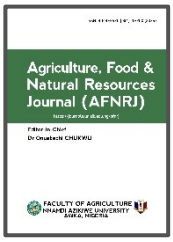
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Original Article

Adaptation behaviour of arable crop farmers towards drought in Kwara State, Nigeria

OPEN ACCESS

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ABSTRACT

This study investigates the adaptation behaviour of arable crop farmers in Kwara State, Nigeria. A multistage sampling procedure was used in selecting 200 respondents for the study. Data were obtained using an interview schedule and were analysed using percentages, means, standard deviation, and multiple regression at $p \leq 0.05$. The results showed that ridging ($\bar{x} = 1.78$), planting cover crops to prevent erosion and retain moisture ($\bar{x} = 1.39$), and use of legumes to improve soil fertility naturally ($\bar{x} = 1.12$) were the most frequent drought management practices used by the arable farmers. The overall adaptation behaviour towards drought was poor ($\bar{x} = 2.84$). Age ($\beta = -0.118$), household size ($\beta = 0.278$), access to weather forecast information ($\beta = 0.319$), land ownership status ($\beta = 0.507$), and access to irrigation facilities ($\beta = 0.109$) significantly influenced the adaptation behaviour of the respondent towards drought. The study recommended increased investment on localized weather forecasting systems and targeted training programs on climate-smart agriculture and drought mitigation techniques

KEYWORDS: *Agricultural production, Climate-smart farming, Food security, Vulnerability*

INTRODUCTION

Agriculture remains the backbone of most economies in sub-Saharan Africa, providing food, employment, and revenue for majority of the populace, especially in rural areas (Rege & Sones, 2022). Among the subsectors of agriculture, arable crop production is particularly critical as it involves the cultivation of staple crops, which are vital for food security, income generation, and employment. However, the productivity and sustainability of arable farming are increasingly threatened by climate variability and extreme weather events, notably drought (Mbonu, 2025).

Drought is one of the most devastating climate-related risks confronting arable crop farmers (Rahman *et al*., 2025). Its impacts include soil moisture depletion, crop failure, reduction in yield, food shortages, and heightened vulnerability of rural livelihoods. In recent decades, the frequency, severity, and unpredictability of drought have escalated, largely due to global climate change. Semenov (2024) reports that Africa is highly vulnerable to climate change due to low adaptive capacity, poor infrastructure, limited access to technology, and high dependence on rain-fed agriculture.

In Nigeria, drought induced by climate variability poses a serious threat to agricultural production and food and nutrition

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security. Approximately 64 % of Nigeria's landmass is prone to drought and desertification, making arable crop farmers particularly exposed to climate-related risks (Yahaya *et al*., 2024). Recurrent drought episodes have disrupted planting seasons, reduced crop yields, and heightened livelihood insecurity among farming households. As climate change impacts intensify, farmers are increasingly required to respond not only through physical adjustments but also through behavioural changes that influence how they perceive risks and adopt appropriate adaptation strategies.

In response to the increasing threats from drought, arable crop farmers are expected to adopt various adaptation and management practices to minimize their exposure to drought and enhance their resilience. Such adaptation behaviour may include changes in cropping patterns, use of drought-tolerant varieties, soil and water conservation practices, adjustment of planting dates, and diversification of livelihoods. Nevertheless, the adoption and intensity of use of these drought management practices vary widely among farmers. This variation is often shaped by socio-economic characteristics, access to information and extension services, institutional support, environmental conditions, and farmers' behavioural responses to perceived climate risks.

Recent climate variability in Kwara State has exposed the state's farmers to increased risk of drought and dry spells that disrupt agricultural activities and threaten livelihoods (Olugbenga *et al.*, 2025). For example, in the 2025 cropping season, an unexpected cessation of rainfall in the state between June and August created a prolonged dry period during the peak of growing season, leading to widespread crop destruction and significant financial losses for farmers who had relied on seasonal climate predictions for planting decisions (ThisDay, 2025). These occurrences highlight the vulnerability of arable crop production to climate variability in the state and underscore the need to better understand how farmers behave and adapt in response to drought risks.

Climate change adaptation is therefore not only a technical process but also a behavioural one, as farmers' perceptions, attitudes, and responses to climate risks play a crucial role in determining whether and how adaptation strategies are adopted. Despite the growing body of literature on climate change adaptation in agriculture, there remains a notable gap in understanding the specific behavioural drivers influencing arable crop farmers' adaptation decisions, particularly in the context of drought in Nigeria.

Against this background, this study assessed the adaptation behaviour of arable crop farmers towards drought in Kwara State, Nigeria. Specifically, the study sought to: describe the socioeconomic characteristics of the respondents in the study area, assess the extent to which various drought management practices are used by farmers in the study area, examine the respondents' drought adaptation behaviour and identify the factors that determine the adaptation behaviour of the arable crop farmers.

MATERIALS AND METHOD

Study Area

The study was carried out in Kwara State, Nigeria. The State is located in the North Central geo- political zone of Nigeria with its capital in Ilorin. The State extends from latitude 7° 45`N in its southern end, latitude 2° 45`E to the west and longitude 6° 40`E to south east. It has an estimated total population of 3,390,330 (National Bureau of Statistics, 2022). The climate of Kwara State follows a tropical pattern with the raining season starting from March and ending in November, with a dry spell in August. The major occupation of the people of the state is farming, which is largely subsistence in scale. Kwara lies in the Guinea savannah ecological zone, which naturally has a distinct rainy season and a long dry season, making rainfall variability more impactful. Changes in climate drivers (like temperature increases and shifting rain patterns) mean that even typical dry seasons can become more intense or unpredictable.

Population for the Study

The population of this study comprised all arable crop farmers in Kwara State.

Sampling Procedure and Sample Size

A multi-stage sampling procedure was used to select respondents for the study. In the first stage, Zone C and D of the Kwara State Agricultural Development Project (KWADP) were purposively selected due to the vast operation of arable farming and devastated effects of drought on agricultural activities in the area. In the second stage, two Local Government Areas (LGAs) with prominent drought effects in the last five years were purposively selected in each zone; in zone D, Ifelodun and Oyun LGAs were selected while Asa and Ilorin south were selected in zone C. The third stage also involved a purposive selection of five communities from each LGA based on the population of arable farmers whose production were affected due to drought occurrence. Lastly, a snowball method was used in identifying ten arable crop farmers per community making a total sample size of about two hundred respondents. Structured interview schedule was used to elicit information from the respondents.

Analytical technique

The extent of use of drought management practices used by the farmers was measured as 'to a great extent', 'to some extent' and 'to no extent'. These operational terms were assigned 2, 1 and 0 scores respectively. Such that the values were added to obtain 3, with a mean score of 1. This mean was used as decision to categorize the extent of use of various drought management practices as either high or low. Farmers' adaptation behaviour to drought was measured using a five-point Likert-type scale comprising "Very often", "Often", "Sometimes", "Seldom" and "Never". These operational terms were assigned scores of 5, 4, 3, 2 and 1 respectively. The scores obtained for each adaptation behaviour item were summed to

generate a composite adaptation behaviour score. The maximum obtainable score was 15, with a mean score of 3. This mean value was used as the decision benchmark for categorising farmers' adaptation behaviour into favourable (scores ≥ 3) and unfavourable (scores < 3) categories of behaviour. Descriptive statistical tools of frequency distribution, percentages, mean counts and standard deviations were used in achieving the objectives except factors that determine the adaptation behaviour of the arable crop farmers which was analysed using multiple regression analysis. For all purposes, p-value of 0.05 was considered as the level of significance.

RESULTS AND DISCUSSION

Sociodemographic characteristics

The sex distribution shown in Table 1 reveals that majority of the respondents were male (86.5%) while 13.5% were females. This male dominance in the study population is possibly due to traditional gender roles in agriculture, where men are often more involved in farming activities than women. This finding aligns with Daudu *et al*. (2021) who reported that men dominate crop production in Nigeria due to higher land access and decision-making power. Women's low representation could also stem from social and cultural constraints limiting their participation in land ownership and formal farming operations (Viashima & Daniel, 2025). Also, majority of the respondents (56%) have age distribution ranging between 41–60 years, with a mean age of 52.4 years. This indicates that middle-aged adults dominate the farming population. The relatively older age could affect innovation adoption and physical resilience, which are critical for climate adaptation, such as drought management. A notable proportion of the respondents were married (82%). This suggests a high level of family responsibility and perhaps a higher tendency toward long-term investment in land and livelihood sustainability. Married farmers may be more inclined to adopt conservation and drought management practices to safeguard household welfare (Olabanji *et al*., 2021). In addition, the average years spent in formal education was 9 years with majority (60%) ranging between 7-12 years. Education could determine access to agricultural information and increase capacity to understand technical guidance related to climate-smart farming. According to Amadi and Osia (2018), educational level significantly influences farmers' awareness, interpretation, and adoption of extension messages and drought mitigation practices. Most of the respondents (78.5%) had a household size between 5-10 persons and a mean of 7 persons. Large household sizes may imply higher labour availability, which could support labor-intensive drought management practices. However, it also suggests a high dependency burden, which can increase vulnerability to climate shocks. Bitana *et al*. (2024) demonstrated that while a large household size can enhance labour availability, it may also impose constraints when income and resources are insufficient. Furthermore, the primary occupation of majority (80%) of the respondents was farming. This indicates that the population largely depends on agriculture for livelihood. Those with farming as the primary occupation are more likely to perceive and react to drought threats with serious concern. Yeleliere *et al*. (2023) found that farming experience and occupational focus are significant predictors of climate adaptation behavior. The average annual farm income was ₦1,495,000. This income profile suggests that many of the farmers operate at subsistence or low-income levels, which could hinder their capacity to invest in drought-resilient technologies like irrigation systems or improved seed varieties. Adeagbo *et al*. (2021) emphasized that income level is a strong determinant of a farmer's ability to implement adaptive measures in response to climate variability.

Table 1: Distribution of respondents based on demographic variables

Demographic variables	Freq. (N= 200)	Percent-ages (%)	Mean
Sex			
Male	173	86.5	
Female	27	13.5	
Age			
Less than 20 years	11	5.5	52.4 years
20-40 years	46	23.0	
41-60 years	112	56.0	
61 years and above	31	15.5	
Marital Status			
Single	32	16.0	
Married	164	82.0	
Separated/divorced/widowed	04	2.0	
Years of formal education			
0	21	10.5	
1-6	56	28.0	9 years
7-12	120	60.0	
13 and above	03	1.5	
Household size			
Less than 5 persons	37	18.5	7 persons
5-10 persons	157	78.5	
11 and above	06	3.0	
Primary Occupation			
Farming	160	80.0	
Civil Service	02	1.0	
Trading	11	5.5	
Artisanship	27	13.5	
Annual Farm Income			
Less than 1,000,000	98	49.0	1,495,000
₦1,000,000-2,000,000	68	34.0	
2,000,001-3,000,000	28	14.0	
3,000,001 and above	06	3.0	

Source: Field Survey, 2025

Socioeconomic characteristics (Institutional variables)

The data in Table 2 shows that more than half of the respondents (51.5%) belong to various farmer associations/cooperatives. Farmer associations are important platforms for disseminating information, accessing credit, pooling resources, and strengthening negotiation power. According to Apata and

Yusuf (2022), cooperative membership enhances access to extension services, inputs, and training, which improves farmers' adaptive capacity. Also, the respondents had an average of 3 extension contacts annually. This is a critical weakness in institutional support. Extension services are intended to provide timely advice on farm management, climate adaptation, and improved practices. Additionally, a large proportion (86.5%) of the respondents had no access to credit facilities. Access to credit is a major constraint among the respondents. Credit facilitates investment in inputs such as drought-resistant seeds, irrigation equipment, and fertilizers. Haryanto *et al*. (2023) found that credit access is significantly associated with the adoption of improved agricultural practices among Nigerian farmers. Majority (93.5%) of the respondents had no access to weather forecast information. The overwhelming lack of access to weather information is heart rendering, especially given the importance of weather knowledge in planning agricultural operations such as planting, irrigation, and harvesting. Alidu *et al*. (2022) noted that climate information is crucial for enabling smallholder farmers to adjust their practices in response to seasonal changes.

Table 2: Distribution of respondents based on institutional variables

Institutional variables	Freq.	Percent-ages (%)	Mean
Membership in Farmer Associations/ Cooperatives			
Yes	103	51.5	
No	97	48.5	
Frequency of Contact with Extension			
Less than 5 times yearly	190	95.0	3
5-10 times yearly	07	3.5	times
11 times and above	03	1.5	
Access to credit facilities			
Yes	27	13.5	
No	173	86.5	
Access to Weather Forecast Information			
Yes	43	21.5	
No	157	78.5	

Source: Field Survey, 2025

Socioeconomic characteristic (Enterprise Variables)

Table 3 shows that majority (55.0%) of the respondents' own land through inheritance. Land acquisition through inheritance is common among smallholder farmers in sub-Saharan Africa. This finding aligns with Okolo and Ogbuefi (2021), who reported that land ownership in Nigeria is largely acquired through traditional systems such as inheritance, especially in rural areas. The average landholding size of 0.9 hectares further reflects the dominance of small-scale agriculture in Nigeria, as supported by FAO (2020), which reported that smallholder farmers in Nigeria typically manage farms of less than 1 hectares.

Table 3: Distribution of the respondents based on the enterprise variables

Enterprise Variables	Freq. (N= 200)	Percent-ages (%)	Mean
Land ownership status			
Inheritance	110	55.0	
Self-acquired	33	16.5	
Borrowed/leased	52	26.0	
Shared cropping	05	2.5	
Land Size			
Less than 5 hectares	191	95.5	
6-10 hectare	07	3.5	0.9 ha
11 hectares and above	02	1.0	
Cropping system practiced			
Monocropping	07	35.0	
Intercropping	101	50.5	
Mixed cropping	92	46.0	
Major Crop Grown			
Cowpeas	12	6.0	
Yam	21	10.5	
Rice	08	4.0	
Maize	70	35.0	
Millet/sorghum	21	10.5	
Pepper/Tomato/Okra/Vegetables	17	8.5	
Cassava	54	27.0	
Farming Experience			
Less than 5 years	08	4.0	
6-10 years	18	9.0	
11-15 years	26	13.0	24.6 years
16 years and above	148	59.0	
Source of Farm Labour			
Family members	157	78.5	
Communal joint efforts	11	5.5	
Hired labour	32	16.0	
Access to Irrigation Facilities			
Yes	4	2.0	
No	196	98.0	

Source: Field Survey, 2025

Limited landholding can constrain the adoption of improved technologies and reduce economies of scale. Intercropping (50.0%) and mixed cropping (46.0) are the major cropping systems practiced by the farmers. The prevalence of intercropping and mixed cropping is consistent with traditional African farming systems aimed at minimizing risk, maximizing land use efficiency, and improving soil fertility. Maize (35.0%) and cassava (27.0%) are the major crops grown in the area. This cropping pattern is consistent with national and regional trends in southern and central Nigeria, where maize and cassava

dominate staple crop production. The farmers had an average farming experience of about 26.6 years. A long duration of farming experience suggests that most of the farmers have acquired indigenous knowledge over time. Such experience is a critical asset in traditional agriculture, influencing decisions on planting times, cropping systems, and pest control. Family members (78.5%) were indicated as the major source of farm labour. The dependence on family labour is a characteristic of smallholder farming systems in Nigeria and Africa in general. Yusuf (2018) highlight that family labour remains the most accessible and affordable form of farm labour, especially in rural settings where mechanization is limited. Only 2% of the respondents had access to irrigation facilities in the study area. Limited access to irrigation is a critical constraint for smallholder farmers, especially in the face of increasing climate variability and erratic rainfall. The low percentage (2%) reflects a broader national challenge, as reported by Adelopdun and Choi, (2018), where less than 5% of Nigeria's arable land is irrigated.

Extent to which Drought Management Practices are Utilised

Table 4 shows the distribution of the respondents according to the extent to which various drought management practices are utilized in their farming operations. The result reveals that 'ridging' was the mostly used drought management practice used by the arable farmers ranking first with a weighted mean score (WMS) of 1.78. This was followed by 'planting cover crops to prevent erosion and retains moisture' (WMS = 1.39) and 'use of legumes to improve soil fertility naturally' (WMS = 1.12). Ridging is a conventional and widely accessible soil and water conservation method. Danso-Abbeam *et al*. (2021), reported that ridging is a common drought adaptation strategy among smallholder farmers in southwestern Nigeria, especially in regions with undulating topography and erratic rainfall patterns. Cover crops such as cowpea are planted primarily to shade the soil, reduce evaporation, and enhance organic matter content. According to Singhal *et al*. (2021), cover cropping is a low-cost but effective soil and water conservation strategy that is gaining attention in sustainable agriculture. The incorporation of legumes into cropping systems to improve soil fertility is closely tied to sustainable soil management, especially under drought conditions where chemical fertilizers may be either too expensive or unavailable. Among the least used management practices are 'crop insurance against drought losses' (WMS = 0.02) and 'application of irrigation techniques' (WMS = 0.05). The relatively low score for some of the practices suggests underutilization, possibly due to limited extension support, inadequate knowledge of benefits, or cultural cropping preferences.

Table 4: Distribution of respondents based on the extent of drought management practices utilized

Drought management practices	Great Extent	Some Extent	No extent	WMS
Mulching	42	63	53	0.74
Minimum/zero tillage to reduce soil moisture loss	37	48	115	0.61
Ridging	156	43	01	1.78
Cover cropping to prevent erosion and retains moisture	52.5	33.5	14.0	1.39
Rainwater harvesting (using tanks, ponds, or pits)	6.5	9.5	84.0	0.23
Irrigation techniques	1.0	3.0	96.0	0.05
Use of early-maturing, drought-tolerant	15.5	32.0	52.5	0.63
Adoption of improved crop varieties	31.5	32.0	36.5	0.75
Intercropping and mixed cropping to reduce total crop failure risk	38.0	21.5	40.5	0.98
Staggered planting (sowing at different times to spread risk)	13.5	28.5	58.0	0.56
Adjusting planting dates based on rainfall forecasts	5.0	16.0	79.0	0.26
Use of legumes to improve soil fertility naturally	33.5	44.5	22.0	1.12
Combining organic and inorganic fertilizers to enhance soil fertility and moisture retention	5.0	18.5	76.5	0.29
Crop insurance against drought losses	0.0	1.5	98.5	0.02
Planting trees among crops	3.5	33	63.5	0.40

Source: Field Survey, 2025

Adaptation Behaviour towards Drought Management Practices

The cumulative mean score of 2.84 as shown in Table 5 suggests that the respondents generally show unfavourable behaviour towards drought management practices. The standard deviation of 0.97 implies that most farmers hold similar views, with relatively few outliers. Specifically, they showed favourable behaviour in relation to targeting rainfall to decide planting time ($\bar{x}$=4.05), use of cultural practices in conserving soil moisture ($\bar{x}$=3.89), planting of cover crops to maintain soil water retention ($\bar{x}$=3.78) and diversification into different crops ($\bar{x}$=3.24). Farmers may adopt practices they perceive as affordable, low-risk, and beneficial while avoiding others that are costly or complex. This finding is supported by Ayi and Undiandeye (2022), who noted that farmers in Nigeria increasingly rely on indigenous knowledge of seasonal rainfall patterns to guide agricultural decisions.

Table 5: Distribution of the respondents based on the behaviour towards drought management practices

Behavioral Statements	WMS	Std. Dev
I used weather information before deciding upon the crops to be grown during the season	1.89	0.92
I have diversified into different crops due to changes in climate	3.24	1.01
I have adopted sprinkler irrigation system on my field to mitigate the effect of prolonged drought	1.12	1.00
I have adopted improved crop varieties to cushion drought effects	3.12	1.00
I used cultural practices in conserving soil moisture in my farm	3.89	0.90
I plant cover crops to maintain soil water retention	3.78	0.91
I practice intercropping and mixed cropping to reduce total crop failure risk	3.21	1.01
I use combined organic and inorganic fertilizers to enhance soil fertility and moisture retention	2.08	0.99
I opted for crop insurance against drought losses	1.07	1.00
I target rainfall to plant, leading to either early or late planting	4.05	1.00
Cumulative Mean Score	**2.84**	**0.97**

Source: Field Survey, 2025

Determinants of the adaptation behaviour of the arable crop farmers

Results in Table 6 indicate that among the fourteen variables entered into the model, five were found to be statistically significant predictors at 5% level of significance. Age (β = -0.118), Household size (β = 0.278), Access to weather forecast information (β = 0.319), Land ownership status (β = 0.507) and Access to irrigation facility (β =0.109) were significant predictors of adaptation behaviour of the respondent. The significant negative coefficient for age indicates that as farmers' age increases, the likelihood of a favourable adaptation behaviour decreases. Older farmers may be less inclined to adopt new practices due to risk aversion or entrenched habits. The positive coefficient for household size indicates that respondents with large households are more likely to adapt to drought situation. This could be because larger households often mean more labor availability, which can ease the burden of implementing adaptive measures. Additionally, access to weather forecast shows strong positive impact on adaptation. Timely and accurate weather forecasts empower farmers to make informed decisions. Khatibu and Ngowi (2025) emphasized that access to climate information significantly improves adaptation outcomes across African farming communities. Furthermore, the significance of land ownership indicates that security of tenure encourages long-term investment in adaptive strategies. Huang *et al*. (2020) noted that farmers who own their land are more likely to adopt soil conservation and irrigation techniques. Lastly, access to irrigation facility being significant means farmers with access will adapt to drought situations better than those without access. Irrigation reduces dependency on erratic rainfall, making it a cornerstone of climate resilience. Owoyemi *et al*. (2022) showed that irrigation access is one of the most effective adaptation tools in African agriculture. The model explains approximately 61.8% of the variance in the adaptation behaviour of on drought situations, indicating a good fit. The adjusted R^2 value of 0.596 further supports the model's robustness. The significant F-value suggests that the overall model is statistically significant. The moderately high R^2 value signifies a strong explanatory power of the socioeconomic factors in predicting the respondents' adaptation behaviour on drought situations.

Table 6: Determinants of adaptation behaviour of the respondents

Variables	Coefficients (β)	SE	t-value	p-value
Sex (Male=1, Female=0)	0.064	0.011	1.45	0.149
Age (years)	-0.118	0.189	-2.23	0.027*
Years of Formal Education	0.091	0.032	2.95	0.064
Household Size	0.278	0.024	3.52	0.031*
Annual Farm Income (₦)	0.066	0.003	1.05	0.103
Membership in Farmer Association (Yes=1, No=0)	0.074	0.267	2.17	0.082
Frequency of Extension Contact	0.082	0.098	1.27	0.067
Access to Credit Facility (Yes=1, No=0)	0.098	0.251	2.53	0.073
Access to Weather Forecast Information (Yes=1, No=0)	0.319	0.326	3.06	0.003*
Land Ownership Status (Owner=1, Others=0)	0.507	0.219	4.06	0.041*
Land Size (hectares)	0.098	0.065	2.68	0.064
Cropping System (Mixed=1, Mono=0)	0.143	0.204	2.58	0.075
Farming Experience (years)	0.072	0.019	3.00	0.083
Access to Irrigation Facility (Yes=1, No=0)	0.109	0.411	1.98	0.019*

R^2= 0.618, Adjusted R^2 = 0.596, F = 19.237, p<0.05

Source: Data Computation, 2025

CONCLUSION AND RECOMMENDATIONS

The study revealed that arable crop farmers in Kwara State exhibit generally poor adaptation behaviour towards drought. Notably was the poor behaviour towards the use of weather information before deciding upon the crops to grow during the season, use of sprinkler irrigation system to mitigate the effect of prolonged drought and subscription to crop insurance against drought losses. The study recommends that;

i. Government and agricultural stakeholders should invest more on localized weather forecasting systems and ensure the timely dissemination to farmers to improve access.
ii. Targeted training programs on climate-smart agriculture and drought mitigation techniques should be implemented. This could serve advocacy purpose in highlighting the importance of various adaptation options for better results.

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Authors' Contributions

OOP conceptualized the study, drafted the methodology, analysed the data and supervised the writing of the manuscript. FBS and OOP managed data collection, IAO and EHO conducted the proof reading of the manuscript.

Ethical Statement

Not applicable

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