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Use of Adaptation Strategies to Climatic Change Crop among Farmers in Odogbolu Local Government Area of Ogun-State, Nigeria

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Abstract
Crop production is one of the most important agriculture enterprises vulnerable to climate change. Several studies have assessed the climate change impact on different crops and other livelihood in Ogun state, but Information on adoption strategies employed by crop farmers to climate change in Odogbolu Local Government Area of Ogun State has not been adequately documented. The study therefore examines crop farmers' adaptation strategies to climate change in Odogbolu Local Government Area of Ogun State, Nigeria. A total of 120 farmers were selected through a multistage sampling procedure and data were collected through the use of a well-structured interview schedule. Descriptive statistics such as frequency counts, and percentages and inferential statistics such as the logit regression model were used to analyze the collected data at p=0.05. The results revealed that the majority were within the age range of 31-50 years, (65.0%) male (77%), married (80.0%) and education (90.0%). Many (67.0%) were small-scale farmers, had a household size of 6-10 members (53.0%), (90.0%) were engaged in farming as their primary occupation with 48% having 6-30 years of farming experience and practice, Muslim (54.0%). Radio and neighbouring farmers (24.0% and 50.0%) were the major sources of climate information. Farmers practised continuous cropping to mitigate the adverse effects of climatic change. The logit regression model analysis revealed that the adaptation strategies of respondents to climate change were significantly influenced by farming experience (0.242), farming type (1.759), education (0.503) and household size (0.382). The level of adaptation strategies of crop farmers in the study area was low despite their long years of experience in farming. Government and NGO agencies should provide adequate information on climate change at the grassroots through deliberate extension education and radio campaigns.
***Keywords**: Climate Change, Adaptation Strategies, Crop, Farmers.*

Introduction

Agriculture is the mainstay of the African economy and in Nigeria, it remains the leading employer of labour as it employs two-thirds of the labour force (Noko, 2017) but at the moment it's been threatened by the effect of climatic change on its productivity. Climate change influences crop and livestock production and is another component of the agricultural system. However, the nature of these bi-physical effects and the human responses to them are complex and uncertain (Apata *et al*., 2009). The cropland, pasture and forest that occupy 60% of the earth's surface are progressively being exposed to threats from increased climatic variability and in the long run to climatic change. Cereal (notably millet and sorghum, groundnut and cowpea are dominant crops in the northern part of the country, while the dominant crops in the south are cassava, yam, palm produce, cocoa and rubber. It is a significant sector of the economy and also the source of raw materials used in processing industries as well as a source of foreign earnings for the country. It follows therefore any climate change is bound to affect the agricultural sector in particular and other socio-economic in general. Developing countries are the most adversely affected by the negative effects of climate-induced events because of their low level of adaptation (IFAD, 2010). The estimate for Africa is that 25-45% of species habitat would be lost, affecting both foods and non-food crops. In developing countries like Nigeria, 11% of arable land could be affected by climatic change. In addition, almost 2/3 of Nigeria's land is prone to drought and desertification. Its water resource is under threat which will affect energy sources. Moreover, rain-fed agriculture and fishing activities which a large proportion of Nigeria's population depends upon for food and livelihood are also under serious threat besides the high population pressure of about 140 million people surviving in the physical environment through various

activities within an area of 923,000 square kilometres (IPCC 2007). Adaptation to climate change is an effective measure at the farm level, which can reduce climate vulnerability by making rural households and communities better able to prepare themselves and their farming for changes and variability in climate, avoiding projected damages and supporting them in dealing with adverse events (IPCC, 2001). Understanding how farmers perceive climate changes and what factors shape their adaptive behaviour is useful for adaptation research (Mertz *et al*., 2009; Weber, 2010). To mitigate the effect of climatic change, efforts must be geared towards understanding the local population's perception of climate change and also the strategies adopted in coping with these changes. This research aims to study the use of adaptation strategies to climate change among crop farmers in Odogbolu Local Government area of Ogun State, Nigeria.

Methodology

Area of Study

The study area is Odogbolu Local Government Area of Ogun State. The L.G.A. is located on a large expanse of land of about 640 square kilometres. It shares boundaries at the north with Ijebu Ode and at the south with Epe Local government area. The local government has a population of 200,000 (NPC, 2006). The vegetation of the area is made up of thick forest and the major arable crops grown are maize, cassava, vegetables and cash crops including kolanut and citrus.

Data collection

Data for this study were collected from primary sources through a questionnaire administered to the farmers in the area of study.

Sample Procedure and Sample Size

A multistage sampling procedure was used to select the respondents' farmers for the study. The first stage was a collection list of farming community towns in the local Government area from the Block Extension office in Odogbolu LGA of the Ijebu Zonal Office of Agricultural Development Project. The second stage was a simple random sampling of farming communities from the list provided and from this list four (4) towns (OMU-AJOSE, ALA, IBEFUN, ILADO and OSOSA) were randomly selected. The third stage involved a collection of a list of arable crop farmers associations from the selected town and from this, a total number of 120 farmers were randomly selected and interviewed for the study.

Data Analysis

Descriptive statistics such as frequency and percentage were used to analyze the demographic characteristics and the logit regression model was used to analyze the determinants of farmers' adaptation strategies to climate change in the study area. The explanatory variables used in the logit models are hypothesized as determinants of farmer's level of adaptation strategies to climate change.
X_1 = Age (years), X_2 = Gender (1 = male, 0 = Female), X_3 = Marital status (1 = married, 0 otherwise), X_4 = Education (1), X_5 = Household Size, X_6 = Farming Experience

Results and Discussion

Socioeconomic Characteristics of crop farmers

The socioeconomic characteristics examined were age, sex, marital status, educational level, household size, religion, farming experience, farm type, primary occupation and secondary occupation. The results in Table 1 revealed that 65% of the respondents were within the age range of 31-50 years, which depicts that they are still very active in farming; this finding agrees with Ogunwande (2023) that the farmers are young and active. The majority (77.0%) were males while 22 % were females, this shows that males still dominate the farming activity. The majority (80.0%) were married, 37.0% had primary education, secondary education (43.0%) and higher education (11.0%), while 3% had no formal education. This means the majority of the respondents are literate, this is expected to favourably enable them to encode and decode information from various media on climate change adaptation strategies. The study also revealed that 53% of the respondents had a household size of 6-10 members, which means they may have more hands to help in the farming activities and this will increase productivity, Olajide (2013). Table 1 also reveals that 48% of the respondents had farming experience of 6-30 years and engaged in small-scale farming activities (67%) according to Aminu *et al*. (2023) small scale farmers have limited access to modern agricultural technology, inadequate access to credit, limited exposure to extension service and high input cost. All this can contribute to farmers' inability to cope with the effects of the climate. Apart from the fact that the majority of the respondents (90%) are into farming as a means of livelihood, they also engage in other occupations to augment their income during the off-farming season to fulfil their household financial obligation.

Respondents Types of Farming Activities to Adapt to Change in Climate

The farming activity of the respondents is very important in understanding crop farmers' adaptation to climatic change. Table 2 revealed that 50% of the respondents, practice mixed cropping and the reason behind this is that the farmers want to make good use of the available soil nutrients and also to serve as a risk against any eventuality that happens to any crop. The arable crops grown in the area are; maize, vegetables and cassava. The majority of their farming activities take place in the rainy season (64%), while 37% take place in the dry and rainy season.

Information sources of respondents on climatic change

Results in Table 3 show that 84% of the respondents claim that they had no access to extension services and this is because they are smallholder farmers, smallholder farmers have limited exposure to extension services Aminu *et al*. (2023), while 19% claimed they do have access to extension service. The results of the

analysis, also revealed that 86% of the farmers have no information sources of types messages on expected rainfall and this may be because the majority of the farmers do not have contact with extension agents. Table 2 shows that peers and friends can be greatly utilized to diffuse information on climate change. This result conforms to Aina (1990) findings on information on improved farming practices in Kaduna state. The results of the analysis also revealed that respondents get information through cooperative society, this result agrees with Aminu and Akinbile (2020) that the sourcing of information is also pronounced among associations.

Crop Farmer's Awareness and Effect of Climatic Changes on Crops

Table 4 shows that 75% of the respondents were aware of the change in rainfall pattern and Table 4 also revealed that 35% of the farmers admitted experiencing drought, which may lead to loss of crops, and the reason for that may be they do not take cognizance of it when it occurs. The farmers (14%) acknowledged that they experienced drought from January to May. While 24% of the farmers adduced that drought is caused by an increase in temperature. The effect of drought as adjudged by 87% of the farmers was a decrease in revenue, while 13% admitted no decrease and this may be because they are not aware of the effect of drought on their crops.

Farmer's Adaptation Strategies to Climatic Change

Results in Table 5 reveal that 38% of the farmers in the study area change their planting time or period to prevent unforeseen circumstances that may occur because of climatic change, this agrees with Aminu *et al* (2023) that a record high percentage of farmers change planting date to accommodate the change in the climate. About 11% increase in water conservation techniques by planting crops that can withstand drought conditions. While 22%, adopted other measures such as altering the use of chemicals, fertilizer, irrigation and tillage.

Respondents' Constraint to Adaptation Strategies to Climate Change

Results of analysis in Table 6, revealed that 50% of the respondents lack information on climatic change, while 27% assessed a lack of appropriate technological knowledge to cope with the change as a major constraint.

Analysis of Determinants that Influenced Farmer's Adaptation Strategies

Table 7a shows results from a logit regression. This model is used to analyze binary data, in this case, whether or not the farmers register a particular perception of climate change. This is regressed on a range of variables including farmers, age, sex, marital status, education, household size, farming experience, distance to market, farm type (an indicator for subsistence farming) and whether or not the farmer received any extension advice(climate information). The table limits the analysis for explaining the perception that there has been no change in temperature and no change in precipitation. The result shows that in either case, the coefficient of farming experience is positively and statistically significant at 10%. This indicates that experienced farmers are likely to perceive no change in precipitation and temperature. As experience increases, farmers are more likely to claim that there is less rainfall, more likely to notice changes in the timing of the rains and more likely to notice a change in the frequency of drought. Also significant in Table 7a is the farm type i.e. subsistence farmers are far more likely to notice changes in rainfall. Market distance is also positively signed and statistically significant at 10%. This implies that farmers are likely to get information about climate change in the nearby market from the farmers. Table 7b shows that education also influences the perception of farmers of drought experience. This implies that educated farmers are more informed about drought effects.

Conclusion

This research work revealed that the majority of arable crop farmers are not informed on short-term climatic change or variation. And the few that have the idea of climatic change lack adequate knowledge or the best adaption strategies to cope with these changes. Respondents' level of adaptation strategies was low. The lack of credit facilities, subsidies, improved variety of seeds of crop and extension agents to advise them and keep them informed on future happenings about the climate are factors affecting the crop farmers in the area on how best to adapt to climate change. Therefore, it must be emphasized that while most agricultural adaptation responses to climate events and change will ultimately be characterized by response by government at the national level is necessary especially to encourage research, training and communication concerning the most appropriate adaptive option for the local farmers to make use of. Tables 7a and b limit the analysis for explaining the perception that there has been no change in temperature and no change in precipitation. The results show that in either case the coefficient of farming experience is positively signed and statistically significant at 10%. This indicates that experienced farmers are less likely to perceive no change in precipitation and temperature. As the experience increases, farmers are more likely to notice a change in the frequency of drought. Also significant in Table 7a is the farm type i.e. subsistence farmers are far more likely to notice changes in rainfall. Market distance is also positively signed and statistically significant at 10%. This implies that farmers are more likely to get information about climate change in the nearby market from other farmers.

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Table 1: Respondents Socioeconomic characteristics

Variables	Category	Frequency	Percentage
Age group	< 30 years	18	15.00
	31-40 Years	31	25.00
	41-50 Years	47	40.00
	51-60 years	12	10.00
	61years and above	12	10.00
	Total	**120**	**100.00**
Sex	Female	29	23.00
	Male	91	77.00
	Total	**120**	**100.00**
Marital Status	**S**ingle	14	12.00
	Marriage	96	80.00
	Widowed	10	8.00
	Divorced	0	0.00
Household Size	1 – 5	36	30.00
	6 - 10	63	53.00
	Above 10	21	17.00
Education Level	Primary	45	37.00
	Secondary	51	43.00
	Higher School	13	11.00
	Not Educated	7	6
	Others	4	3.00
Farm Type	Subsistence Type	23	20.00
	Small Scale	81	67.00
Years of Farming	1 – 5 years	26	22.00
	6 - 20 years	8	7
	21 – 30 years	50	41
	Above 30 years	36	30.00
Religion	Christian	52	44.00
	Islam	63	53.00
	Traditional	4	3.00
Primary Occupation	Farming	108	90.00
	Tailoring	6	5.00
	Technician	6	5
Secondary Occupation	Artisan	58	48.00
	Civil Servant	10	8.00
	Health Worker	8	7.00
	None	44	37.00

Source: Field Survey, 2022

Table 2: Respondents Farming Activities to Adapt to Change in Climate

Variables	Category	Frequency	Percentage
Farming System	Shifting Cultivation	17	14.00
	Continuous Cropping	43	36.00
	Mixed Cropping	60	50.00
	Total	**120**	**100.00**
Types of Crop Grown	Maize only	9	7.00
	Cassava only	29	24.00
	Vegetable only	10	8.00
	Maize, Vegetable& Cassava	45	37.00
	Maize, Vegetable, Cassava & Yam	16	13.00
Types of Season Crop	Dry Season Crop	6	5.00
	Rainy Season Crop	77	64.00
	Dry & Rainy Season Crop	37	31.00

Source: Field Survey, 2022

Table 3: Respondent Information Sources on Change in Climate

Variables	Category	Frequency	Percentage
Access to Extension Advice	Yes	19	16.00
	No	101	84.00
	Total	**120**	**100.00**
Types of Extension Agents that Visit Respondents	Government Agency	11	9.00
	Non-Governmental Organization	4	3.00
	No Response	105	88.00
Information on Expected Rainfall	No	104	86.00
	Yes	16	14.00
Other Sources of Information on Climatic Variation	Media	29	24.00
	Neighbouring farmers	60	50.00
	Others	4	4.00
	None	27	22.00
Sources of Credit	Relatives and friends	22	18.00
	Farmers and Cooperative Association	21	17.00
	Commercial Bank & Loan Society	12	11.00
	Others	5	4.00
	No Response	60	50.00

Table 4: Respondents' Awareness and Effect of Climate Change on Crops

Variables	Category	Frequency	Percentage
Rainfall Notice	No	31	25.00
	Yes	89	75.00
	Total	**120**	**100.00**
Time Crops are Planted after these Noticeable Change	January	2	2.00
	February	2	2.00
	March	14	12.00
	April	60	50.00
	May	10	8.00
	Non Respondents	32	21
Time Crops are Planted before these Noticeable Change	February	34	28.00
	March	45	38.00

	April	8	6.00
	October	3	3.00
	Non Respondents	30	25.00
Effect of Excessive Rainfall on Crops	No	15	13.00
	Yes	105	87.00
	Total	120	100.00
Drought Experience	No	78	65.00
	Yes	42	35.00
Period of the Farming Farmers Experience Drought	January	17	14.00
	March	7	6.00
	May	5	4.00
	July	6	5.00
	August	2	2.00
	October	2	2.00
	November	2	2.00
	Non Respondents	79	65.00
Drought Causes	Increase in Sunlight	23	24.00
	Increase in Sun Density	7	8.00
	Deforestation	1	3.00
	Non Respondents	69	65.00
Effect of Drought on Revenue	Yes	92	87.00
	No	8	13.00

Source: Field Survey, 2022

Table 5: Respondents Adaptation Strategies to Climatic Change

S/No	Option	Frequency	Percentage
1	Mixed Cropping	6	5.00
2	Change the time of planting	38	31.00
3	Increase Water Conservation Techniques	13	11.00
4	Other adaptation Measure (use of chemicals, fertilizer, irrigation and tillage)	26	22.00
5	No adaptation	37	31.00

Source: Field Survey, 2022

Table 6: Respondents Constraint to Adaptation Strategies to Climate Change

S/no	Constraint	Frequency	Percentage
1	Lack of information about Climatic Variation	60	50.00
2	Lack of Knowledge of Appropriate Technology	32	27.00
3	Lack of credit or saving	17	14.00
4	No Access to water	7	6.00
5	Lack of Appropriate Seeds	4	3.00
	Total	**120**	**100.00**

Source: Field Survey, 2022

Table 7a: Perception of Precipitation Change

Variables	Coefficient	t - value
Age	-0.004757	0.667763
Sex	-1.265266	1.23441
Marital Status	0.92731	1.391593
Education	-0.372092	0.7071995
Farm Type	1.759309	2.564843*
Household Size	0.3820989	0.2254885
Market Distance	0.650871	2.38933*
Farming Experience	0.2423009	2.1387114*
Extension Advice	0.727604	1.007225
Access to Credit	-0.0000205	0.0000191

Source: Field Survey, 2022. R^2 = 0.4664. Log like hood = 11.420492

Table 7b. Perception of Temperature Change

S/No	Variables	Coefficient	t - value
	Age	-0.745845	0.4419638
	Sex	-0.3722758	0.9120912
	Marital Status	-0.9027138	1.759752
	Education	0.5036411	2.2230034*
	Farm Type	0.762901	0.8176466
	Household Size	-0.781795	0.1194315
	Market Distance	-0.008604	0.157524
	Farming Experience	0.2423009	0.450669
	Extension Advice	0.727604	1.007225
	Access to Credit	-1.61e-06	8.10e-06

Source: Field Survey, 2022. R^2 = 0.3940. Log like hood = -24220719
****** = Significant at 10%, ** = Significant at 5%, * = Significant at 1%***