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Arable Crop Farmers' Adaptation Measures To Climate Change In Ohaji/Egbema L. G. A., Imo State, Nigeria

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Abstract

This study assessed arable crop farmers' adaptation strategies to climate change in Ohaji/Egema L. G. A., Imo State, Nigeria using research survey design. The study used descriptive statistics to analyse survey data. Results of the study indicated that majority of the farmers are females (60.8%) and mean age of farmers in the study area was 49 years. The survey result also showed that mean number of years spent in school was twelve years implying that they finished secondary school and could read, write and access information; access to extension service was low in the study area (31.5%).The study revealed that farmers have the knowledge of climate variability and always use adaptation strategies in the study area. The survey result also discovered that the perceived effects of climate change in the study area were reduced yield, reduced income, loss of nutrients due to leaching, increased cost of inputs, high rate of spoilage of farm produce, etc. The research findings further revealed the adaptation measures adopted by arable crop farmers in the study area as use of cover crop/mulching, use of improved/tolerant varieties, mixed cropping, use of disease/pest resistant varieties, use of organic manures, etc. Constraints that militated against the use of adaptation measures include poor extension services, low farm income, high cost of farm inputs, inadequate weather information, etc. It is therefore, recommended that affordable climate change adaptation technologies should be developed for arable crop farmers to adopt

Keywords: *Arable crop, climate change, adaptation strategies, perceived effect*

Introduction: **Nigeria with over 216 million people (National Bureau of Statistics (NBC, 2022)), is the most populated country in Africa and the sixth in the world**. It is the **tenth-largest producer of crude oil in the world** and achieved lower-middle-income status in 2014 (World Food Programme (FAO, 2020). However, around 84 million Nigerians, representing about **37 percent** of the total population, **live below the poverty line ((**Global Network against Food Crises [GNAFC] 2020).Conflict and insecurity, rising inflation and other economic shocks and the impact of the climate crisis continue to drive hunger in Nigeria – with **26.5 million people across the country projected to face acute hunger** in the years ahead (Global Network Against Food Crises [GNAFC] 2020 and Food and Agriculture Organization [FAO] 2024). This is a staggering increase from the 18.6 million food insecure people at the end of 2023 (FAO, 2024). Sono, Wei and Jin (2021) noted that countries in Sub- Saharan Africa, including Nigeria are more vulnerable to the vagaries of climate because of their geographical location, wide spread poverty, low incomes, and low institutional capacity, weak response to climate change effects as well as their heavy reliance on climate-sensitive or rain – fed agriculture.

Recent studies have indicated serious changes in Nigeria's weather patterns and environmental conditions, these changes include: increase in temperatures; heavy rainfall; delayed and shorter rainy seasons; longer rainy seasons; unreliable rainfall patterns; significant decline in amount of rainfall from the normal averages, drought and flooding (Tasie (2021) and Henri-Ukoha and Adesope (2020) which have negatively impacted the lives and livelihoods of smallholder farmers. Climate change has been identified as one of the greatest challenges to the persistent low agricultural productivity amidst myriads of efforts by government and other stakeholders to control it (Nwaiwu *et. al.*, 2013 and Orebiyi, *et al.*, 2014).

These trends in climate change and variability are projected to continue due to increased concentrations of greenhouse gases in the atmosphere (Food and Agriculture Organization [FAO] 2024). Appropriate adaptation to climate change has been recognised as a viable opportunity available for both farmers and the agencies and professionals working with them for raising farmers' yields and incomes in ways that are environmentally sustainable (Abraham et al. 2014). Recent researches have demonstrated that without appropriate adaptation strategies the changing climate can be challenging for agricultural production and food security, but with the implementation of adaptive farming measures and practices, potential challenges to achieving smallholder farmer household food security and income can be significantly reduced (Elijah, Osuafor and Anarah, 2018). Climate variability has brought Nigeria's agricultural system under serious threats and stress. Ohaji/Egbema LGA in Imo State is not left out. A place once known as the food basket of the State is lagging behind due to climate crisis, cattle herdsmen menace and oil bunkering activities (increase in greenhouse gases and land pollution). This implies that food and nutrition security in the area and beyond are under serious threat as arable crop production is a significant aspect of agricultural activities in the area (Kanu and Onyekwere, 2023). Extreme climatic events such as excessive rainfall, droughts and floods, land pollution due oil bunkering or kpor fire and forest fires have become a regular occurrence which results in tragic crop failure, increased hunger, malnutrition, pests and diseases and reduced agricultural productivity (Orebiyi, *et al*., 2014). In the study area, agricultural production is largely non-mechanized; therefore weather and climate variables assume prominence in every stage of production. Farmers depend largely on climate signals as major determinants of their farming activities. Farmers had encountered series of loses as a result of change in climate (Orebiyi, *et al*., 2014). Though, crops like cassava, yam and maize are known to tolerate drought to a reasonable extent, are still adversely affected by the variability in climate. All stages of crop production are affected by the variations in climate. Unfortunately, scientists have it that variations in climate may not be avoided entirely because of inability of countries like Nigeria to stop the emission of green house gases. Therefore the basic way to mitigate it is by building up resilience or adaptation strategies to help farmers cope with the effect of this change. How the arable crop farmers in the study area are adapting to climate change and the adaptation measures used are not known. Bearing the commercial and nutritional importance of arable crops in the study area, it becomes very imperative to inquire as well as identify the climate – smart coping measures used by these farmers in the study area. This will surely help them to cope with the variability in climate thereby enhancing their production activities, income and welfare of farmers. It is against this background that this study assessed the adaptation measures to climate change on arable crop production in Ohaji/Egbema and the climate - smart measures used by the farmers. Considering the above, it is pertinent to assess farmers' adaptation strategies to climate change in Ohaji/Egbema LGA, Imo State, Nigeria. To achieve this, the following research objectives guided the study; ascertain the socio-economic characteristics of the arable farmers in the study area; describe the arable crop enterprise types; ascertain farmers perceived effects of climate change; assess the adaptation measures to climate change used by farmers; Identify the constraints militating against the use of adaptation strategies to climate change by farmers.

Methodology: Study Area: The study was conducted in Ohaji/Egbema LGA in Imo State, Nigeria. Ohaji/Egbema is an agrarian and oil rich local government area of Imo State, Nigeria with headquarters in Mmahu – Egbema. Ohaji/Egbema is made up of seventeen autonomous communities. Ohaji/Egbema LGA lies in the South/Western part of Imo State and shares boundaries with Owerri in the East, Oguta in the North and Ogba/Egbema/Ndoni in Rivers State in the South/West. The people of Ohaji/Egbema are blessed with vast fertile land for agriculture and wildlife, and are mostly farmers, hunters and fishermen. The study used primary and secondary data. Primary data were generated through questionnaire administered to farmers. Secondary data was based on published and unpublished literature. All the 5,740 Agricultural Development Programme (ADP) contact farmers in the study area formed the population of the study. Sample for the study was drawn through a multistage sampling technique. First stage was the identification of the autonomous communities in the study area and there were seventeen autonomous communities in all. In the second stage, ten (10) communities (Umuagwo, Obile, Obitti, Mgbirichi/Alakuru, Opuoma, Assa, Awarra, Umuokanne, Obosima, and Mmahu) were randomly selected from the seventeen (17) autonomous communities in the study area. Thirdly, a list of arable crop farmers was made which formed the sampling frame. In the fourth stage, twelve (12) respondents were randomly selected from each of the ten (10) communities. This gave a total of one hundred and twenty (120) arable crop farmers who served as respondents for the study. Therefore, the sample size of this study is one hundred and twenty arable crop farmers.

The objectives of the study were achieved using descriptive statistics such as frequency, percentages and mean. To identify adaptation strategies to climate change used by farmers, the respondents were asked using a three-point Likert-type scale of always = 3, rarely = 2, never = 1 and to indicate the scale that agreed with their opinion. The mean computation was achieved and a discriminating index was arrived at by dividing the value of the rating scales by the number of scales, thus: (R+O+N)/3 = 3+2+1/3 = 2.0 (discriminating index). Choosing an interval 0.5, upper limit of 2+ 0.5 = 2.5, lower limit = 2- 0.5 = 1.5. All items with $X \geq 2.5$ were considered 'always' while $X < 2.4$ but $X \geq 1.5$ were considered 'rarely' and $X < 1.5$ were considered 'never'. To analyze farmers' perceived effects of climate change, the respondents were asked to indicate their perceived effects of climate change from a list of possible effects of climate change obtained from literature and personal observation measured on a three point Likert-type scale of high = 3, moderate = 2, low = 1. The mean computation will be achieved with the formula: X=f(X)/N

Where:

X = the value by which farmers perceived effects of climate change are to be judged.

f = frequency

$\sum X$ = sum of the various perceived coefficient obtained

N = sample size (120 arable crop farmers)

Grand mean = Sum of means/no. of items

Standard deviation = ∑f(X-X)/N

A discriminating index was arrived by dividing the sum of the value of the rating scales by the number of scales, thus: (H+M+L)/3 = (3+2+1)/3 = 2.0 (discriminating index). Choosing an interval 0.5, upper limit of 2+ 0.5 = 2.5, lower limit = 2 - 0.5 = 1.5. All items with X ≥2.5 were considered 'high' while X< 2.4 but > 1.5 were considered 'moderate' and X<1.5 were considered 'low'.

Results and Discussion: Socio-economic Characteristics of arable crop farmers in Ohaji/Egbema LGA

Table 1: Mean and percentage distribution socio - economic characteristics of arable crop farmers in Ohaji/Egbema LGA

S/N	Variables	Mean/percentage (%)
1.	Age (years)	49.0
2.	Sex (Percentage of females)	60.8
3.	Marital Status (Married in percentage)	88.0
4.	Education (No. of years spent in school)	12.0
5.	Household Size (No. of people)	8
6.	Farming Experience (Years)	17
7.	Membership of cooperative group (percentage of membership)	62.5
8.	Farm Size (hectares)	1.2
9.	Extension Visit (percentage of access)	31.5
10.	Annual farm income (Naira)	832,000

Source: Field Survey, 2024

Table 1 shows the socio – economic characteristics of arable crop farmers in the study area. The results showed that the average age of the farmers' respondents was 49 years. This implies that the farmers were in their active and productive years and could withstand the strenuous processes of climate change adaptation in arable crop farming. Thus, the farmers would therefore be expected to show positive disposition in willingness to use adaptation strategies. This finding agrees with that of Orgu, et al. (2024) who reported that young and middle aged farmers are full of energy to provide what is needed in climate change adaptation and arable crop farming. The result in Table 1 further showed distribution of farmers by sex which indicates that most (60.8%) of farmers were females. The result showed that female farmers dominated arable crop farming in the study area. The survey result also showed the marital status of the farmers (88.0%) and depicts that most of the farmers were married. They will favourably be disposed to embrace technologies that would raise their standard of living such as adaptation strategies to climate change. This finding is in line with that of Tasie (2021), who opined that married women have high responsibility and expectation to meet household demand and could easily adopt technologies that reduce impact of climate change. The result in Table 1 indicates that the average number of years spent in school was twelve years. This shows that the farmers' respondents attended secondary school and were educated enough to easily understand the role technologies play in their farming activities and climate change adaptation which might affect their willingness to use them to increase yield in the study area.

The result revealed that the mean household size of farmers' respondents was eight (8) persons per household. This could be an advantage in terms of supply of free or cheap farm labour. This finding is in agreement with the finding of Ayanlade et al. (2023), who asserts that large household size would increase farm labour supply needed to boost arable crop farming and climate change adaptation to enhance productivity. On farming experience, the result indicated that the mean farming experience as 17 years. This shows that the farmers had been in arable crop production for a long time to know there is climate change and may have been adapting to climate change. The numbers of years in arable crop production should have exposed them to crop production management practices and climate change mitigation and adaptation strategies to boost yield. This finding agrees with that of Orgu, et al. (2024), who opined that the number of years in farming helps to manage the consequences of climate change. The result in Table 1 showed that most of the farmers (62.5%) belong to social organisations (cooperative societies). Social organisations are channels of creating awareness and disseminating vital information about adaptation to climate change and also helps to the pooling of resources together by members to boost output, increase farm revenue and farmers welfare. This finding in tandem with that of Ahmadu and Ewansiha (2023), who averred that cooperative membership help in dissemination of information about climate change and improved technologies to cushion the effect of climate change. The study revealed that only 31.5% of the farmers had extension visits and the visits were not regular. This implies poor agricultural extension services in the study area and this has the potential of depriving farmers' access to the requisite information and knowledge of improved inputs and innovation on climate change adaptation strategies. This finding agrees with Tasie (2021), who avowed that agricultural extension services have capacity to boost farmers' adaptive capacity to climate change.

Lastly, Table 1 avowed that the annual mean farm income of respondents was 832,000 naira. This indicates that arable crop farmers in the study area have relatively high annual farm income which could help the farmers in adoption of innovation and climate change adaptation financing.

Arable crop farmers' enterprise type

Table 2 Distribution of arable crops farmers based on crop enterprise type

Arable Crop	Frequency	Percentage (%)
Cassava	120	100.0
Maize	120	100.0
Vegetables	120	100.0
Yam	58	48.3
Cocoa yam	45	40.0

Source: Field Survey, 2024 Multiple responses recorded

Table 2 showed that all the farmers (100%) cultivated cassava, maize and vegetables. The choice of these crop enterprises could be as a result of the minimal labour requirement and the reduced stress involved in there agronomic practices. These crops can be mixed cropped (co – cultivation) and intercropped with other crops. Farmers practice mixed cropping and intercropping to reduce the risk of crop failure due to environmental and climatic stress. This finding agrees with the finding of Eze (2016), who asserts that mixed cropping is a guard against crop failure.

Arable crop farmers perceived effects of climate change on arable crop farming

Table 3: Perceived effects of climate change on arable crop farming

EFFECTS	High	Moderate	Low	Std Dev.	MEAN	DECISION
Reduced crop yield	80(66.7)	29(24.2)	11(9.2)	1.4	2.57	High
Reduced income	74(61.7)	32(26.7)	14(11.7)	1.3	2.50	High
Loss of farm land to erosion	34(28.3)	37(30.8)	39(32.5)	0.8	1.79	Moderate
Loss of nutrients due to leaching	57(47.5)	41(34.2)	26(21.7)	1.2	2.33	Moderate
Increased pest and disease infestation	50(41.7)	25(20.8)	45(37.5)	1.6	2.67	High
Stunted growth of crops	59(49.2)	40(33.3)	20(16.7)	1.1	2.31	Moderate
Increased water scarcity and drought	52(43.3)	40(33.3)	35(29.2)	1.4	1.93	Moderate
Increased cost of seedlings and other inputs	51(42.5)	39(32.5)	30(25.0)	1.2	2.18	Moderate
High rate of spoilage of farm produce	50(41.7)	35(29.2)	35(29.2)	1.3	1.32	Low
Late maturity of crop	49(40.8)	45(37.5)	26(21.7)	1.4	2.19	Moderate
Changing planting/harvesting dates	71(51.2)	32 (26.7)	17 (14.2)	0.98	2.45	Moderate
					2.02	Moderate

Table 3 showed the distribution of the farmers based on perceived effects of climate change. The Table indicates that reduced yield (X = 2.57), reduced income (2.50) and increased pest and disease infestation (2.67) are the greatest effects of climate change in the study area. The Table implied that some of the perceived effects are high and some moderate. The effects of climate change, therefore brings about the low productivity of arable crops in the study area which leads to low income and low standard of living. This result supports the findings Eze (2016) and Albert and Okidin, (2014), who in their separate studies assert that climate change had brought about low yield of crops.

Adaptation measures to climate chang

Table 4: Arable crop farmers' adaptation measures to climate change in Ohaji/Egbema LGA

Adaptive Strategies	Always	Rarely	Never	Std dev.	Mean	Decision
Use of cover crop/mulching	80(62.5)	30(25.0)	10(8.33)	0.7	2.63	Always
Use of improved/tolerant varieties	79(65.8)	32(26.7)	9(7.5)	0.9	2.67	Always
Mixed cropping	80(66.67)	25(20.8)	15(12.5)	0.8	2.54	Always
Livelihood diversification	83(69.2)	27(22.5)	10(8.33)	0.7	2.60	Always
Use of disease/pest resistant varieties	85(42.5)	30(29.2)	5(21.7)	0.9	2.67	Always
Intercropping	83(69.2)	27(22.5)	10(38.33)	0.7	2.60	Always
Changing planting/harvesting dates	80(66.57)	25(20.8)	15(12.5)	0.9	2.54	Always
Frequent weeding	75(62.2)	40(33.3)	5(4.2)	0.8	2.58	Always
Switching to non-farm activities	78(39.2)	31(25.8)	11(29.2)	0.8	2.56	Always
Planting early maturing varieties	82(68.3)	29(24.2)	9(7.5)	0.7	2.61	Always
Increase in the use of family labour	75(62.5)	30(25.0)	15(12.5)	0.9	2.50	Always
Changing the time of land preparation	77(64.2)	29(24.2)	14(11.7)	0.8	2.53	Always
Use of Organic manures	75(45.8)	38(31.7)	7(16.7)	0.9	2.57	Always,
Use of Pesticide/herbicide	74(61.7)	31(25.8)	15(15.5)	0.7	2.50	Always

Table 4 reveal the adaptation measures adopted by arable crop farmers in Ohaji/Egbema LGA. All the listed measures or technologies were always used by most the farmers as adaptation strategies to cushion the effects of climate change to boost farm output, increase farm income and better their living conditions of the arable crop farmers. This is attributed to the understanding that people sought and have access to information from different sources. This finding is in agreement with Tasie, 2021), who in the study of arable crop farmers' adaptation practices to climate change risks in Rivers State, Nigeria, outlined many adaptation strategies to climate change farmers use to reduce the impact of climate change on the arable crop farming.

Constraint to Farmers Adaptation Strategies to Climate Change

Table 5: Distribution of farmers based on constraints to adaptation to climate change

Constraints	*Frequency	Percentage (%)
Poor extension service delivery	**115**	**95.8**
Low farm income	**117**	**97.5**
High cost of farm inputs	**110**	**91.7**
Poor access to weather information	**112**	**93.3**
Lack of credit facilities	**116**	**96.7**
High cost of farm labour	**95**	**79.2**
Inadequate knowledge of climate change	**97**	**80.8**
Poor access to improved agric. technology	**101**	**84.2**
Inadequate capital	**104**	**86.7**
Poor infrastructural facilities	**87**	**72.5**
Land tenure system	**84**	**70.0**

***Multiple responses**

The result in Table 5 showed the constraints to adaptation to climate change among the arable crop farmers in Ohaji/Egbema LGA. The result in Table 5 indicated that all the constraints were serious constraints because of the high percentage of response for each constraint. The Table revealed that low farm income (97.5%), lack of credit facilities (96.7%), poor extension services (95.8%) and poor access to weather information (93.3%) were the major constraint facing farmers adaptation to climate change in the study area. This finding is in consonance with the study of Eze (2016), who opined that smallholder farmers have very low resource and finance base and as such they are vulnerable to climate variability and lack the capacity to adapt to climate change and also have less likelihood of accessing weather information or capacity to develop technologies on their own.

Conclusion: This study investigated arable crop farmers' adaptation measures to climate change in Ohaji/Egbema LGA. The study adopted survey research design and showed that farmers have the knowledge of climate variability and that there were perceived effects of climate change on arable crop farming such as reduced yield, reduced income, etc. and the farmers always use various measures like use of cover crop/mulching, resistant crop varieties, mixed cropping, intercropping, etc. to adapt to the changing climate in the study area. Constraints that militated against the use of adaptation measures include poor extension services, low farm income, high cost of farm inputs, inadequate weather information, etc.

Recommendations: Based on the result of this study, the following recommendations were made: (1) extension services should be strengthened to enlighten farmers about climate change adaptation measures (2) Affordable climate change adaptation technologies should be developed for resource-poor farmers to adopt (3) climate change adaptation financing should be intensified as a critical pathway to invest in the climate adaptation and resilience efforts of climate vulnerable farmers of the study area and (4) climate and weather information from relevant agencies like Nigerian Meteorological Agency (NiMet) should be disseminated to the farmers through relevant public and private agencies.

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