Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng DETERMINANTS OF USE OF CLIMATE-SMART PRACTICES AMONG ARABLE CROP FARMERS IN UYO AGRICULTURAL ZONE, AKWA IBOM STATE, NIGERIA

\*Okon, U. E., Ernest, I. J. and Udoh, A. N.

Department of Agricultural Economics and Extension, Akwa Ibom State

University, Ikot Akpaden, Mkpat Enin, P.M.B. 1167, Uyo, Akwa Ibom State, Nigeria,

\***Corresponding Authors' Email:** ubokudomokon@aksu.edu.ng Orcid id: https://orcid.org/0000-0002-0518-0093 GSM:+2348030757061

ABSTRACT

The study analyzed the determinants of use of climate-smart practices among arable crop farmers in Uyo Agricultural Zone, Akwa Ibom State, Nigeria. A multi-stage sampling procedure was applied to select 123 respondents. Data were collected using questionnaire and analyzed using simple percentages, mean, standard deviation and the Multinomial Logistic regression analysis. Findings showed that 30.8% of farmers were within the age bracket of 51-60 years with a mean of 40 years. The result show that 98.4% of the farmers were educated and 49.7% attended secondary school. Most (83.8%) of the farmers were female with a mean household size of 6 persons. However, 40.6% of the farmers were experienced with 88.6% engaging in off-farm work. About 76.7% were members of cooperatives and adopted between 5-10 climate-smart practices (90.3%). A total of 17 climate-smart practices were adopted by farmers. These were grouped into four broad categories. Of these, crop management practices were mostly used (63.8%), followed by field management practices (51.2%), while farm risk reduction practices and soil conservation practices accounted for 43.3% and 43.5% respectively. Results of the multinomial logit showed that educational attainment, age of farmer, household size, extension contact, farm size, credit access, monthly income, farming experience, marital status and group membership were among the socioeconomic factors that exerted varying degrees of influences on the choice of different climate-smart practices adopted by arable crop farmers. Hence, it is recommended that policies that will increase access to extension services, encourage cooperative membership, boost farm income, and enhance educational attainment be pursued.

Keywords: Adaptation, Food, Multinomial, Resilience and Sustainable

# **INTRODUCTION**

Agriculture has long been a dominant sector of the Nigerian economy, serving as a major source of livelihood despite the prominence of oil exploration (Afolayan, 2017; Olomola, 2018; Food and Agricultural Organization, 2020). However, the sector is facing significant challenges due to the global impact of climate change, which threatens sustainable food production amidst a growing population (Okon *et al.*, 2018). The adverse effects of climate change, such as rising temperatures, sea levels, changes in rainfall patterns, and the emergence of new pests and diseases, pose new risks to agriculture and food systems globally (Intergovernmental Panel on Climate Change, 2007; Kehinde *et al.*, 2019; Vermeulen *et al.*, 2013; Brida *et al.*, 2013).

The availability of arable land fluctuates due to human and climatic factors such as irrigation, deforestation, desertification, and urban sprawl (FAO, 2007). Climate change, defined by the IPCC (2001) as any change in climate over time due to natural variability or human activity, is expected to decrease the efficiency and resilience of global agricultural production (Gornall *et al.*, 2010; Wang *et al.*, 2018; Etim *et al.*, 2019).

The agricultural sector in Nigeria remains the mainstay of rural livelihoods and is highly weather-dependent, making it particularly susceptible to climate change (Etim *et al.*, 2019; Etim



Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng and Etim, 2020). African countries are especially vulnerable due to their reliance on rain-fed agriculture, high poverty levels, low human and physical capital, inequitable land distribution, and poor infrastructure (Sambo, 2010; Boateng *et al.*, 2017). Farmers are both contributors to and victims of climate change, with agriculture responsible for significant greenhouse gas emissions and deforestation (IPCC, 2007; Chakravarty *et al.*, 2012). In developing countries like Nigeria, unsustainable practices such as slash-and-burn agriculture and over-exploitation of ecosystems exacerbate soil degradation, decrease productivity, and increase food insecurity (Terdoo and Adekola, 2014; Garibaldi *et al.*, 2017).

To mitigate these impacts, farmers are encouraged to adopt Climate-Smart Practices (CSP) that reduce greenhouse gas emissions and build resilience to climate change (Etim *et al.*, 2019; Kehinde *et al.*, 2019). Climate-smart agricultural practices, such as zero tillage, inter-cropping, and agroforestry, aim to sustainably increase productivity and income, adapt to climate change, and reduce emissions (Bernier *et al.*, 2015; Kehinde *et al.*, 2019). Despite the significant challenges posed by climate change, agriculture continues to be a crucial sector for rural livelihoods in Nigeria, highlighting the need for effective climate-smart strategies (Etim *et al.*, 2019; Etim and Etim, 2020).

The relationship between agriculture and climate change is of increasing interest, with projections indicating a decrease in agricultural productivity and food security due to climate change (Emmanuel and Oba, 2019). While agriculture contributes significantly to global emissions, there is insufficient information regarding the determinants of the adoption of climate-smart agricultural practices by rural farmers (Wiederkerh *et al.*, 2018). Factors such as farmers' knowledge, educational level, cultural differences, resource availability, and socio-economic status influence the adoption of new agricultural technologies (Etim and Ndaeyo, 2020).

Again the impact of climate change and pandemics, such as COVID-19 highlights food systems vulnerabilities and interconnections (Thornton *et al.*, 2024) and the enormous pressures being puts on the available natural resources (Okon *et al.*, 2018). Long-term projections suggests that climate change is capable of jeopardizing the attainment of the Sustainable Development Goal (SDGs) number two (2) of zero hunger by 2030. It is imperative for arable crop farmers to adopt climate smart practices for sustainability in their farming operations. There is limited empirical literature on the determinants of the use of climate-smart practices among arable crop farmers in Uyo Agricultural Zone, Akwa Ibom State, Nigeria. This study was designed to bridge this information gap by providing answers to the following research questions; what are the Climate Smart Practices adopted by arable crop farmers in the study area? and what factors influenced the utilization of climate-smart practices by arable crop farmers in the study area?

## MATERIALS AND METHODS The Study Area

The study was conducted in Uyo Agricultural Zone in Akwa Ibom State, Nigeria. Uyo Agricultural Zone consists of the following Local Government Areas; Ibiono Ibom, Itu, Nsit Ibom, Nsit Ubium, and Uyo. As one of the six Agricultural Zones in Akwa Ibom State, the Zone is segmented into 8 blocks which cut across the five local government areas. The area falls within the rainforest zone with an annual rainfall of about 2000mm to 3000mm an annual temperature of about 270°C and a relative humidity range of 70 to 80%. There are two distinct seasons; the dry



Volume 7, Number 4, December, 2024

<u>ISSN (Print): 2651-6144; ISSN (Online): 2651-6365</u> <u>Website: http://www.jasd.daee.atbu.edu.ng</u> season (November-March), and a rainy season (April-October). The economic activities of the inhabitants are farming, trading, crafts, transportation, civil service, and artisans among others. The main crops grown are cassava, oil palm, maize, plantain, cocoyam, okro, fluted pumpkin, water leaf, rice, rubber, and raffia palm. The State has a bimodal rainfall pattern with the rains lasting, on average, for eight to nine months followed by a short dry season. The rains are heavy and begin in March and end in November, peaking in July and September. The weather can also

# support appropriate crops all around the year.

# **Sampling Technique**

A multi-stage random sampling technique was used in selecting respondents. The first stage involved random selection of five (5) blocks from the existing eight blocks that made up the zone. In the second stage, five (5) cells were randomly selected from each of the selected blocks making a total of twenty-five (25) cells. In the third stage, five (5) arable crop farmers were randomly selected from each of the chosen cells making a total of one hundred and twenty-five (125) arable crop farmers. But out of the one hundred and twenty-five (125) questionnaires administered, one hundred and twenty-three (123) were filled and returned which was used for the study.

# **Analytical Technique**

The study adopted both descriptive and inferential statistics. The socioeconomic characteristics of arable crop farmers and the various climate-smart practices adopted by the farmers were analyzed using descriptive statistics such as frequency tables, simple percentages and mean. The estimate of the factors influencing the utilization of Climate Smart Practices adopted by arable crop farmers was analyzed using multinomial logistic regression analysis.

# **Model Specification**

According to Gujarati (2011), a generalized multinomial Logit model is specified as thus:

$$\Pi_{ij} = P_r (Y_{ij} = 1) = \frac{e^{j + \beta_{j} \chi_i}}{\sum_{j=1}^3 e^{j + \beta_{j} \chi_i}} \dots \dots (1)$$

 $Y_{ij} = 1$ , if an arable crop farmer adopt alternative j (j= 1, 2, ..., 5). Where j = 1 (Field management practices); j = 2 (crop management practices); j = 3 (Field risk reduction practices); j = 4 (Soil conservation practices) and j = 5 (No climate-smart practice). The B's is a set of coefficients attached to each alternative; while X's are a set of explanatory variables that determine the respective probability. The dependent variable ( $\Pi_{ij}$ ) represents the probabilities that an arable crop farmer adopts alternatives 1, 2, 3, 4, and 5 respectively. Given our 5 alternatives available to the arable crop farmer, then

 $\Pi_{ij} + \Pi_{ij} + \Pi_{ij} + \Pi_{ij} + \Pi_{ij} = 1 \dots \dots \dots (2)$ 

The set of explanatory (X's) variables that define equation 2 are given below.

EDU = Educational Qualification of a cassava farmer (year)

AGE = Age of a cassava farmer (years)

HHS = Household size of cassava farmer (number of persons)

EXC = Extension contact (Number of times per farming season)

FAS = Farm Size of a cassava farmer (ha)

CREA= Access of credit in the current farming season (Yes=1, No=0)

MOI = Monthly income (Naira)

FAME= Family Experience (Years)

GEN = Gender of a farmer (a dummy, where 1 female and 0- otherwise)



Volume 7, Number 4, December, 2024

<u>ISSN (Print): 2651-6144; ISSN (Online): 2651-6365</u> <u>Website: http://www.jasd.daee.atbu.edu.ng</u> MAR = Marital status of a cassava farmer (a dummy; where I-married and 0-otherwise) GOM = Group membership (Number of years of membership)

## **RESULTS AND DISCUSSION**

## Socioeconomic Characteristics of Cassava Farmers in the Study Area

The result presented in Table 1 shows the socioeconomic characteristics of arable crop farmers in the study area. The age distribution shows that 30.8% and 26.85% of the farmers were within the age bracket of 41-50 years and 51-60 years, respectively. However, 24.4% were above 60 years while 1.6% were within the age bracket of less than 30 with a mean age of 44 years. This implies that farmers in the study area were adult and mature, and were conversant with various effects of climate change on crop production and possess the ability to take appropriate measures to combat its effects to improve arable crop production in the area. This finding agrees with the assertion of Okon *et al.* (2018) that farmers were within the mean age of 40 years and they were more economically active.

Furthermore, the distribution according to educational level reveals that most (98.4%) of the farmers were highly educated. A further breakdown reveals that 49.7% of the farmers had secondary education, 40.6% had primary education, 8.1% had tertiary education and 1.6% had no formal education. The high level of literacy will enhance their level of awareness about climate change and its impact on agricultural production as well as the importance of adopting climate-smart agricultural practices. Henri-Ukoha *et al.* (2020) reported that, level of education of a farmer enhances his ability to understand and evaluate new technologies and practices. This also tallied with Boateng *et al.* (2017), that the educational level of a farmer typically correlates positively with the adoption of technological innovations because of the assumed link between education and knowledge accumulation and the farmer's capacity in decision-making.

Results further revealed that, most (83.8%) of the farmers were female while 16.2% were male. This indicates that arable crop production in the study area was dominated by females. This dominance of females might be due to men's migration out of agriculture for a greener pasture. Etim and Ndaeyo (2020) also reported that, majority (62.5%) of the farmers were female whereas only 37.5% were male. The distribution according to household size indicates that 48.8% of the farmers had a household size of less than 5 persons, followed by 46.3% with 5-10 persons, while 4.9% had a household size of more than 10 persons. This moderate household size might deprive farmers of available labour (both family and hired) necessary for combating climate change effects or boosting arable crop production. This finding contradicts Oyawole *et al.* (2019), who reported a mean household size of nine persons in the study area. This discrepancy could be due to current advocacy for birth control to reduce population growth.

Additionally, most (88.6%) of farmers engaged in off-farm activities, while only 11.4% were solely involved in farming. This implies participants have a broader knowledge base and contacts that can be utilized for effective climate-smart agricultural practices and overall crop production. Henri-Ukoha *et al.* (2020) also reported that 72.14% of farmers were involved in off-farm activities.

### Table 1: Socioeconomic Characteristics of Respondents (n=123)



Characteristic	Frequency	Percentage
Age		
<i>≦</i> 30	20	16.3
31-60	38	30.9
Above 60	65	52.8
Educational level		
No formal education	19	15.5
Primary school	32	26
Secondary school	61	49.6
Tertiary education	11	8.9
Gender		
Male	20	16.3
Female	103	83.7
Household size (Mean = 4.9)		
≦5	61	49.6
6-10	45	36.6
11-15	11	8.9
Above 15	6	4.9
Participation in off-farm work		
Yes	109	88.6
No	14	11.4
Farm size		
Less than 1 ha	9	7.3
1-2 hectares	53	43.1
Above 2 hectares	61	49.6
Farming experience (Mean = 11)		
Less than 5 years	24	19.5
5-10 years	21	17.1
11-15 years	25	20.3
16-20 years	23	18.7
Above 20 years	30	24.4
Access to extension		
Yes	37	30.1
No	86	69.9
Cooperative membership		
Yes	98	79.7
No	25	20.3
Source: Field Survey 2023		

Volume 7, Number 4, December, 2024 ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

Source: Field Survey, 2023



Volume 7, Number 4, December, 2024

# ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

The distribution according to farm size indicates that 49.5% of respondents had a farm size of over 2 hectares, followed by 43.2% with 1-2 hectares and 7.3% with less than 1 hectare. This indicates that arable crop production was conducted on large plots. Larger farm sizes are expected to yield higher crop yields, influencing farmers' income levels and their adoption of climate change adaptation strategies. This contradicts Etim and Ndaeyo (2020), who reported that 50% of farms were less than 1 hectare, 40% between 1 and 2 hectares, and only 10% cultivated more than 2 hectares. The mean farming experience of the farmers was 11 years. The high level of experience is likely to benefit arable crop production due to increased efficiency, specialization, and job perfection. Etim and Ndaeyo (2020) also reported on farming experience in their study.

## Climate-Smart Practices Adopted by Farmers in the study area

The list of climate-smart practices adopted by farmers in the study area is presented in Table 2. A total of 17 climate-smart practice were utilized by farmers. These smart practices were classified into four broad groups following the method adopted by Wekesa (2017). These are field management practices, crop management practices, farm risk reduction practices and conservation practices. Empirical studies have listed these climate-smart practices by Onyeneke 2018; Tarfa *et al.* (2019); Museka (2017); Onyegbala and Oladeji (2017); Okpe and Aye (2015) and Onyeneke *et al.*, (2018) as climate-smart practices adopted by farmers.

Considering field management practices, about 79.9% planted on mounds and ridges, 48.8% used live barriers and 25.2% practised terracing. The high use of mounds and ridges was because of their capacity to control erosion. This is so because of the intense rainfall characterizing the study area which usually results in excessive flooding. The low use of irrigation and terracing was previously reported by Tarfa *et al.* (2019). The study area was characterized by high rainfall that is well distributed which favours the growth of crops and, hence, does not require irrigation practices.

Regarding crop management practices, 94.3% planted on multiple fields, 90.2% changed their planting dates, 77.2% used improved varieties of crops, 47.9% planted crops on tree land while 49.7% and 32.5% reported that they planted cover crops and also integrated legumes into crop plantation, respectively as presented in Table 2. Tarfa *et al.* (2019) and Aboire (2017) reported the high use of crop diversification as climate adaptation practices. Also, the high adoption of changes in planting dates was due to the changes in rainfall patterns. Tarfa *et al.* (2019) previously reported the high use of changing during the planting period as a climate-smart practice. The low adoption of planting cover crops contradicted the finding of Tarfa *et al.* (2019) who reported that most farmers (70.61%) planted cover crops in Imo State, Nigeria. The low planting of trees in cropland was also previously reported by Tarfa *et al.* (2019)

Findings also showed that the most widely utilised risk reduction practices were portfolio diversification (93.5%), followed by cooperative membership (64.2%), use of irrigation (13.8%) and crop insurance (1.6%). The high adoption of portfolio diversification stems from the need to generate extra income that can be used to augment farm income as presented in Table 2. Tarfa *et al.* (2019) reported the high use of portfolio diversification among farm families in Imo State, Nigeria. The high adoption of cooperative membership reflects the increased awareness of farm families on the benefits associated with cooperative membership. The low utilization of insurance policies reveals the low popularity of insurance among farm families in the study area.



Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

As for soil conservation practices, the majority (56.0%) reported that they used fertilizers. This was followed by the use of organic manure (44.7%), mulching (34.9%) and the use of agrochemicals (33.3%) as presented in Table 2. This is an indication that farmers are becoming increasingly aware of the use of fertilizers to boost yields. The low use of mulching and agrochemicals shows the non-popularity of these practices among farmers in the study area. Elsewhere, Tarfa *et al.* (2019) reported the high use of mulching materials (70%) among farmers as an adaptation practice. They attributed its high use to its capacity to conserve soil moisture for plants. However, about 18 respondents did not adopt any of the climate-smart practices in the study area.

Climate Smart Practice	*Frequency	%	Mean %
Field Management Practices			
Use of terraces	31	25.2	
Planting on mounds/ridges	98	79.7	
Use of live barriers	60	48.8	
Total	189		51.2
Crop Management Practices			
Use of improved varieties of crops	95	77.2	
Integrating legumes into crop rotation	40	32.5	
Planting of cover crops	50	40.7	
Changing of panting dates	111	90.2	
Planting in multiple fields	116	94.3	
Planting of crops on tree land	59	47.9	
Total	371		63.8
Farm Risk Reduction Strategies			
Portfolio diversification	115	93.5	
Use of irrigation	17	13.8	
Crop insurance	2	1.6	
Cooperative membership	79	64.2	
Total	213		43.3
Soil Conservation Practices			
Use of fertilizer	70	56.9	
Use of organic/compost manure	55	44.7	
Mulching	43	34.9	
Use of Agrochemicals	41	33.3	
Total	209		42.7
Note: * signify multiple responses.	Source: Field survey data 2023		

 Table 2: Climate Smart Practices Adopted by Farmers (n=123)

# Most Adopted Climate Smart Practices in the Study Area



Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

Further examination of the four broad categories of climate-smart practices as presented in Table 3 show that crop management practices were ranked  $1^{st}$  as the most adopted practice (63.8%), followed by field management practices (51.2%), which was ranked  $2^{nd}$ . However, the use of risk reduction practices (47.3%) and soil conservation practices (42.5%) was ranked  $3^{rd}$  and  $4^{th}$ , respectively. The overall mean utilization percentage was 51.2%. This showed a moderate adoption of climate-smart practices among farmers in the study area. The mean percentage utilization (51.2%) for the use of field management practices was lower than the (78.13%) reported by Tarfa *et al.* (2019) and Onyeneke *et al.* (2018) in their studies, respectively.

Climate-smart practice	Mean	Rank
Field management practices	51.2	2 <sup>nd</sup>
Crop management practices	63.8	1 <sup>st</sup>
Farm risk reduction practices	47.3	3 <sup>rd</sup>
Soil conservation practices	42.5	4 <sup>th</sup>
Grand mean percentage utilization	51.2	5 <sup>th</sup>
Source: Computed using field survey data 2023		

# Table 3: Most Adopted Climate Smart Practices in the Study Area

**Determinants of Farmers' Utilization of Climate Smart Practices** 

Table 4 presents the MNL estimates for the effects of farmers' socioeconomic factors on their option of climate-smart practices in the study area. These were grouped following the method of Wekesa (2017) into four broad categories: field management practices, crop management practices, farm risk reduction strategies, and soil conservation practices. From the result, the log-likelihood chi-square (1137.11) was significant at a 1% probability level (p<0.01) and denoted the strong explanatory power of the estimated model. The McFadden R<sup>2</sup> was 0.814, showing that the variables in the model account for about 81.4% variability in the utilization of climate-smart practices.

From the result, the education coefficient was positive and significant across the utilization of all the climate-smart practices. This implied that the utilization of climate-smart practices would increase with increasing levels of farmers' education. Educated farmers are always well informed to easily know and appreciate the benefits associated with the use of climate-smart practices than their illiterate counterparts. This finding agrees with those of Onyenekwe *et al.* (2016) who reported that education was associated with the adoption of climate-smart practices.

The age coefficient was negative across all the utilization of all the climate-smart agricultural (CSA) practices but was only significant for crop management practices (p<0.01) and soil conservation practices (p<0.01). This is likely because older farmers are often risk-averse. Benier *et al.* (2015) reported that age reduces the adoption of climate-smart practices. Boansi *et al.* (2017) also found that the age of farmers negatively and significantly reduced the use of improved technology, portfolio diversification, and changes in planting dates as climate-smart practices. However, this finding conflicts with those of Challa and Tilahun (2014), who reported that the use of climate-smart practices increases with an increase in a farmer's age.



Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

The estimated coefficient for household size generated mixed results. While it was negative and reduced the utilization of field management practices, risk reduction practices, and soil conservation practices, it had a positive significant influence on the adoption of crop management practices at a 1% level (p<0.01). This positive relationship aligns with the findings of Teklewold *et al.* (2016), who reported that large household size was positively correlated with the adoption of improved seeds, water management, and efficient use of inorganic fertilizer. Tarfa *et al.* (2019) also found that higher household sizes increased the adoption of soil conservation practices and the planting of trees. Conversely, Tarfa *et al.* (2017) reported that increasing household size reduced the use of changes in planting dates and land management strategies.

The variable for extension contact was positive across the utilization of all the climatesmart practices but was only significant for the adoption of field management practices (p<0.05), crop management practices (p<0.01), and soil conservation practices (p<0.01). This is expected because extension services are meant to improve productivity and address farming challenges, thereby boosting the adoption of such services, some of which are climate-smart practices.

Farm size was positive across the adoption of all the practices but was significant for field practices (p<0.01) and risk reduction strategies and practices (p<0.05). Possession of a secured ownership title (p<0.01) will increase farmers' zeal toward experimenting with new climate-smart practices, thus influencing their usage. This finding is consistent with those of Taría *et al.*, (2016), who found a positive relationship between larger farm sizes and the adoption of soil conservation practices, adjusting planting dates, and farmland management.

The estimated variable for access to credit was positive and significantly influenced the adoption of all the risk-smart practices. Access to credit boosts farmers' liquidity position, enabling them to afford costly practices such as building irrigation facilities and procuring seedlings and improved seeds. Kassie (2017) reported that most climate-smart practices are costly and require substantial finances. This finding agrees with those of Tarfa *et al.* (2019), who found that credit access was positively correlated with the adoption of improved farm practices, portfolio diversification, the planting of trees, and the procurement of agrochemicals, fertilizers, and seedlings.

The monthly income coefficient was positive and significant across the utilization of all the climate-smart practices. Farmers with higher incomes can afford more costly climate-smart practices than their poorer counterparts. This finding supports those of Tarfa *et al.*, (2019) and Kassie (2017).

The coefficient for gender was positive across all the climate-smart practices. It was significantly related to the use of field management practices (p<0.01), risk reduction strategy (p<0.01), and soil conservation practices (p<0.01). This finding shows that increasing gender inclusivity among farmers will increase the adoption of climate-smart practices, aligning with the findings of Wekesa (2017).

The coefficient for group membership was positive and increased the use of all the climatesmart practices. It was significant for field management practices, risk reduction practices, and soil conservation practices. Membership in groups exposes farmers to various channels of information and extension services, modifying their attitudes and leading to higher adoption rates of climate-



Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

smart practices. Tarfa *et al.* (2019) found that group membership enhanced the adoption of improved crop varieties, and Mulwa *et al.* (2017) supported these findings.

	le 4: Determinants of utilization of climate smart practices by arable crop farmers in the
Study Area	dy Area

TI	Field Management Practices	Crop Management Practices	Risk Reduction Practices	Social Conservation Practices
Intercept	42.10 (14.2)***	34.61 (3.6)***	17.20 (2.4)**	18.20 (1.89)
Education	9.018 (2.46)**	10.003 (5.66)***	33.026 (2.18)**	16.005 (1.93)
Age	-22.006 (1.14)	16.02 (2.25)**	-26.004 (3.08)***	-11.002 (1.89)
Household Size	-18.009 (2.53)**	-21.003 (3.92)***	14.023 (0.65)	-23.022 (1.06)
Extension Contact	20.01 (20.08)**	16.02 (11.24)***	32.013 (0.65)	6.116 (2.46)**
Farm Size	32.016 (3.82)***	6.005 (0.66)	20.001 (3.72)***	18.027 (2.02)**
Credit Access	19.04 (2.44)*	32.001 (6.102)***	18.009 (2.04)**	5.006 (1.841)
Monthly Income	3.018e-05 (1.98)*	2.208e-05 (2.43)**	7.62e-06 (8.16)***	1.61e-04 (2.04)**
Farming Experience	27.04 (1.13)	12.016 (0.82)	17.007 (1.14)	28.002 (0.98)
Gender	32.013 (6.34)***	16.006 (1.112)	26.032 (9.01)***	31.038 (4.04)***
Marital Status	17.964 (1.04)	-23.42 (0.77)	-16.43 (0.96)	11.40 (1.06)
Group Membership	14.242 (2.05)** No Climate Smart	28.602 (2.44)** No Climate Smart	8.083 (1.94)* No Climate Smart	22.860 (1.10) No Climate Smart
Base Category	Practice	Practice	Practice	Practice
McFadden R2	0.814	0.814	0.814	0.814
LR CHF(X <sup>2</sup> )	1137.11***	1137.11***	1137.11***	1137.11***

**Note:** \*\*\*, \*\*, and \* signify significant at 1%, 5%, and 10% levels respectively. **Source:** Computer printout STATA

# CONCLUSION AND RECOMMENDATIONS

The study examined the various climate-smart practices and their determinants among arable crop farmers. Findings have shown that the adoption of climate-smart practices was low with crop management practices being the most widely adopted. From the study, the adoption of climate-smart practices was affected by farmer's age, educational attainment, household size, extension contact, credit access, monthly income, gender, as well as group membership. Hence, the study concluded that there was greater awareness and adoption of a wide range of climatesmart practices by farmers in the study area.

Based on the research findings, the following recommendations are offered:

i. Access to extension services was found to enhance the choice of all the climate-smart practices; hence, policies that will encourage extension access should be pursued. Such policies should include training and deploying more extension personnel to rural areas to sensitize farmers on the benefits associated with the use of climate-smart practices.





# Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

- ii. The formation of groups such as cooperatives should be encouraged among farmers as a way of accessing climate-smart agricultural information.
- iii. Some arable crop farmers did not adopt any of the climate-smart practices; hence, adequate enlightenment and sensitization campaigns should be carried out to educate farmers on the benefits associated with the adoption of climate-smart practices in the study area.
- iv. Education attainment was also found to enhance the utilization of all the climate-smart practices; hence, policies that will boost farmers' education should be pursued. Such measures include encouraging farmers' enrolment in evening schools and satellite campuses. Also, farm-based training, workshops, and seminars should be periodically organized for farmers as a way out.

#### REFERENCES

- Bernier, Q., Meinzen-Dick, R., Kristjanson, P., Haglund, E., Kovarik, C., Bryan, E., Ringler, C. and Silvestri, S. (2015). Gender and Institutional Aspects of Climate-Smart Agricultural Practices: Evidence from Climate-Smart Villages of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen: CCAFS. Available online at: <u>http://www.ccafs.cgiar.org</u>
- Boansi, D., Tambo, J. A. and Miller, M. (2017). Analysis of farmers' adaptation to weather extremes in West Africa. *Climate and weather extremes*, 16: 1-13. doi: <u>https://doi.org/10.1016/j.wace.2017.03.001</u>
- Boateng, K. K., Obeng, Y. Y. and Mensah, E. (2017). Rice cultivation and greenhouse gas emissions: review and conceptual framework with reference to Ghana. *Agriculture*, **7**(1): 1-7.
- Brida, A. B., Owiyo, T. and Sokona, Y. (2013). Loss and damage from the double blow of flood and drought in Mozambique. *International Journal of Global Warming*, **5**(4):514-531.
- Emmanuel, A. A. and Oba, O. E. (2019). Assessment of the Use of Climate Smart Agricultural Practices among Smallholder Farmers in Ogun State. *Acta Scientific Agriculture*, **3**(6):47-56.
- Etim, N. A. A., Etim, N. N. and Udoh, E. J. (2019). Climate-smart agriculture practices by rural women in Akwa Ibom State, Nigeria: Adoption choice using Multinomial Logit Approach. *Makerere University Journal of Agriculture and Environmental Sciences*, **8** (1):1-19
- Etim, N. A. and Ndaeyo, N. U. (2020). Adoption of Climate Smart Agricultural Practices by Rice Farmers in Akwa Ibom State, *Nigeria Journal la life science*, **1**(4):20-30.
- Etim, N.A. and Etim N.N. (2020). Rural Farmers' Adaptation Decision to Climate Change in Niger Delta Region, Nigeria. In: Leal Filho W. (eds) Handbook of Climate Change Resilience. Springer, Cham, 1-15. https://doi.org/10.1007/978-3-319-71025-9 100-2
- FAO (2007). The State of Food and Agriculture: Paying Farmers for Environmental Services. Agricultural Development Economics Division (ESA), FAO, Rome. www.fao.org/docrep/010/a1200e/a1200e00.htm
- FAO (2013). Climate-Smart Agriculture Sourcebook. Rome, Italy. Retrieved from http://www.fao.org/docrep/018/13325e/i3325e00.html
- FAO (2020). FAO Statistical Programme of Work 2020-2021. Rome. https://doi.org/10.4060/ca9734en
- Food and Agriculture Organization (F.A.O.) (2007). Adaptation to Climate Change in Agriculture, Forestry and Fisheries: Perspectives, Framework and Priorities. FAO, Rome, Italy.
- Garibaldi, L. A., Gemmill-Herren, B., D'Annolfo, R., Graeub, B.E., Cunningham, S.A. and Breeze, T.D. (2017). Farming Approaches for Greater Biodiversity, Livelihoods, and Food Security. *Trends in Ecology and Evolution*, **32**(1):68-80.
- Gornall, J., Betts, R., Burke, E., Clark, R., Camp, J., Willett, K. and Wiltshire, A. (2010). Implications of climate change for agricultural productivity in the early twenty-first century. Philosophical Transactions of the Royal Society B: Biological Sciences.
- Henri-Ukoha, A. (2020). Assessment of the viability of climate adaptation strategies of cassava-based farmers in Southern Nigeria. *Journal of Agriculture and Food Sciences*. **18**(1):105-117.
- Intergovernmental Panel on Climate Change (IPCC) (2001). Impact, Adaptation and Vulnerability. Contribution of Working Group II of the Intergovernmental Panel on Climate Change to the Third Assessment Report of IPCC. Cambridge University Press. London.



## Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

- Intergovernmental Panel on Climate Change (IPCC) (2007). Contribution of Working Group II to the Fourth Assessment Report of IPCC. Summary for policymakers. Retrieved on December 29, 2017. From http://www.ipcc.ch/pdf/assessment5pm.pdf.-report/ar4/ng2-
- Intergovernmental Panel on Climate Change (IPCC) (2007). Impact, Adaptation and Vulnerability. Contribution of Working Group I of the Intergovernmental Panel on Climate Change to the Third Assessment Report of IPCC. Cambridge University Press. London.
- IPCC, (2014). Summary for policymakers. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.
- IPCC. (2007). Climate Change 2001: Impacts, Adaptation and Vulnerability, Contributions of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York.
- IPCC. (2001). Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2011; p. 881.
- Kehinde, M. O., Shittu, A. M. and Osunsina, I. O. O. (2019). Willingness to accept incentives for a shift to climatesmart agriculture among lowland rice farmers in Nigeria. *Nigerian Journal of Agricultural Economics*. 9(1):29-44.
- Mulwa, C., Marenya, P., Rahut, D. B. and Kasssie, M. (2017). Response to climate risk information, household demographic and farm characteristics climate risk management 16: 208-221. https://doi.org/10.1016j. 2017.01.002.
- Nyasimi, M., Amwata, D., Hove, L., Kinyangi J. and Wamukoya, G. (2014). Evidence of impact: Climate-smart agriculture in Africa. CCAFS Working Paper no. 86. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available at: http://ccafs.cgiar.org/publications/evidence-impact-climate-smart-agricultureafrica
- Ojoko, E. A., Akinwunmi, J. A., Yusuf, S. A. and Omobowale, A. O. (2017). Factors influencing the level of use of Climate Smart Agricultural Practices (CSAPs) in Sokoto State, Nigeria. *Journal of Agricultural Sciences*, 62(3): 315-327
- Okon, U. E., Agom, D. I., Ukpe, O. U. and Amusa, T. A. (2018). Effective Choice of Livelihood adaptation strategies to Climate Variability: Empirical evidence from rural farm households in Akwa Ibom State, Nigeria. *International Journal of Development and Sustainability*. 7(6):1992-2003.
- Okpe, B. E. and Aye, G. C. (2015). Adaptation to climate change by farmers in Markurdi Nigeria. *Journal of Agriculture and Ecology Research* http://dx.doi.org/10.9734/JAERI/2015/12169 International, 2 1: 20-57
- Olomola, A. (2018). Financial Stimulus and Performance of the Commercial Agricultural Credit Scheme (CACS) in Nigeria, 2018 Conference, July 28-August 2, 2018, Vancouver, British Columbia 277445, International Association of Agricultural Economists.
- Onu, A. D., Tologbonse, E. B., Adeniji, O. B. and Ejechi, M. E. (2014). Analyses of determinants of adaptation to climate change among arable crop farmers in the Federal Capital Territory, Abuja. *Nigeria Agricultural Journal*, 45(1):54-64.
- Onyeneke, R. U., Igberi, C. U., Uwadika, C. O. and Aligbe J. O, (2018). Status of Climate Smart Agriculture in South East Nigeria. *Geojournal* **83**(2):333-346 http://doi.org/10.007/510708-017-9773-2
- Onyeneke, R. U. (2018). Challenges of adaptation to climate change by farmers in Anambra State, Nigeria. *International. Journal of Bioscience, Agriculture and Technology*, **9**(1):1-7.
- Oyawole, F. P., Dipeolu, A. O., Shittu, A. M., Obayelu, A. E. and Fabunmi, T. O. (2019). What drives the adoption of climate-smart agricultural practices? Evidence from maize farmers in northern Nigeria. *Nigerian Journal of Agricultural Economics*. **9**(1):14-28.
- Sambo, M. N. (2010). Climate Change in Kaduna State. Paper presented at the second Lagos State Summit on Climate Change. 4th May.
- Tarfa, P. Y., Ayuba, H. K., Onyeneke, R. U., Idris N., Nwajiuba, C. and Igberi, C. (2019). Climate Change perception and Adaptation in farmers in Nigeria's Guinea Savannah, Empirical Evidence from Nigeria. Applied Ecology and Environment Research, 17(3):7085-7112



Volume 7, Number 4, December, 2024

ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng

- Terdoo, F. and Adekola, O. (2014). Assessing the role of climate-smart agriculture in combating climate change, desertification and improving rural livelihood in Northern Nigeria, *African Journal of Agricultural Research*, 9(15):1180-1191.
- Thornton, P., Croz, D. M., Kgler. C. Remans, R., Zornetzer, H. and Herrero, M. (2024). Enabling Food System Innovation: accelerators for change. *Global Food Security*, 40, 1-13.
- Vermeulen, E. W. and Zougmore, R. (2013). Beyond climate-smart agriculture: toward safe operating spaces for global food systems. *Agricultural Food Security*. **2**(12):1-6.
- Wang, J., Vanga, S., Saxena, R., Orsat, V. and Raghavan, V. (2018). Effect of climate change on the yield of cereal crops: A review. *Climate*, 6(41):1-19.
- Wekesa, B. M. (2017). Effect of climate-smart agricultural practices on food security of small-scale farmers in Teso North sub-county, Kenya. Department of Agricultural Economics and Agri-Business Management, Egerton University.