

Climate Change Adaptation Strategies Among Smallholder Crop Farmers in Imo State, Nigeria

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Abstract

Climate change poses significant challenges to agricultural production, particularly among smallholder farmers who depend largely on rain-fed agriculture. This study examined the socio-economic characteristics of smallholder crop farmers and the adaptation strategies adopted in response to changing climatic conditions in Imo State, Nigeria. A multistage sampling procedure was used to select 120 farmers, and data were analyzed using descriptive statistics. Results showed that 56.7% of the respondents were female, with a mean age of 54.5 years. Most farmers had primary education (46.7%), were married (73.3%), had a mean household size of six persons, and possessed an average farming experience of 26.7 years. The mean farm size was 0.66 ha, indicating predominance of smallholder farming. Adaptation strategies adopted included early planting (37.1%), zero tillage (14.4%), mixed cropping (12.0%), and use of hybrid varieties (12.0%). The study concludes that farmers predominantly rely on low-cost agronomic adaptation measures. Strengthening extension services and improving access to climate-smart technologies are essential for enhancing farmers' adaptive capacity.

Keyword: Climate Change Adaptation, Smallholder Crop Farmers, Adaptation Strategies, Socio-economic Characteristics, Imo State, Nigeria

Introduction

Agriculture remains one of the most climate-sensitive sectors of the economy and serves as a major source of livelihood for rural households in developing countries. In Nigeria, the agricultural sector contributes significantly to employment, income generation, and food production, particularly among smallholder farmers who account for the bulk of domestic food supply. However, agricultural production is increasingly threatened by climate change and variability manifested through irregular rainfall patterns, rising temperatures, flooding, droughts, and increased incidence

of pests and diseases (Intergovernmental Panel on Climate Change [IPCC], 2023). These climatic challenges have adverse effects on crop productivity, farm income, and household welfare, thereby threatening the sustainability of rural livelihoods. Smallholder crop farmers are particularly vulnerable to climate-related risks because their production systems depend largely on natural rainfall and are characterized by limited access to improved technologies, credit facilities, extension services, and other productive resources (FAO, 2023). As climatic conditions continue to change, farmers are compelled to modify their farming practices to reduce production risks and maintain agricultural output. According to the IPCC (2023), adaptation is essential for reducing vulnerability and enhancing resilience in agricultural systems exposed to climatic shocks. Adaptation measures adopted by farmers may include changes in planting dates, use of improved crop varieties, mixed cropping, soil conservation practices, water management techniques, and other climate-smart agricultural innovations. The ability of farmers to adapt effectively to climate change is influenced by their socio-economic characteristics. Variables such as age, educational attainment, household size, farming experience, farm size, gender, and access to extension services determine the capacity of farmers to access information, evaluate risks, and adopt appropriate adaptation strategies (Ncongwane et al., 2022; Musa et al., 2023). Educational attainment, for instance, enhances farmers' ability to understand climate information and implement improved farming practices, while farming experience contributes to better decision-making based on accumulated indigenous knowledge (Daudu et al., 2023). Similarly, extension services facilitate the dissemination of climate-related information and adaptation technologies that improve farmers' resilience to environmental shocks (Adeyemi et al., 2023). Several empirical studies have documented the adaptation strategies employed by smallholder farmers in response to changing climatic conditions. Gebrehiwot and van der Veen (2021) reported that adjusting planting dates, crop diversification, and conservation farming were among the most commonly adopted adaptation measures among smallholder farmers in Sub-Saharan Africa. In Nigeria, Ogunfolaju et al. (2026) found that mixed cropping, improved crop varieties, and soil conservation practices were important adaptation strategies for mitigating climate-related production risks. Similarly, Nwaeboh and Egwuonwu (2024) observed that access to information and institutional support significantly influenced farmers' adaptation decisions. Despite the growing body of literature on climate change adaptation, empirical information on the socio-economic characteristics and adaptation practices of smallholder crop farmers in Imo State remains limited. Given the increasing vulnerability of agricultural production to climatic variability in the State, there is a need for location-specific evidence to support effective policy formulation and intervention programmes. Understanding the characteristics of farmers and the adaptation strategies they employ is essential for designing targeted measures that enhance resilience and promote sustainable agricultural production. Therefore, this study examines the socio-economic characteristics of smallholder crop farmers and identifies the adaptation strategies adopted in response to changing climatic conditions in Imo State, Nigeria.

Methodology

The study was conducted in Imo State, Nigeria, which is located in the southeastern region of the country. The State is characterized by intensive food crop production and a predominantly rural farming population. Agriculture remains an important source of employment and household income within the State. A multistage sampling procedure was employed in selecting respondents. In the first stage, one Local Government Area was purposively selected from each of the three agricultural zones of the State, namely Ideato South, Ohaji-Egbema, and Onuimo. Two

communities were randomly selected from each Local Government Area, followed by the random selection of two villages from each community. In the final stage, 10 food crop farmers were randomly selected from each village, resulting in a total sample size of 120 respondents. Primary data were collected using a structured questionnaire and oral interviews. Information was obtained on respondents' socio-economic characteristics, including age, gender, education, household size, farming experience, farm size, income, extension contact, and agricultural production activities. Descriptive statistics such as means, frequencies, and percentages were used to describe the socio-economic characteristics and adaptation strategies to changing climatic condition of the respondents.

Results and Discussions

Socio-Economic Characteristics of Farmers in Imo State

The result of the socio-economic characteristics of crop farmers is presented in Table 1.

Table 1: Socio-Economic Characteristics of Farmers in Imo State

Variable	Frequency	Percentage	Mean
Sex			
Male	52	43.3	
Female	68	56.7	
Age			
39 – 43	6	5.0	
44 – 48	12	10.0	
49 – 53	35	29.2	
54 – 58	30	25.0	
59 – 64	37	30.8	54.5 years
Level of Education			
No Formal Education	5	4.2	
Primary Education	56	46.7	
Secondary Education	49	40.8	
Tertiary Education	10	8.3	
Marital Status			
Married	88	73.3	
Single	13	10.8	
Divorced	2	1.7	
Widowed	17	14.2	
Household Size			
3 – 4	14	11.7	
5 – 6	61	50.8	
7 – 8	45	37.5	6 Persons
Extension Visit (No. of times)			
No Visit	39	32.5	
Once	12	10.0	
Twice	65	54.2	
Thrice	4	3.33	1.3 Times
Farming Experience			
6 – 20	41	34.2	

21 – 35	53	44.2	
36 – 50	26	21.7	26.7 Years
Farm Size (Hectare)			
0.10 – 0.50	31	25.8	
0.50 – 1.00	59	49.2	
1.00 – 1.50	25	20.8	
1.50 – 2.00	5	4.2	0.66 Hectare

Source: Computed from Field Survey Data, 2026

Table 1 shows the result of the socio-economic characteristics of the respondents. 43.3% of the respondents were male and 56.7% were female. This shows that higher proportion of the farmers in the study area were female. This implies that crop production in the study area is female dominated. This suggests that food crop production in the study area is largely female-driven, a pattern commonly observed in smallholder agriculture across South-East, Nigeria particularly Imo State. This agrees with the study of FAO, 2023 and World Bank, 2024 that in sub-Saharan Africa, women play a central role in crop production and food system stability.

The age distribution shows that 30.8% of the respondents fall within 59 - 64 years of age, 29.2% of the respondent fall within 49 - 53 years, and 25% falls within 54 - 58 years. The mean age of the respondents was 54.5 years, implying that most farmers are in their middle ages, but active, capable of handling their farming tools by themselves, and capable of generating income to meet the food security requirements. This is consistent with the findings of Dauda et al. (2023) who reported that Farmers within this age category often possess the physical capacity and experience required for agricultural production while contributing substantially to household income.

Educational attainment shows that a majority (46.7%) have primary education. This implies that the farmers have formal education that enables them to adoption agricultural innovations that will enhance their crop productions and also ensure that they meet the requirement of food security status. This level of education may influence limited adoption of advanced climate-smart technologies. According to FAO (2022), education significantly enhances farmers' capacity to interpret climate information and adopt adaptive innovations. This result aligns with Ncongwane et al. (2022), who found that access to climate information significantly improves farmers' adaptive behaviour and capacity to implement adaptation strategies.

The result further shows that, 50.8% of the respondents have 5 - 6 persons per household. The mean household size was 6 persons. This implies that, the farming household have capable hands that can be substituted for hired labour. This suggests relatively large family units, which may provide farm labour but also increase consumption pressure. This result agrees with the findings of Yeleliere et al. (2023) who also reported that farmers with household sizes between 6 and 7 persons have an adequate number of individuals to provide food and energy for a comfortable life. Marital status distribution shows that 73.3% of the respondents were married, 10.8% were single. This result shows that majority of the respondents were married. This agrees with the common statement that farming activities are mostly done by married people, who use farming to raise additional income to meet the needs of their households, and also provide sufficient foods to meet the food security requirements of their households. The results agrees with the findings of Isaiah et al. (2026) who reported that farming is mostly the occupation of the married who use it to provide for their families.

Extension contact shows that 54.2% of the respondents have 2 times extension contact, 32.5% had no extension contact, and 15% had extension contact once in a production period. The mean extension visit was 1.3 times in a production period. This implies a low extension visit, showing a

weak institutional support. The result corroborates earlier findings that weak extension outreach, inadequate mobility of extension agents, and limited farmer–extension interactions continue to constrain agricultural transformation and technology adoption among Nigerian farmers (Musa et al., 2023; Adeyemi et al., 2023).

Farming experience shows that 44.2% of the respondents have 21 - 35 years of farming experience. The mean farming experience was 26.7 years. This means that the respondents have adequate farming experience to know the right combination of inputs to achieve food security. The result is consistent with Musa et al. (2023) that accumulated knowledge enhance input-use efficiency and production decision-making. This is consistent with Daudu et al. (2023) who reported that farming experience significantly improves technical efficiency and productivity outcomes among smallholder farmers.

Farm size shows that 49.2% of the respondent have a farm size of 0.50 to 1.00 hectare of cultivated farm size. The mean farm size was 0.66 ha. This implies that the respondents cultivated less than 1 hectare of farmland. This result agrees with Mgbenka & Mbah (2016), and Adeyemo & Adeagbo (2024) who reported that smallholder farming systems in Nigeria consistently show that most farmers operate on small fragmented holdings, typically less than 2 hectares, with a large proportion cultivating below 1 hectare.

Table 2: Adaptation strategies to changing climatic conditions

Adaptation Strategy	*Frequency	Percentage	Rank
Early planting	62	37.1	1 st
Zero tillage	24	14.4	2 nd
Mixed cropping	20	12.0	3 rd
Use of hybrid varieties	20	12.0	3 rd
Erosion control using vertical grass	16	9.6	4 th
Flood control using channels and gutters	12	7.2	5 th
Pest and disease control using pesticides	4	2.4	6 th
Crop rotation	4	2.4	6 th
Use of organic manure	2	1.2	7 th
Nursery practices	2	1.2	7 th
Good agronomic practices	1	0.6	8 th

Source: Computed from Field Survey Data, 2026. *Multiple responses

The results show that farmers mainly adopt low-cost and agronomic-based adaptation strategies, with early planting (37.1%) being the most dominant strategy. This reflects farmers' reliance on seasonal adjustment and climate risk timing rather than the use of capital-intensive technological innovations. Similar evidence from recent empirical studies shows that smallholder farmers in Sub-Saharan Africa often prioritize timing adjustments such as shifting planting dates as a first-line adaptation strategy due to their low cost and immediate feasibility (IPCC, 2023; Gebrehiwot & van der Veen, 2021). Zero tillage (14.4%), mixed cropping (12%), and use of hybrid varieties (12%) indicate partial adoption of climate-smart agricultural practices. These practices align with climate-resilient agricultural systems that emphasize soil conservation, crop diversification, and genetic improvement as key adaptation pathways under increasing climate stress conditions (FAO, 2023; Ogunfolaju et al., 2026). However, low adoption of improved strategies such as organic manure (1.2%), nursery practices (1.2%), and other agronomic innovations (0.6%) suggests limited access to production inputs, knowledge gaps, and weak extension outreach systems. This pattern reflects persistent structural constraints in Nigerian agriculture, where access to climate

information, credit, and extension services remains uneven, thereby limiting uptake of transformative adaptation technologies (Ogunfolaju et al., 2026; IPCC, 2023).

Overall, this pattern supports broader evidence that smallholder farmers tend to adopt incremental and low-cost adaptation strategies rather than transformative climate-smart agricultural technologies, largely due to financial, institutional, and informational constraints (IPCC, 2023; Gebrehiwot & van der Veen, 2021).

Conclusion and Recommendations

Conclusion

The study examined the socio-economic characteristics of smallholder crop farmers and the adaptation strategies employed to cope with changing climatic conditions in Imo State, Nigeria. The findings revealed that crop production in the study area is largely dominated by female farmers, highlighting the critical role of women in sustaining household food production and rural livelihoods. The farmers were predominantly middle-aged and possessed considerable farming experience, indicating the availability of practical knowledge that could support adaptation to climate-related challenges. Most respondents had some level of formal education, suggesting a reasonable capacity to understand and adopt improved agricultural practices when adequately supported. The study further showed that the respondents operated on relatively small farm holdings, confirming the dominance of smallholder agriculture in the area. Although household sizes were moderately large and could provide family labour for farming activities, extension contact was generally low, reflecting weak institutional support for agricultural development and climate adaptation. Regarding adaptation strategies, farmers relied mainly on low-cost and easily accessible practices such as early planting, zero tillage, mixed cropping, and the use of hybrid varieties. These strategies demonstrate farmers' awareness of changing climatic conditions and their efforts to minimize production risks. However, the very low adoption of practices such as organic manure application, nursery management, and other climate-smart innovations suggests the existence of constraints related to information access, extension services, and input availability. Overall, the findings indicate that while farmers have adopted several adaptation measures, their adaptive capacity remains constrained by limited institutional and technological support.

Recommendations

1. Government and development agencies should strengthen agricultural extension services to improve farmers' access to climate information and adaptation technologies.
2. Training programmes on climate-smart agricultural practices should be organized regularly to enhance farmers' knowledge and adoption of improved adaptation measures.
3. Input support programmes should promote access to improved seed varieties, organic soil amendments, and other climate-resilient production technologies.
4. Special interventions should target female farmers, who constitute the majority of crop producers, through improved access to credit, training, and productive resources.
5. Farmer-based organizations and cooperatives should be strengthened to facilitate information dissemination, collective learning, and access to adaptation resources.
6. Policies aimed at improving rural agricultural infrastructure and institutional support systems should be implemented to enhance the resilience of smallholder farmers to climate change.

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References

- Adeyemi, O., Adejoh, V., Anjorin, O., Ariyo, O., Makanjuola, B., Sablah, M., & Onabolu, A. (2023). Nutrition capacity assessment of agriculture extension services in Nigeria. *Food and Nutrition Bulletin*, 44(1 Suppl.), S92–S102. <https://doi.org/10.1177/03795721231158417>
- Adeyemo, T. A., & Adeagbo, A. O. (2024). SDG 2 – ending hunger: The effect of Nigeria’s land titling on production output and food security of farming households. *Frontiers in Sustainable Food Systems*, 7, 1290576. <https://doi.org/10.3389/fsufs.2023.1290576>
- Daudu, A. K., Abdoulaye, T., Bamba, Z., Shuaib, S. B., & Awotide, B. A. (2023). Does youth participation in the farming program impact farm productivity and household welfare? Evidence from Nigeria. *Heliyon*, 9(4), e15313. <https://doi.org/10.1016/j.heliyon.2023.e15313>
- FAO. (2023). *Agricultural production in Nigeria: Trends and challenges*. Rome, Italy: Food and Agriculture Organization of the United Nations.
- Food and Agriculture Organization of the United Nations (FAO). (2022). *FAO Action Plan 2022–2025 for the implementation of the FAO Strategy on Climate Change 2022–2031*. Rome: FAO. <https://doi.org/10.4060/cc7014en>
- Gebrehiwot, T., & van der Veen, A. (2021). Farmers’ drought experience, risk perceptions, and behavioural intentions for adaptation: Evidence from Ethiopia. *Climate and Development*, 13(6), 493–502. <https://doi.org/10.1080/17565529.2020.1806776>
- Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the IPCC*. IPCC.
- Isaiah, G. I., Anyiam, K. H., Obi-Nwandikom, C. O., Okoro, F. N., Ukoha, I. I., Anyanwu, U. G., Nwachukwu, E. U., Ejike, O. U., Enoch, O. C., Obasi, A. C., Anyanwu, A. U. T., Madu, J. A., Bala, M. B., & Onwuanuogu, K. C. (2026). Comparative analysis of organic fertilizer use among waterleaf (*Talinum triangulare*) and fluted pumpkin (*Telfairia occidentalis*) vegetable farmers in Owerri West LGA, Imo State, Nigeria. *International Journal of Agriculture and Earth Science*, 12(5), 1–15. <https://doi.org/10.56201/ijaes.vol.12.no5.2026.pg1>
- Mgbenka, R. N., & Mbah, E. N. (2016). A review of smallholder farming in Nigeria: Need for transformation. *International Journal of Agricultural Extension and Rural Development Studies*, 3(2), 1–11. <https://ejournals.org/ijaerds/vol-3-issue-2-may-2016/review-smallholder-farming-nigeria-need-transformation>
- Musa, U. R., Abdullahi, S., & Sulaiman, A. (2023). Farmers assessment of extension services delivery in Bauchi State, Nigeria. *Nigerian Journal of Agriculture and Agricultural Technology*, 3(1), 111–120. <https://doi.org/10.59331/njaat.v3i1.460>
- Ncongwane, K. P., Thakadu, O. T., Chikoore, H., & Mashao, D. (2022). Climate information pathways and farmers' adaptive capacity: Insights from South Africa. *Environmental Development*, 44, 100743. <https://doi.org/10.1016/j.envdev.2022.100743>
- Nwaeboh A. V., & Egwuonwu H. A. (2024). Perceived Effects of Climate Variability on Crop Production in Imo State, Nigeria. *Research Journal of Agricultural Economics and Development* 3(1), 52-60. DOI: 10.52589/RJAED-UZGU3RTQ.
- Ogunfolaju, M. O., Ahmed, T. A., & Ebenehi, O. (2026). Determinants of food insecurity among smallholder farmers in North Central Nigeria: Policy implications. *Frontiers in Nutrition*, 13. <https://doi.org/10.3389/fnut.2026.1790322>

- World Bank. (2024). Women, agriculture and work in Africa. Washington, DC: World Bank Group.
- Yeleliere, E., Antwi-Agyei, P., & Guodaar, L. (2023). Farmers response to climate variability and change in rainfed farming systems: Insight from lived experiences of farmers. *Heliyon*, 9(9), e19656. <https://doi.org/10.1016/j.heliyon.2023.e19656>.