



## **YAM FARMERS ADAPTATION STRATEGIES IN MITIGATING THE EFFECTS OF CLIMATE CHANGE ON YAM PRODUCTION IN PLATEAU STATE, NIGERIA**

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### **ABSTRACT**

The study examined Yam Farmers Adaptation Strategies used in Mitigating the Effects of Climate Change on Yam Production in Plateau State, Nigeria. The specific objectives of the study were to describe the socio-economic characteristics of yam farmers' sources of information on the effects of climate change adaptation strategies used by yam farmers in mitigating the effects of climate change and the constraints to yam farmers in the adaptation strategies to mitigate the effects of climate change in the study area. Multi-stage sampling techniques were employed in selecting 321 respondents. Primary data were obtained through the administration of structured questionnaire and analyzed using descriptive statistic. The findings revealed that majority (72.4% and 68.3%) of the respondents were male and married, with a mean age and household size of 43 years and 10 persons respectively. In terms of education, 58.6% had formal education (primary, secondary or tertiary). The mean farming experience and farm size of 14 years and mean was 2.1ha. The findings further revealed that farmers relied heavily on informal information sources such as Personal experience ranked 1<sup>st</sup> (96.8%), followed by markets (94.9%), fellow farmers (92.7%), and village/market meetings (89.2%). In addition, the results revealed that adaptation strategies used by the respondents were improved yam seed varieties (0.94), changing planting dates (0.90), planting cover crops (0.86), planting trees (0.84), and mulching (0.80). The constraints to the use of mitigating strategies included inefficiency of information sources with mean score of 2.8, high cost of irrigation facilities (2.8), high cost of inputs (2.8), inadequate drought-resistant varieties (2.8), inadequate extension services (2.7), and inadequate government support (2.7). The study concluded that yam farmers in the study area used improved yam seed varieties, changing planting dates, and mulching as an adaptation strategy to the effects of climate change on yam production in the study area. In view of the constraints highlighted the study recommended that socio-economic status of the yam farmers should be enhanced to enable them afford and adopt proven technologies that would mitigate climate change and Extension agents who are supposed to be in close contact with yam farmers should be trained on weather forecasts interpretation so as to disseminate the needed information to their contact farmers.

**Keywords:** Climate Change, Adaptation, Strategies, Mitigation, Yam farmers.

### **INTRODUCTION**

Climate change is a major global challenge to agricultural production, food security and the livelihood of the people particularly the changing rain pattern and high temperature in Nigeria posing a great threat to yam production. Adaptation to climate change is the anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage they can cause, or taking advantage of opportunities that may arise. Climate change is evident in an increase of diseases and pests, extreme climatic events such as flooding, extreme heat, and drought has led to soil degradation thereby declining agricultural production and migration of farmers from rural to urban regions thereby affecting development of rural regions in the country (Botai and Mabhaudhi, 2021). Nigeria's climate has been changing and this is evident in the increase in temperature; variable rainfall; rise in sea level and flooding; drought and desertification; land degradation and many more frequent extreme weather events. Human infrastructure is also threatened by changing in climate, with evidence



of encroachment of coastlines, stress to the energy grid, decreased hydroelectric power supply and shifting structures or landscapes, loss of shelter, roads, and farmlands due to erosion in some parts of Nigeria has reached a point where this calls for urgent actions, (Oladipo, 2022).

Droughts have also become a constant in Nigeria, and are expected to continue in Northern Nigeria, Lake Chad and other lakes in the country are drying up and at risk of disappearing. Temperature has risen significantly since the 1980s. Climate projections for the coming decades reveal a significant increase in temperature over all the ecological zones (Haider, 2022). Nigeria ranks as the leading producer of white yams in the world, accounting for 66% (approximately 50.1 million tons) of annual global production (FAO, 2021). There is no exact up-to-date statistical data for yam production in Plateau State, Nigeria, as official figures are often released annually or less frequently by government bodies like the National Bureau of Statistics (NBS). However, Plateau State is identified as a significant agricultural region known for producing various crops, including yam, alongside grains, vegetables, and other fruits. Farming in Nigeria is characterized by smallholder farmers, who typically practice subsistence farming. Yam farmers adapt to climate change by using strategies such as changing planting dates, using drought-resistant varieties, mulching, intercropping with other crops, applying fertilizers and organic manure, and employing cover cropping to improve soil health. Using practices such as multiple cropping, crop diversification with early-maturing or pest-resistant varieties and employing soil and water management techniques like mulching, cover cropping, and fertilizer application, though adoption levels vary. Therefore, understanding the impact of adaptation strategies on farmers, the extent of these interventions and the potential improvements to support local communities more effectively remains critical (Marie *et al.*, 2020).

In order to adapt to climate change, farmers need to perceive ongoing changes as serious enough to warrant adaptation to the observed changes. However, it is uncertain if Nigerian farmers will be able to adapt given the unusual rate at which climate change is expected to materialize in the future years (Altea, 2020). Fierros-González and Lopez-Feldman (2021) predict that producers who rely on rain-fed agriculture, those with restricted access to credit and insurance, and those without connections to local or national markets will probably be disproportionately impacted by these trends. The adoption of climate change adaptation strategies is influenced by multiple factors. Socioeconomic characteristics, such as age, education level, gender, farm income, and farm size, play a significant role (Marie *et al.*, 2020). In Nigeria, many farmers have resorted to diversifying into non-farm activities and adjusting their farming practices to accommodate the changing climatic. However, these strategies are often reactive and focus on short-term climate stressors rather than long-term resilience (Oyedijiet *et al.*, 2024). Despite several literature shows that more attention has been paid to climate change ecosystem modeling, climate change impacts, adaptation and risk assessment, but relatively little attention has been devoted to farmers' options for adaptation of yam farmers experiencing climate change. Climate calamities are posing serious challenges to smallholder yam farmers in Plateau state and Nigeria. Adapting to climate change is mostly location-specific, and its effectiveness depends on local institutions and socioeconomic setting. This research gap serves as motivation for my study to elucidate the responsive adaptation strategies of small-scale yam farmers to investigate the socioeconomic characteristics; sources of information, identify adaptation strategies employed and constraints faced by yam farmers in adaptation strategies to mitigate climate change in the study area.

The main objective of the study is to examine Yam Farmers Adaptation Strategies in Mitigating the Effects of Climate Change on Yam Production in Plateau State, Nigeria, while the specific objectives are to:

- i. describe the socio-economic characteristics of yam farmers in the study area;
- ii. identify yam farmers' sources of information on the effects of climate change;
- iii. adaptation strategies adopted by respondents to mitigate effect of climate change and
- iv. describe the level of constraints to the yam farmers in climate change used in adaptation strategies to mitigate the effects of climate change in the study area.



## **METHODOLOGY**

### **Description of the Study Area**

The study was carried out in Northern and South zones of Plateau State; Plateau State has 17 Local Government Areas which are divided into three agricultural zones, namely; Plateau North, Plateau Central and Plateau South. The State has a land mass of about 26,899km<sup>2</sup> of which more than 56% is land. (PLAGIS, 2020). It is located between Latitude 8<sup>o</sup> 24'N and 10<sup>o</sup> 38'N and Longitude 8<sup>o</sup> 32' and 10<sup>o</sup> 38' East, (PLAGIS, 2020). Plateau State is celebrated as "The Home of Peace and Tourism". The State had a population of 3,206,531 in 2006 population census but had a projected population of about five million four hundred thousand, nine hundred and four people (5,400,974), while the projected population of selected LGAs 1,336,900 at 2.4% annual population growth rate (NPC, 2006; NBS, 2024). Plateau State has a near temperate climate with an average temperature of between 18<sup>o</sup> and 22<sup>o</sup> C. Harmattan winds caused the coldest weather between December and February. The warmest temperatures usually occur in the dry season months of March and April. The mean annual rainfall varies from 131.75 cm (52 in) in the southern part to 146 cm (57 in) on the Plateau. The highest rainfall is recorded during the wet season months of July and August. Economic activities in Plateau State, primarily revolve around agriculture, particularly the cultivation of potatoes, yam, cassava, rice, maize, guinea corn, fruits, and vegetables like avocado pear, strawberries, cabbage, carrot, cucumber etc which engages a large percentage of the population. Livestock production on the Plateau include cattle breeding/fattening, sheep and goat, poultry (broilers & layers), quails turkey, piggery, but poultry production (broilers & layers) is ranked 1st as a predominant livestock activity followed by cattle production. (Investors' Guide, 2021).

### **Sampling Techniques and Sample Size**

Multi-stage Sampling Technique was employed in selecting the respondents for the study. The first stage was the purposive selection of two zones which are Southern and Northern zones in the state due to their prominence in yam production. The second stage involved the purposive selection of three (3) Local Government Areas (LGAs) from each zone. In the Southern zone, are Mikang, Qua'anpan and Shendam LGAs. The third stage involved purposive selection of two Districts from each of the LGAs due to their dominance in yam production which gave a total of 12 Districts. In the fourth stage, systematic sampling technique was used to select two yam farming communities from each of the district giving a total of 24 farming communities. The final stage, random sampling technique was used to select 15% of total number of yam farmers in each selected community (sampling frame) of the six LGAs. This gives a total number of 321 respondents in the study area.

### **Methods of Data Collection**

Data were collected from primary sources in the administration of structured questionnaire along with an interview schedule. The primary data collected were analyzed using descriptive statistics, such as frequency counts, percentage and mean score. The questionnaire was divided into section based on the specific objectives.

### **Methods of Data Analysis**

The data generated were analysed using descriptive statistics, mean score and standard deviation to achieve the objectives of the study. An analytical framework for a Likert scale involves using the scale to collect quantitative data on attitudes or opinions, then applying statistical models to interpret the results. The framework includes designing statements with symmetrical response options. A five-point Likert scale to determine the mean scores was used to achieve objective. That is, examine the constraints to yam farmers in the adaptation strategies to mitigate the effects of climate change. Likert scale of Strongly severe (5), severe (4), Undecided (3) Less severe (2) and Not severe (1). The mean score is  $5+4+3+2+1 = 15/4 = 3.0$  (threshold). Based on the weights assigned, a midpoint of 3.0 was obtained. The decision rule is that a mean score of 3.0 and above indicates agreement with the statement while a mean score of less than 3.0 posits disagreement with the statements of constraints. Inferential statistics such as Spearman correlation and Kruskal-Wallis tests were used to analyse the hypothesis of the study.



## **RESULTS AND DISCUSSION**

### **Socioeconomic Characteristics of the Respondents**

The result from Table 1 revealed socioeconomic characteristics of the respondents which provide a foundational understanding of the yam farming community and its capacity and vulnerability of yam farmers in study area to respond to climate change. These variables are essential in climate-change studies because they influence farmers' perception, sensitivity, and adaptive responses to environmental changes. Empirical evidence consistently shows that age, household size, farming experience, farm size, and income significantly determine farmers' awareness of climate change and their ability to respond effectively (Adeagboet *al.*, 2021; Olawatimilehin & Ayanlade, 2023).



**Table 1: Socioeconomic Characteristics of the Respondents (n=316)**

Variables	Frequency	Percentage (%)	Mean ± SD	[Min, Max]
Age (years)			43.07 ± 12.25	[19, 68]
<b>15–24</b>	17	5.4		
<b>25–34</b>	68	21.5		
<b>35–44</b>	74	23.4		
<b>45–54</b>	107	33.9		
<b>55–64</b>	28	8.8		
<b>65 and above</b>	22	7.0		
Farm size (ha)			6.35 ± 9.69	[1, 40]
<b>0–4.9</b>	248	78.5		
<b>5–9.9</b>	35	11.1		
<b>10–14.9</b>	4	1.3		
<b>30–34.9</b>	11	3.5		
<b>35 and above</b>	18	5.7		
Household size			10.38 ± 8.70	[1, 35]
<b>1–5</b>	100	31.6		
<b>6–10</b>	97	30.7		
<b>11–15</b>	31	9.8		
<b>16–20</b>	17	5.4		
<b>21–25</b>	43	13.6		
<b>26–30</b>	22	7.0		
<b>31 and above</b>	6	1.9		
Farming experience (years)			18.99 ± 9.63	[2, 35]
<b>0–4</b>	29	9.2		
<b>5–9</b>	31	9.8		
<b>10–14</b>	39	12.3		
<b>15–19</b>	38	12.0		
<b>20–24</b>	71	22.5		
<b>25–29</b>	33	10.4		
<b>30 and above</b>	75	23.7		
Sex				
<b>Male</b>	224	70.9		
<b>Female</b>	92	29.1		
Marital status				
<b>Single</b>	81	25.6		
<b>Married</b>	225	71.2		
<b>Divorced</b>	4	1.3		
<b>Widowed</b>	5	1.6		
<b>Widower</b>	1	0.3		
Educational level				
<b>No formal education</b>	1	0.3		
<b>Adult education</b>	1	0.3		
<b>Primary education</b>	117	37.0		
<b>Secondary education</b>	127	40.2		
<b>Tertiary education</b>	70	22.2		
Land acquisition				
<b>Inheritance</b>	212	67.1		
<b>Purchase</b>	77	24.4		
<b>Leasehold</b>	4	1.3		
<b>Gift</b>	23	6.8		

**Source:** Field Survey, 2025

The result from Table 1 revealed that the respondents which provide a foundational understanding of the yam farming community and its capacity to respond to climate change. The mean age of 43.07 years indicates that the respondents are largely in their economically active years. This is



a strong advantage for yam production because yam is labour-intensive and requires physical energy for land preparation, staking, weeding, harvesting, and post-harvest handling. At the same time, middle-aged farmers often have enough farming experience to recognize shifting rainfall patterns, drought spells, and rising heat stress. Studies have shown that age can influence both awareness and the intensity of adaptation, although the direction is not always uniform; younger farmers may be more open to innovation, while older farmers may rely more on accumulated local knowledge. Adeagbo *et al.* (2021) found age to be among the significant determinants of adaptation strategy adoption among smallholder farmers in southwest Nigeria, and Dyanty *et al.* (2025) also reported that age was part of the socioeconomic factors affecting adaptation decisions.

The results also revealed that majority (78.5) farm size is small respondents operating on less than 5 hectares with a mean farm size of 2.12 hectares. This pattern is typical of smallholder yam systems and has direct implications for adaptation. Small farms often make it harder to adopt capital-intensive practices such as irrigation, large-scale mechanization, or major drainage works, but they may also encourage closer farm management and quicker adjustment of planting time or crop combinations. Adeagbo *et al.* (2021) and Maiwashe Tagwi and Khoza (2024) both show that farm size is one of the factors associated with adaptation behavior, and the broader review by Manono *et al.* (2025) emphasizes that farm-scale characteristics are central to whether farmers can adopt climate-smart practices. This disagrees with the study of Akinola (2019), revealed that the average farm size of was 1.1 hectares. Small farm sizes, often a result of fragmented land inheritance systems, limit respondents' ability to generate surplus income for reinvestment in climate-smart technologies such as irrigation systems, drought-tolerant seed varieties, or soil conservation structures (Muyanga and Jayne, 2019). This characteristic of smallholder dominance is consistent with the structure of yam farming across West Africa, as reported by Andres *et al.* (2021), who noted that yam production is central to the livelihoods of millions of smallholder families, yet these respondents remain highly vulnerable to environmental and economic shocks. In the small farm structure suggests that low-cost adaptation options such as mulching, intercropping, improved seed, and changing planting dates are likely to be more feasible than high-cost technologies.

In addition, the results revealed that the respondents had a mean household size of 10 and maximum of 35 persons which is relatively large. This matters in two ways. First, a larger household can provide the family labor needed for labor-intensive yam production and can reduce the cost of hired labor. Second, large households also increase consumption pressure, meaning the farm must produce enough to support more dependents, which can make climate shocks more damaging. The literature shows that household size is often associated with adaptation because it affects both labor availability and financial pressure. Adeagbo *et al.* (2021) found household size to be one of the significant variables influencing adaptation among farmers in southwest Nigeria, and the yam study from Nasarawa also identified household size among the major factors influencing adaptation choices. The findings disagree with Akinola, (2019), study showed the average farming household size of yam farmers in the study area was five. In the context of climate change, this has a dual implication. On one hand, a large household provides a readily available labour force for labour-intensive adaptation practices like mulching, making ridges, and intensive weeding (Wuepper *et al.*, 2020). This complex role of household size is highlighted by Maggio and Sitko (2019) , who found that while family labour is critical, larger household size can also correlate with higher poverty levels, thereby constraining investment. A large household structure may therefore function as both a support and a constraint, depending on whether the household has enough productive labour and income. Furthermore, the results showed that respondents' annual income is low to moderate for most respondents farming households, with a mean of ₦579,265.82. This is important because income determines whether farmers can afford improved seed, fertilizer, labour, agrochemicals, transport, and irrigation-related costs. Low income often limits adaptation to low-cost options only, while higher income expands the range of strategies available. The modern literature consistently shows that farm income and access to financial resources influence climate adaptation. Adeagbo *et al.* (2024), identified yearly income as one of the major factors influencing yam farmers' adaptation choices, while Dyanty *et al.* (2025) and Maiwashe Tagwi and Khoza (2024), also show that socioeconomic resources shape the adoption of adaptation strategies. The



income structure of respondents therefore suggests that financial constraint may be one of the reasons why farmers rely more on low-cost measures than on expensive technological responses.

The findings from Table revealed that respondents in the study area had an average farming experience is substantial with a mean of 18.99 years. This is one of the strongest assets in the dataset because long experience improves farmers' ability to notice climate anomalies, compare past and present seasons, and select local responses that have worked before. Experience also builds practical knowledge of soils, rainfall timing, yam varieties, and pest patterns. However, experience does not automatically guarantee adoption of modern adaptation measures; sometimes it increases attachment to traditional methods. Even so, most recent studies still treat farming experience as a major determinant of adaptation. Adeagbo *et al.* (2021) found farming experience to be significant in climate adaptation decisions, Madaki *et al.* (2023) showed that climate knowledge is reinforced by repeated exposure to climate events, and Adejo *et al.* (2024) identified farming years as important in yam adaptation behavior. The moderate-to-high farming experience suggested strong indigenous knowledge of rainfall patterns, soil behaviour, and pest cycles. Experienced respondents likely recognized gradual climatic shifts and adjusted planting calendars accordingly. However, long-term experience may sometimes encourage reliance on traditional knowledge, potentially limiting openness to modern climate forecasting tools. Adaptation effectiveness depends on combining indigenous knowledge with scientific information. Akinbode *et al.* (2022) in Ogun State reported that experienced respondents adopted mixed cropping systems as adaptation. Iorlamen and Terna (2023), observed that experience significantly enhanced resilience strategies in yam production.

Similarly, the results revealed that method of land acquisition is dominated by inheritance, which accounts for 67.1% of the respondents being the most common, points to a land tenure system that provides a degree of customary security but lacks formal title. Inherited land often gives farmers stronger security of use than short-term leasing, and that can encourage investment in perennial soil improvements, manure management, and other long-term adaptation measures. While 24.4%, 7.3% and 1.3% had acquired land through purchase, gift and leasehold which has a major implication for adaptation. Secure land rights are a cornerstone of long-term investment in agriculture. Respondents with insecure tenure e.g., leasehold or even those with inherited land subject to community claims are less likely to invest in practices with long-term payoffs, such as planting trees, building terraces, or applying organic matter to build soil health, for fear of not reaping the future benefits (Lawry *et al.*, 2022). Majority (70.9) of the respondents had farming as their primary occupation This means that most respondents are highly dependent on agriculture for livelihood and are therefore more exposed to climate variability. Such dependence can motivate stronger interest in adaptation, but it can also make households more vulnerable when climate shocks reduce harvests. The evidence from Nigeria shows that non-farm employment can increase adaptive capacity because it supplies extra cash for inputs, information access, and risk spreading. Danso-Abbeam *et al.* (2021) found that rural non-farm employment increased the extent of climate adaptation among smallholder farmers in southwest Nigeria.

### **Respondents Sources of Information on Climate Change**

The finding in Table 2 presented the respondents' sources of information on climate change. The results revealed that personal experience ranked first (96.8%). The result agrees with Mohammed, *et al.*, (2024), their study showed the source of information on climate change among respondents indicated that personal experience of farmers was found to be a major source of information on climate change adaptation, with a mean of (3.777). Personal knowledge allowed respondents to form complex mental reasoning of the climate which can affect their farming operations. This implied that personal experiences make farmers to understand the reality of climate change more easily than less experience ones. This implied that most farmers relied primarily on direct observation of environmental changes. However, this finding disagrees with Chukwuet *al* (2023), on the sources of information on changes in climatic factors showed that 45.42% indicated that they became informed of changes in climatic factors through radio programmes and announcements, This implies that radio has been the most effective medium of disseminating information on environmental factors to farmers in Ebonyi State. Also, Mobile telephone ranked second (94.9%), The results agreed with Nirmal and Ravi (2021) who found



that telephone calls are cheap and cost effective in getting information to famers on adaptation practices in order to mitigate the effects of climate change. The growing role of mobile telephone suggested increasing access to communication technologies in rural areas. This aligned with the findings of the International Telecommunication Union (2022), which reported expanding mobile penetration across developing countries. Followed by Radio (92.7%) and village/market meetings (89.2%).

**Table 2:** Respondents’ Sources of Information on Climate Change

<b>Variables</b>	<b>Frequency*</b>	<b>Percentage</b>	<b>Rank</b>
Personal experience	306	96.8	1 <sup>st</sup>
Mobile telephone	300	94.9	2 <sup>nd</sup>
Fellow farmers	293	92.7	3 <sup>rd</sup>
Radio	282	89.2	4 <sup>th</sup>
Agro-dealers	268	84.8	5 <sup>th</sup>
Markets place	227	71.8	6 <sup>th</sup>
Religious organizations	70	22.2	7 <sup>th</sup>
Village & market meeting	67	21.2	8 <sup>th</sup>
Farmers’ cooperative society	66	20.9	9 <sup>th</sup>
Social organizations	62	19.6	10 <sup>th</sup>
Television	55	17.4	11 <sup>th</sup>
Internet	55	17.4	11 <sup>th</sup>
Extension agents	48	15.2	13 <sup>th</sup>
PADP	35	11.1	14 <sup>th</sup>

**Source:** Field survey, 2025 \*Multiple responses

These findings indicated that informal communication networks played a dominant role in information dissemination. Also, Agro-dealers (84.8%) and markets (71.8%) were important sources of information. However, formal institutional sources ranked relatively low, where social organisations (19.6%), farmers’ cooperative societies (20.9%), fellow farmers (92.7%), television (17.4%), internet (17.4%), Extension agents (15.2%) and PADP (11.1%) were less frequently cited. The results disagreed with Nose and John (2020), whose results revealed that extension workers were the most preferred and reliable source of information to farmers on climate change adaptation in the study area. This suggested weak agricultural extension outreach in the study area. Similar concerns were raised by the National Bureau of Statistics (2023), which noted limited access of rural farmers to formal agricultural advisory services. The findings therefore implied that climate change information in the study area was largely experiential and peer-based rather than institutionally driven. Strengthening extension services and digital advisory platforms would enhance farmers’ adaptive capacity.

**Adaptation Strategies Used by Yam Farmers in Mitigating the Effects of Climate Change**

Table 3 assessed adaptation strategies using an adoption index threshold of 0.41. Use of improved yam seed varieties (0.94) had the highest adoption rate. Improved varieties are often more drought-tolerant and disease-resistant. Changing planting dates (0.90) was also widely adopted, reflecting farmers’ responsiveness to rainfall variability. Planting of cover crops (0.86), mulching (0.80), and tree planting (0.84) indicated soil conservation awareness. These practices enhance moisture retention, reduce erosion, and improve soil structure. FAO (2022) identified such practices as core components of climate-smart agriculture.



**Table 3:** Adaptation Strategies Adopted by Respondents to Mitigate Effect of Climate Change

Variables	Mean	Remark
Use of improved yam seed variety	0.94	Adopted
Changing of planting dates	0.90	Adopted
Mulching	0.80	Adopted
Planting of cover crops	0.86	Adopted
Planting of trees	0.84	Adopted
Increased use of inorganic fertilizer and organic manure	0.68	Adopted
Changes in harvesting date	0.58	Adopted
Migration to other location	0.46	Adopted
Using Irrigation in drought Periods	0.21	Not adopted
Diversification into non-farm activities	0.21	Not adopted
Purchase of agricultural insurance	0.24	Not adopted
Planting of yam in early rainfall	0.28	Not adopted
Planting of early maturing yam variety	0.25	Not adopted
Intercropping yam with other crops	0.19	Not adopted

**Source:** Field survey, 2025 Adoption index  $<0.41$ =Not adopted  $\geq 0.41$ =Adopted

Increased use of fertilizers and manure (0.68) suggested attempts to compensate for declining soil fertility. However, excessive fertilizer use may increase greenhouse gas emissions, reflecting an adaptation–mitigation trade-off. Migration (0.46) and changes in harvesting dates (0.58) indicated livelihood flexibility. Migration may represent a coping rather than sustainable adaptation strategy. Conversely, irrigation (0.21), agricultural insurance (0.24), diversification into non-farm activities (0.21), intercropping (0.19), and early maturing varieties (0.25) were not adopted. These low adoption rates suggested financial constraints, limited access to irrigation infrastructure, and weak institutional support systems. The World Bank (2023) emphasized that access to credit, extension services, and climate finance significantly determines farmers’ adaptive capacity. The low uptake of capital-intensive strategies in this study area reflected structural limitations in rural agricultural systems.

#### **Level of Constraints to the use of Adoption of Adaptation Strategies among Yam Farmers**

The findings in Table 4 revealed the constraints were rated as "severe" is a powerful testament to the overwhelming challenges faced by respondents. This is not a situation with one or two manageable bottlenecks; it is a complex, multi-layered system of barriers that collectively trap respondents in a state of low adaptive capacity. The results revealed that untimely access to climate information with mean score (2.7), inefficiency of information sources (2.8), complexity of information (2.8), and complexity of information sources (2.7) were all rated severe. These findings suggested weaknesses in climate communication systems within the study area. The Nigerian Meteorological Agency (2023) acknowledged limited penetration of localized climate forecasting services in rural communities. Similarly, FAO (2022) emphasized that effective adaptation requires timely, simplified, and actionable climate information.



**Table 4:** Level of Constraints to Adoption of Adaptation Strategies among Yam Farmers

Variables	Mean	Remarks
Untimely access to climate information	2.7	Severe
Inefficiency of information source	2.8	Severe
Complexity of information	2.8	Severe
High cost of irrigation facilities	2.8	Severe
Lack of access to improved technologies	2.7	Severe
Inadequate of improved drought resistant yam varieties	2.8	Severe
Low level of awareness on climate change	2.7	Severe
Low level of education	2.6	Severe
Deteriorating roads from farm gates to market	2.7	Severe
Withdrawal of labour force to less climate risk ventures	2.6	Severe
Inadequate extension agents	2.7	Severe
Inadequate extension service delivery	2.7	Severe
Inadequate government support	2.7	Severe
High cost of inputs	2.8	Severe
Complexity of information source	2.7	Severe
High cost of irrigation facilities	2.7	Severe
Poor access to improved technologies	2.6	Severe
Adulteration of fertilizers	2.7	Severe
Inadequate of improved agricultural technologies	2.7	Severe

**Source:** Field survey, 2025 <2.5=Not severe ≥2.5=Severe

The finding further showed inadequate extension agents (2.7), poor extension service delivery (2.7), and inadequate government support (2.7) were severe constraints. These findings indicated institutional weaknesses in agricultural advisory systems. The National Bureau of Statistics (2023) reported low extension worker-to-farmer ratios in Nigeria, limiting farmers’ access to technical guidance. On the other hand, high cost of irrigation facilities (2.8), lack of access to improved technologies (2.7), inadequate drought-resistant yam varieties (2.8), adulteration of fertilizers (2.7), and high input costs (2.8) were also severe. These constraints indicated limited access to climate-resilient technologies and financial barriers. The World Bank (2023) noted that smallholder farmers in West Africa face significant barriers to irrigation development and agricultural insurance uptake due to high capital requirements. In addition, deteriorating roads (2.7) and withdrawal of labor to less climate-risk ventures (2.6) were also severe constraints. Poor rural infrastructure increases transaction costs and discourages investment in productivity-enhancing technologies. This is consistent with the findings of Antwi-Agyei *et al.* (2022) and Stringer *et al.* (2020), who emphasize the need for multi-sectoral, integrated approaches to build the adaptive capacity of smallholder respondents in sub-Saharan Africa. Generally, the finding indicates that constraints to adaptation among yam farmers are multifaceted, encompassing informational, financial, institutional, technological, and infrastructural dimensions. Addressing these challenges will involve strengthening extension services, improving access to timely and relevant information, enhancing financial support mechanisms, investing in rural infrastructure, and promoting access to appropriate technologies. Without such interventions, farmers may remain limited to low-cost and less effective adaptation strategies, thereby increasing their vulnerability to climate change.

**Table 5:** Association between Adaptation Count and Yam Production Outcome

Test	Statistic	Df	p-value	Decision
<b>Spearman Rank Correlation</b>	$\rho = -0.076$	—	0.179	Fail to reject
<b>One-Way ANOVA</b>	F = 1.14	5, 310	0.337	Fail to reject
<b>Kruskal-Wallis Test</b>	$\chi^2 = 11.52$	5	0.042	Reject (marginal)
<b>Welch's ANOVA</b>	F = 2.02	5.0, 18.0	0.124	Fail to reject

**Note:** Levene's test indicated heterogeneous variances across outcome groups (F =19.53, p < 0.001), necessitating Welch's correction.

**Source:** Field Survey, 2025.



**Decision:** The primary Spearman correlation ( $\rho = -0.076$ ,  $p = 0.179$ ) and one-way ANOVA ( $F = 1.14$ ,  $p = 0.337$ ) both failed to reach significance. The null hypothesis is therefore **not rejected** at  $\alpha = 0.05$ . However, the Kruskal-Wallis test detected marginal distributional differences across yield categories ( $\chi^2 = 11.52$ ,  $p = 0.042$ ), which warrants cautious interpretation as evidence of possible non-linear or threshold effects.

The absence of a significant linear association between adaptation intensity and perceived yam production ( $\rho = -0.076$ ,  $p = 0.179$ ) is arguably the most practically consequential finding of this study. It challenges the widely held assumption embedded in many extension frameworks that greater strategy diversification automatically translates into improved agricultural outcomes under climate stress (Aryal *et al.*, 2023). This null result is consistent with emerging critiques of "adaptation counting" approaches — methodologies that treat the sheer number of adopted strategies as a proxy for climate resilience — while neglecting strategy quality, contextual appropriateness, and synergistic potential (Thomas *et al.*, 2023; Simelton *et al.*, 2023).

The cross-sectional study design captures adoption status at a single point in time, rendering it incapable of detecting time-lagged yield responses — a particularly salient limitation for perennial interventions such as tree planting, soil conservation, and cover cropping, whose agronomic benefits typically materialise over multiple growing seasons (Lipper *et al.*, 2022). Second, unmeasured confounders — including soil quality variation, localised pest and disease pressure, within-state rainfall variability, and differential market access — may exert stronger independent influences on perceived yield than adaptation behaviour per se (Mbow *et al.*, 2023). Third, the equal weighting assigned to all 14 strategies in the composite index ignores their differential cost-effectiveness, technical feasibility, and scalability under Plateau State conditions, introducing measurement noise that attenuates detectable associations (Eriksen *et al.*, 2023). The Kruskal-Wallis test ( $\chi^2 = 11.52$ ,  $p = 0.042$ ) nonetheless hints at non-linear or threshold effects that merit further investigation. The means table reveals a striking pattern: farmers reporting "increased cost of production" adopted the highest mean number of strategies (8.67), followed by those reporting "poor yield" (8.17). This ordering is consistent with reactive coping behaviour wherein the intensification of adoption is driven by accumulated losses rather than proactive risk management — a dynamic increasingly documented in the climate adaptation literature across sub-Saharan Africa (Eriksen *et al.*, 2023). The Welch's ANOVA result ( $F = 2.02$ ,  $p = 0.124$ ), which corrects for the documented heterogeneity of group variances (Levene's  $F = 19.53$ ,  $p < 0.001$ ), confirms that the marginal Kruskal-Wallis result does not survive robustness testing.

## CONCLUSION AND RECOMMENDATIONS

The study concluded that farmers' socioeconomic factors such as age, gender, land acquisition method, and farming experience significantly influenced adaptation decisions. Sources of information on climate change were mainly through the use of personal sources of information. Although respondents demonstrated a high level of awareness and adopted several indigenous and low-cost adaptation strategies, their adaptive capacity remained constrained by institutional, financial, technological, and infrastructural limitations. Therefore, improving institutional support systems and reducing structural barriers are critical to strengthening climate resilience among yam farmers.

The study recommends strengthen extension services, need to provide improved drought-resistant yam varieties and improved technologies to reduce the burden of high costs. Improve access to credit for climate-resilient investments, and promote conservation agriculture and agroforestry. Encouraging the use of resilient crop varieties and improved soil practices, along with establishing reliable climate information systems, Capacity-building programmes should be organized to improve farmers' technical knowledge and adaptive skills, especially for younger and less experienced farmers to enhance productivity.

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*Nigerian Journal of Agriculture and Agricultural Technology (NJAAT)*  
**Volume 6, Number 2B, June 2026**  
**ISSN (Print): 2811-1885; ISSN (Online): 2811-1893**



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