternative crops, intercropping with other types of crops, crop insurance, water harvesting techniques, early warning systems, monitoring systems, human migration, changing planting times, diversification in and out of agriculture, reliance on safety nets and social networks, and sale of assets (Giweze *et al*., 2025).

Intercropping of yam and cassava in Anambra State is a key climate change adaptation strategy, boosting resilience by diversifying income, improving soil health (through mulching/cover), and increasing overall yield compared to monocultures (Udemezue, 2017). To reduce the impacts of climate change on crop production and agricultural productivity, adopting and implementing different adaptation measures is pertinent, and such adaptation measures include: using traditional ecological knowledge, irrigation activities, water harvesting, strong policy support, use of advanced technology, strong institutional framework, use of available opportunities, and the introduction of stress-tolerant varieties of crops.

Ogbonna (2019) asserted that mulching as it conserves water, altering date of planting, planting early-maturing crops, irrigation, intensification in frequency of weeding, early/punctual harvesting, minimum tillage, diversification of sources of income, efficient conservation of seed, farm shifting/rotation, conservation of water channels as drainage system of water, planting pest-and diseases-resistant crops, planting drought- and heat-resistant crop varieties, conservation of soil moisture through efficient tillage operations are adaptation measures taken by arable crop farmers to reduce the impacts of climate change on agricultural production.

Intercropping of yam and cassava holds significant agricultural and economic importance because of climate change. The intercropping farming system is a vital component of food security and agricultural livelihoods in Nigeria, and the integration of climate-smart techniques is also essential for mitigating the impacts of climate change on agricultural productivity (Zainab *et al*., 2023). The effectiveness of the intercropping system in disseminating climate-smart agricultural practices, especially yam and cassava production, remains a critical area for investigation and improvement of food security in Nigeria. Adoption of climate-smart agricultural techniques is crucial for sustainable

food production, particularly in regions that are vulnerable to climate change impacts.

In Anambra State, climate change has caused severe flooding and erosion, rise of sea level, seasonal temperature changes, more intensive and frequent storms, more heat waves, irregular rainfall pattern, extreme floods, extreme weather conditions, and drought, thus, causing low agricultural output, hunger and poverty as many farms are washed away or waterlogged as well as other extreme events which influence farming activities. It causes food shortages and a reduction in supply, especially yam and cassava in Anambra State. Specifically, Anambra East and West, Ayamelum, and Ogbaru local government areas are riverside areas that are always prone to excessive flooding. However, because of the effects of climate change on agriculture, farmers in the areas have adopted different strategies for climate change (Udemezue, 2017). Therefore, the broad objective of the study was to assess climate change among yam and cassava farmers in Anambra state, Nigeria: adaptation for sustainable agricultural yield and food security index while the objectives of the study were to: Examine the causes of climate change by yam and cassava farmers, identify the effects of climate change to yam and cassava farming, estimate the adaptation strategies used by the farmers and identify the constraints to climate change adaptation by yam farmers in the study area.

METHODOLOGY

The study area for this research is Anambra State. The State is located in the Southeast of Nigeria. It is bounded by Delta State to the West, Imo State to the South, Enugu State to the East, and Kogi State to the North. The State lies on the longitude 60 35E and 7E and latitude of 50 38N and 60 47E (Udemezue *et al*., 2024). The target population for this study was yam and cassava farmers in the State. A multistage sampling design that involved random and purposive procedures was used for the study. Four local governments out of 21 local governments in Anambra State were selected due to their perceived effect on climate change occurrences. Ayamelum, Anambra East, Anambra West, and Ogbaru local governments were selected for the study.

In the second stage, two communities, each from a local government, were selected. In the last stage, 30 farmers were selected from each community using simple random techniques, and this gave a total sample size of 120 respondents. Data were collected using structured questionnaires. Data collected for the research were analyzed using statistical tools such as percentages and mean scores.

RESULTS AND DISCUSSIONS

The findings in Table 1 show that 56.7% of the respondents were male, whereas 46.7% were female, indicating that yam and cassava production in Anambra State involves both genders, though male farmers slightly dominate. In terms of age distribution, 37.2% of the farmers were between 51 and 60 years, followed by 27.5% within 20–30 years. This suggests that most farmers are middle-aged to elderly, which may affect the adoption of modern adaptation technologies due to risk aversion or limited physical strength. Marital status revealed that 65.8% were married, implying household responsibilities that may influence production decisions and risk management strategies. Educational level showed that 41.6% attained secondary education, 29.2% had primary education, while 25.8% had no formal education. The relatively moderate literacy level suggests some

Table 1: Socioeconomic characteristics of yam and cassava farmers in Anambra State

Variables	Frequency	Percentage	Mean
Sex			
Male	68	56.7	
Female	56	46.7	
Age			
20–30 years	33	27.5	
31–40 years	14	13.4	41 years
41–50 years	26	21.7	
51–60 years	45	37.2	
Marital status			
Single	14	11.7	
Married	79	65.8	
Windowed	4	3.3	
Divorced	23	19.2	
Educational level			
Non	31	25.8	
Primary school	35	29.2	
Secondary school	50	41.6	
Tertiary institution	4	3.3	

Source: Field work, 2025

capacity to understand climate information, though extension delivery must be simplified and practical. This finding contradicts Falola and Achem (2017), who state that rural farmers were characterized by a low level of literacy [Tables 2-5].[1-9]

Perceived Causes of Climate Change

Farmers identified excessive use of agrochemicals (mean = 3.23) as the most significant cause of climate change effects in the area, ranking 1st. Excessive rainfall (mean = 3.11) was followed closely. Interestingly, global-scale drivers, such as ozone layer depletion, fossil fuel burning, and crude oil spillage, were ranked low. This indicates that farmers perceive climate change mainly through local environmental experiences, especially excessive use of agrochemicals and rainfall variability. The dominance of excessive use of agrochemicals and excessive rainfall perception aligns with earlier findings by Udemezue (2017), who reported that river-side communities in Anambra State are highly vulnerable to seasonal floods.

Table 2: Causes of climate change among yam and cassava farmers in Anambra State

Causes	Mean	SD	Ranking
Excessive use of agrochemicals	3.23	1.28	1st
Continuous cropping	2.49	1.39	2nd
Depletion of the ozone layer	1.23	1.43	3rd
Overgrazing	1.59	1.39	4th
Crude oil spillage	1.38	1.47	5th
Burning of fossil fuel (industries)	1.30	1,20	6th
Burning of waste	1.27	1,01	7th
Bush burning	1.11	1.14	8th

Source: Field work, 2025

In terms of the effects of climate change on yam and cassava production

The results reveal that farmers consider several impacts as very serious: Rotting of root and tuber crops (mean = 3.5), crop failure and decreased yields (mean = 3.6), food insecurity increase (mean = 3.6), and reduction in market value (mean = 3.2 range). Flood-induced waterlogging contributes heavily to root rot in yam and cassava, thereby reducing both yield and tuber quality. Increased insect infestation (mean = 3.3) and soil salinity (mean = 2.6) were also reported as serious concerns. These findings support global climate-agriculture linkages discussed by Samiappan *et al*. (2025), who emphasized that climate variability significantly reduces agricultural productivity in vulnerable regions. The implication is pervasive, indicating that climate change threatens not only farm output but also rural livelihoods and food security in Anambra State.

Adaptation strategies adopted by farmers

The most adopted strategies include: Use of early maturity crop varieties (mean = 2.76), adjustment of planting/harvesting dates (mean = 2.64), livelihood diversification (mean = 2.56), planting on mounds and ridges (mean = 2.50), and use of multiple cropping (M = 2.41). Planting on mounds and ridges is particularly important in flood-prone communities, as it reduces waterlogging and root rot. However, strategies such as reliance on weather forecast (mean = 1.85), minimum tillage (mean = 1.33), planting of trees (M = 1.23), and moderate application of agrochemicals (M = 1.02) recorded low adoption. This suggests limited access to climate information and modern agricultural technologies. This result agrees with Udemezue *et*

Table 3: Effects of climate change on yam and cassava crops among farmers

Variables	VS (4)	S (3)	SS (2)	NS (1)	Total	Waited mean	Remark
Increase in waterlogging	45 (180)	0 (0)	42 (84)	33 (33)	255	2.1	SS
Enhancing soil salinity	50 (200)	13 (39)	20 (40)	37 (37)	316	2.6	S
Lead to crop failure/decrease in yields	86 (344)	24 (72)	10 (20)	0 (0)	436	3.6	VS
Increases insects infestation	64 (256)	22 (66)	20 (40)	14 (14)	376	3.1	S
Food insecurity increases	87 (348)	25 (75)	6 (12)	2 (2)	437	3.6	VS
Loss of lives and properties	60 (240)	33 (99)	23 (46)	4 (4)	389	3.2	S
Rotting of root and tuber crops	88 (352)	15 (45)	10 (20)	7 (7)	424	3.5	VS
Reducing the market value of the crops	67 (268)	30 (90)	0 (0)	23 (23)	381	3.2	S

Decision rules: 0.1–1.49=NS, 1.5–2.49=SS, 2.5–3.49=S, 3.5–4=VS. NS: Not serious, SS: Slightly serious, Serious=, VS: Very serious

Table 4: Adaptations to climate change among yam and cassava farmers in the study area

Variables	Mean
Using early maturity crop varieties	2.76
Adjustment of planting/harvesting date	2.64
Livelihood diversification	2.56
Planting on mounds and ridges	2.50
Shifting from high flooding areas to the lesser one	2.44
Use of multiple cropping	2.41
Planting drought-resistant crops	1.99
Reliance on the weather forecast and information	1.85
Application of minimum tillage	1.33
Planting trees	1.23
Moderate use of agrochemical	1.02

Source: Field work, 2025

Table 5: Constraints to adaptations to climate change among yam and cassava farmers in the study area

Constraints	Mean
Inadequate climate change information	2.50
High cost of improved crop varieties	2.21
Poor information delivery on early weather warnings from NIMET	2.19
Poor government policy	2.09
Shortage of farm land	1.69
Shortage of laborers	1.33
Limited financial resources	1.20
Inadequate extension services	1.09

Source: Field work, 2025

al. (2023) that shifting from high flooding areas to the less affected ones, planting on mounds and ridges, and practicing planting early-maturity crops were adopted by the farmers as the best option for managing climate change in their previous studies.

Constraints to adaptation

The major constraints identified include: Inadequate climate change information (mean = 2.50), high cost of improved varieties (mean = 2.21), and poor early warning information from NIMET (mean = 2.19). These findings highlight institutional and financial barriers limiting effective adaptation. Without reliable climate forecasts and affordable technologies, farmers remain highly vulnerable.

CONCLUSION

The study established that climate change, particularly flooding and excessive rainfall, significantly affects yam and cassava production in Anambra State. The major consequences include crop failure, rotting of tubers, food insecurity, poverty, and reduced market value of produce. Although farmers adopt coping strategies such as early planting, use of early maturing varieties, and ridge/mound cultivation, adoption of advanced adaptation measures such as weather forecasting and minimum tillage remains low due to financial and informational constraints. Climate change, therefore, poses a serious threat to sustainable agricultural production and rural livelihoods in the study area.

RECOMMENDATIONS

Strengthening Extension Services

Government and agricultural agencies should intensify climate education programs through radio, workshops, and community outreach to improve farmers' understanding of adaptation options.

Improved Climate Information Delivery

Early warning systems and seasonal weather forecasts should be simplified and disseminated effectively to rural farmers.

Subsidy on Improved Varieties

The government should subsidize flood-tolerant and early-maturing yam and cassava varieties to encourage adoption.

Access to Credit Facilities

The provision of soft loans and agricultural credit schemes will enable farmers to invest in adaptive technologies.

Infrastructure for Flood Control

Construction of drainage systems and embankments in flood-prone areas of Anambra East and West will reduce farm losses.

Policy Support and Institutional Strengthening

Climate-smart agricultural policies should be implemented to enhance resilience and ensure food security.

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