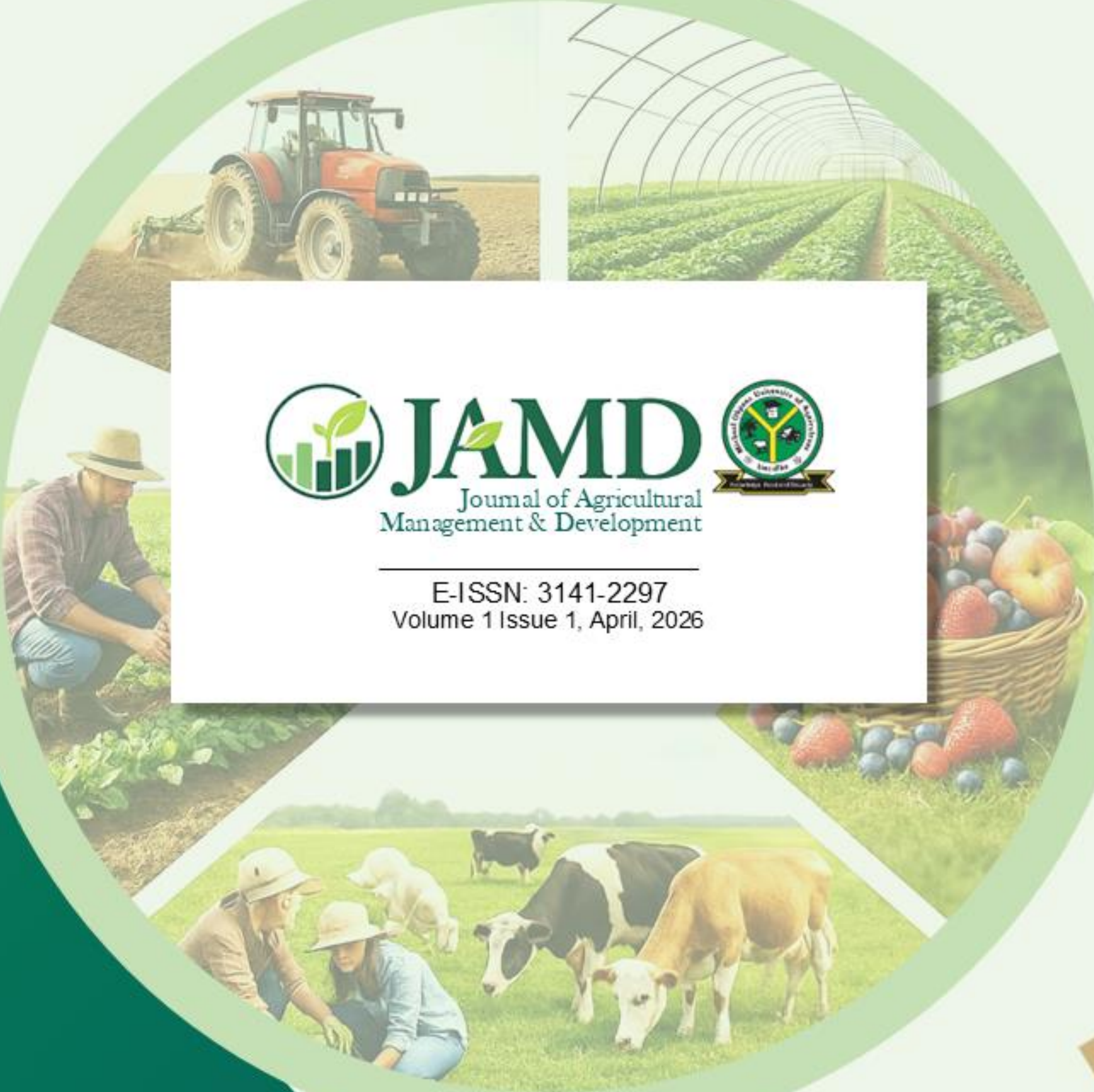


JAMD

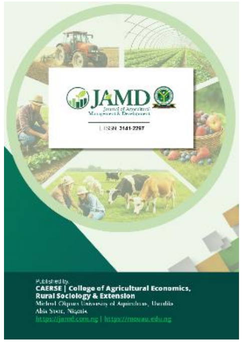
Journal of Agricultural Management & Development

E-ISSN: 3141-2297
Volume 1 Issue 1, April, 2026

ISSN 3141-2297
9 773141 229005

Published by:
CAERSE | College of Agricultural Economics, Rural Sociology & Extension
Michael Okpara University of Agriculture, Umudike
Abia State, Nigeria
https://jamd.com.ng | https://mouau.edu.ng

JAMD Journal of Agricultural Management & Development



Journal of Agricultural Management & Development
E-ISSN: 3141-2297
Volume 1 Issue 1, April, 2026

Assessment of the Effects of Climate Change Mitigation Practices Among Arable Crop Farmers in Ideato North Local Government Area, Imo State, Nigeria

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Keywords:
Climate Change, Mitigation, Farmers, Ideato North

Journal homepage: www.jamd.com.ng

ABSTRACT

The study assessed the effects of climate change mitigation practices among arable crop farmers in Ideato North LGA, Imo State, Nigeria. The specific objectives of the study were to identify the socio-economic characteristics of the respondents; ascertain the adaptive and mitigating measures used by farmers; ascertain the perceived effect of climate change. Purposive and multi-staged random sampling techniques were used to select a sample size of 64 respondents who are involved in arable crop production and affected by climate change. Data were collected with a structured questionnaire, and analysed using descriptive and inferential statistics (tobith regression analysis). Results show that majority of the respondents were female, over 50% of the farmers were married, majority of the farmers acquired primary education. The result revealed that regular weeding X=4.57, use of water channels X=4.45, use of organic manure X=4.46 were the major adaptive measures used. In the perceived effects, the result revealed that destruction of wild life X=4.56, drying of streams early X=4.44 affected the farmers. The tobith regression estimate of the influence of socioeconomic characteristics of the knowledge of climate change, the chi-square value of 6.48.464 confirms the fitness and it is statistically significant at 1% level which affirms the significant relation of the dependent and independent variable. For socio-economic of climate change adaptive mitigation, the chi-square value of 807.945 confirms the fitness and significant at 1% level and the variables are positively related. The study therefore concludes that the famers were conversant with adaptive mitigation of the climate change and thereby has derived means to cope with the climate change. The study therefore recommend that efforts should be shown by governments, NGOs, individuals to acquaint and educate famers on how they will cope more on the climate change related issue.

Introduction

Climate change has intensified the frequency and severity of extreme weather events, such as droughts, floods, storms, and heat waves, posing significant challenges to farmers worldwide (Ekweanya, Anyanwu, Odoh and Ifenkwe, 2021). In response, farmers are adopting various strategies to mitigate risks, enhance preparedness, and adapt to changing environmental conditions (Ifeanyi-Obi and Iwuagwu, 2022). Farmers play a central role in managing agricultural risks and adapting to climate variability. Their knowledge, experience, and adaptive capacity are essential for devising effective strategies to cope with climate change-related disasters. Climate change-related disasters encompass a wide range of extreme weather events and environmental phenomena that are exacerbated or influenced by global climate change. These disasters pose significant threats to human well-being, infrastructure, ecosystems, and économies, with profound implications for sustainable development, social equity, and planetary health (Rodriguez, and Smith 2023). Understanding the nature, causes, impacts, and responses to climate change- related disasters is crucial for enhancing resilience, mitigating risks, and promoting adaptive strategies at local, national, and global scales. Farmer-led preparedness encompasses a holistic and proactive approach to managing climate change-related risks and uncertainties in agriculture Ifeanyi-Obi, Issa, (2022), AFDB, 2021). It was also, noted that Nigeria specifically ought to be concerned by climate change because of the country's high vulnerability due to its long (800km) coastline that is prone to sea-level rise and the risk of fierce storms. In addition, almost 2/3 of Nigeria's land cover is prone to drought and desertification. Its water resources are under threat which will affect energy sources (like the Kainji and Shiroro dam). Moreover, rain-fed agriculture practiced and fishing activities from which 2/3 of the Nigerian population depend primarily on foods and livelihoods are also under serious threat besides the high population pressures of 140 million people surviving on the physical environment through various activities within an area of 923,000 square kilometers (IPCC 2017; NEST 2022). To approach the issue appropriately, one must take into account local communities' understanding of climate change, since they perceive climate as having a strong spiritual, emotional, and physical dimension. It is therefore assumed that these communities have an inborn, adaptive knowledge from which to draw and survive in high-stress ecological and socio-economic conditions. Thus, the human response is critical to understanding and estimating the effects of climate change on production and food supply for ease of adaptation. Accounting for these adaptations and adjustments is necessary in order to estimate climate change mitigations and responses.

Although the agricultural sector is being transformed by commercialization at the small, medium and large-scale enterprise levels, the country is still faced with a number of constraints. According to International Food Policy Research Institute (IFPRI) (2018), the constraints include poor agricultural pricing and low fertilizer use, low access to agricultural credit, land tenure insecurity and land degradation, poverty and gender issues, low and unstable investment in agricultural research as well as poor market access and marketing efficiency. In addition to these, climate and weather parameters have consistently been changing. Climate refers to the average or typical weather conditions observed over a long period of time (usually over 30 years) for a given area (Spencer, 2019). The classical period is 30 years as defined by the World Metrological Organization (WMO). Climate encompasses the statistics of temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric partial count and other metrological elemental measurement in a given region. On the other hand, climate change is a significant and lasting change in the statistical distribution of weather patterns over period ranging from decades to millions of years (World Bank (2021). Climate change and Agriculture are inter-related processes, both of which take place on a global scale. Global warming is projected to have significant impacts on conditions affecting Agriculture. These conditions include temperature, carbon dioxide, glacial run off, precipitation and their interactions are of significant importance. These changes in climate have had negative effects on agriculture over the years with arable crops not left out. Between 2016 and 2023, world grain production has stabilized over 1.8 billion tones. From 2018 to 2023, grain stocks have been dropping, resulting in a global grain harvest that was short of consumption by 93 million of tons in 2003 (World Bank, 2021). There has also been a reduction in harvest of these crops.

It has been predicted that the resultant increase in temperature due to climate change will accelerate physiological development resulting in hastened maturation and reduced yield (Bassey, C.E., 2023). It is also a well-known fact that the occurrence of moisture stress resulting from drought, during flowering, pollination and grain filling is harmful to most arable crops. Growing seasons are expected to become shorter as temperature increases e.g. rice yield starts decreasing at over 340c. It has also been noted that food production in Africa could half by 2030 (IPCC, 2021). Furthermore, extreme weather events (climate change) such as thunder storm, flood, heavy rainfall and heavy wind are detrimental to agricultural activities in crops, livestock and humans. These often lead to failure of crops and incidence of pests and diseases due to migration in response to climate change and variations. Nigeria is an Agrarian Economy with 75% small farmers accounting for the nation's agricultural output (Bello, 2023). Most of these farmers depend solely on the natural weather conditions for production and therefore need effective adaptive and mitigating measures to cope with these changes. The Imo state ADP and intervention programmes like National Fadama Development Project (NFDP), National Programme for Food Security (NPFS) and NGOs are in place to deliver extension services to farmers in all aspects of agriculture. However, it could not be categorically stated that they disseminate climate change adaptation and mitigation practices/information to farmers particularly on arable crops. Hence, this study is conducted to assess the climate mitigation practices among arable crop farmers in Ideato North LGA, Imo State, Nigeria. The objectives of the study were to describe the socio-economic characteristics of arable crop farmers in the study area; ascertain the adaptive and mitigating measures used by farmers on climate change; and ascertain the perceived effects of climate change by farmers.

Hypothesis

H0$_1$: There is no significant relationship between respondent socio-economic characteristics and the perceived effect of climate change.

Methodology

The was conducted in Ideato North Local Government Area of Imo state. It is one of the twenty-seven local government areas that made up Imo state. It was initially established in 1976 as Ideato Local Government, but was later sub-divided into Ideato North and Ideato South. In terms of education, they have advanced educated personnel in virtually all fields of endeavour. That is why some of them are civil servants and self-employed. Some of the areas are characterized by inadequate and deteriorated road walkways, unregulated building patterns, poor sanitation, noise pollution and overcrowding as a result of human migration. Ideato North local government area is located within the Orlu agricultural zone of Imo state. It is located on longitude 5o 48′21.89" N and latitude of 7o 08′ 20.62" E. It has an area of 88km2 and had a population of 159,879 at the 2006 census. The people of the area are known for their crafts, apprenticeship, and farming. They produce cash crops such as oil palm, raffia palm, groundnut, cotton, cocoa, rubber. The food crops grown in large quantities include cassava, cocoyam, breadfruits, yam, maize, melon, and trifoliate yam. The population for this study comprised of arable crop farmers in Ideato North LGA, Imo State, Nigeria. Multi-stage sampling procedure were used to select arable crop farmers. Firstly, four (4) communities were purposively selected because of the farming activities in the area. Secondly, a random sampling procedure was used to select two (2) villages from the communities under study making a total of eight (villages). In the third stage, eight (8) arable crop farmers were randomly selected from each of the villages, giving a total 64 respondents. Data for this study were collected from primary and secondary sources. The primary source of data was mainly the use of a structured questionnaire which was designed to elicit information on an assessment of climate change mitigation practices among arable crop farmers in Ideato North LGA, Imo State, Nigeria. The secondary source of data collections were textbooks, journals and scholarly materials. Data for this study were analysed using descriptive and inferential statistics. Specifically, objectives 1,2,3, was analysed using descriptive statistics such as frequency, mean counts, percentages and likert type rating scale. The hypothesis was analysed using Tobit analysis.

Results and Discussion

Socioeconomic characteristics of the respondents

The result revealed that majority of the respondent were female against the male counterparts which is an indication that females were more involved in farming activities. The result from the bar chart reveals that majority of the farmers were married which means that have families who are much involved in farming activities in the study area. The implication of this result is that married ones are considered to be more responsible to take any rational decision as it affects climate change. Ekweanya, *et al* (2021) noted that married farmers with their household are usually better off to adopt labor intensive farming activities, thereby leading to increased output. The result reveled that majority of the respondents had at least primary school education, followed by the secondary school education, whereas the respondents with no formal education and tertiary education were low, which is an indication that the more knowledge they have helped them to be aware of the climate change and how they can be able to adapt effectively to climate change. The implication of this result is that educated farmers will have more knowledge about climate change, and it is in consonant with the findings of Oladebo, (2023) that educated farmers facilitates understanding, accepting and participating in innovations that will yield positive things. The result indicates that majority according to the pie chart were aware of the climate change mitigation in the area. This is an indication that due to their educational level, they were able to have the knowledge of the climate change in the area. The more educated they become, the more knowledge they have on climate change mitigation.

Adaptive and mitigating measure used by farmers

The result revealed that regular weeding to avoid breed of insects pest were x=4.53, the use of water channels as draining system x=4.45, use of organic manure x=4.40, breeding of drought and heat resistant crop varieties x=4.39 were the major adaptive measures the farmers used to cope with the climate change, although that all other variables were high which is an indication that the farmers had some adaptive measures to cope with the climate change mitigation. In the mitigation measures, the table revealed that proper conservation of seed x= 4.23, avoidance of deforestation/ trees felling's x=4.27, reduced the use of generators for electrification x=4.27 and afforestation x=4.08 were the major mitigating measures used by the farmers to cope with the climate change mitigation in the area, which means that they were all aware and were ready to find solutions on the climate change.

Perceived effects of climate change by farmers

The result revealed that destruction of wildlife x=4.56, drying of streams early x=4.46, reduced production cycle x=4.44, shift in time of planting x=4.41, reduction in farm income due to reduced yield x=4.39, premature ripening of fruit x=4.36, reduction in the fish production x=4.20, loss of pastures x=4.31etc were the major factors seen as the perceived effect of climate change by farmers. Through the perceived effect, the farmers were able to cope with the climate change since the grand mean = 4.32 was achieved which is an indication that the farmers were aware of the climate change mitigation.

Hypothesis testing

$H0_2$: There is no significant relationship between farmer's socio-economic characteristics and their per. The result on Table shows the Tobith regression estimate of the influence of socioeconomic characteristics on the use of climate change adaptive mitigation strategies in the study area. The Chi-square value of 807.945 confirms the fitness of the model used and is statistically significant at 1% alpha which affirms the significant relationship the dependent and the predictor variables. The coefficient of age (0.029) was statistically significant at 1% level of probability and positively related. This implies that increase in age of the farmers will increase their intensity of the use of climate change adaptive and mitigation strategies in the study area. The coefficient of farming experience (0.017) was statistically significant at 1% level of probability and positively related. This implies that increase in the farmers experience will result to a corresponding increase in the use of climate change adaptive and mitigation strategies in the study area. The coefficient of income (3.771E-5) was statistically significant at 5% level of probability and positively related. This implies that increase in the farmer's income will result to a corresponding increase in the use of climate change adaptive and mitigation strategies in the study area. The hypothesis which stated that there is no significant relationship between farmer's socio-economic characteristics and the use of climate change adaptive and mitigation strategies in the study area was therefore rejected at 5% alpha level and concluded otherwise.

Conclusion and Recommendations

Climate change is knocking on our door and efforts should be geared towards limiting its effect on agricultural performance. The study assessed the climate change mitigation practices among arable crop farmers in Ideato North LGA, Imo State, Nigeria. The result revealed that majority of the famers were female, and they acquire primary education. Regular weeding to avoid breed of insects pest were x=4.53, the use of water channels as draining system, use of organic manure, breeding of drought and heat-resistant crop varieties, were the major adaptive measures the farmers used to cope with the climate change. Proper conservation of seed, avoidance of deforestation/ trees felling's, reduced the use of generators for electrification and afforestation, destruction of wildlife, drying of streams early, reduced production cycle, shift in time of planting, reduction in farm income due to reduced yield, premature ripening of fruit, reduction in the fish production, loss of pastures etc were the major factors seen as the perceived effect of climate change by farmers.

The coefficient of age (0.029) was statistically significant at 1% level of probability and positively related. This implies that increase in age of the farmers will increase their intensity of the use of climate change adaptive and mitigation strategies in the study area. The coefficient of farming experience (0.017) was statistically significant at 1% level of probability and positively related. This implies that increase in the farmers experience will result to a corresponding increase in the use of climate change adaptive and mitigation strategies in the study area.

The study therefore recommends among others that;

a) Efforts should be shown by governments, NGOs, individuals to acquaint and educate famers on how they will cope more on the climate change related issue.
b) Government agencies should provide information regarding climate change scenarios, seasonal variability, and the impacts of climate change so that farmers can make decisions instructed about the best mitigation and adaption measures available
c) Government should available improved seedlings at affordable prices or subsidize prices as this has been known as one of the management techniques towards mitigating climate change effects

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Appendix

Figure 1: Frequency distribution of respondents according to their sex

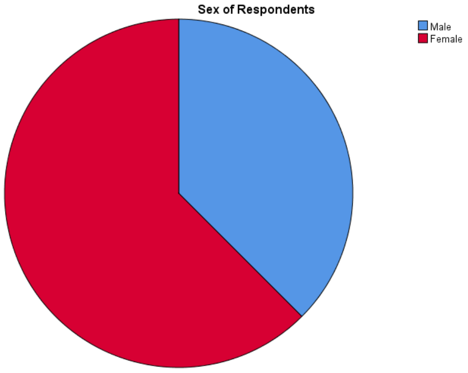

Figure 2: Frequency distribution of respondents according to their marital status

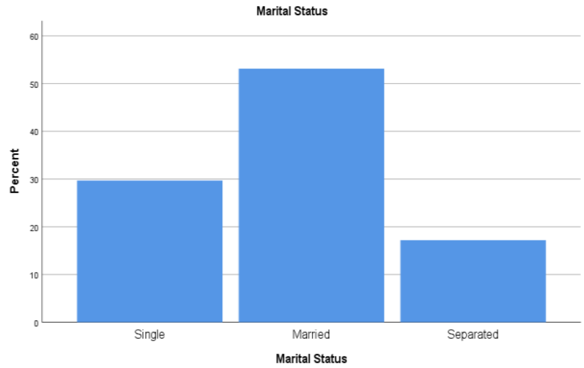

Figure 3: Frequency distribution of respondents according to their education level

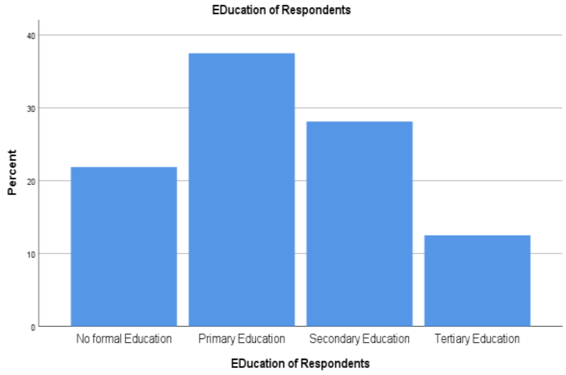

Figure 4: Frequency distribution of respondents according to their awareness of climate change

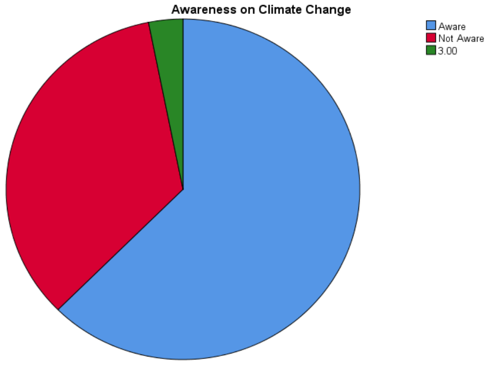

Table 1: Mean frequency distribution of respondents according to adaptive and mitigating measure used by farmers

Identified Adaptive and mitigation strategies	SA (5)	A (4)	UN (3)	DA (2)	SD (1)	Sum	SD	Mean
Adaptive								
Cli Crop rotation	24(120)	29(116)	10(30)	0(2)	0(0)	268	0.753	4.19
Use of water channels as draining system	35(175)	23((92)	6	0(0)	0(0)	285	0.665	4.45
Use of organic manure	35(175)	21(84)	7(21)	1(2)	0(0)	282	0.750	4.40
Planting of cover crops	26(130)	23(92)	15*45)	0(0)	0(0)	267	0.788	4.17
Mixed cropping practices	30(150)	26(104)	5(15)	0(0)	0(0)	275	0.810	4.30
Planting of pest and disease resistant crops	27(135)	24(96)	11(33)	1(2)	1(1)	272	0.817	4.25
Mulching	27(135)	27(108)	9(27)	0(0)	1(1)	276	0.731	4.31
Regular weeding to avoid breed of some insect pest	40(200)	15(60)	4(12)	3(6)	2(2)	290	0.854	4.53
Breeding of drought and heat resistant crop varieties	31(155)	21(84)	11	1(2)	0(0)	281	0.657	4.39
Conserving of soil moisture through appropriate tillage operation.	21(105)	28(112)	4(12)	10(20)	1(1)	274	0.806	4.28
Use of improved varieties	33(165)	20(80)	11(33)	0(0)	0(0)	255	1.046	3.98

Identified Adaptive and mitigation strategies	**SA (5)**	**A (4)**	**UN (3)**	**DA (2)**	**SD (1)**	**Sum**	**SD**	**Mean**
Diversify income sources	20(100)	32(	9(27)	3(6)	0(0)	278	0.760	4.34
Mitigating								
Afforestation	32(160)	24(96)	5(15)	3(6)	0(0)	261	0.802	4.08
Proper conservation of seeds	27(135)	21(84)	14(42)	0(0)	2(2)	277	0.818	4.32
Avoidance of deforestation/tree felling	29(145)	23(92)	12(36)	0(0)	0(0)	273	0.840	4.27
Reduced the use of generators for electrification	29(145)	23(92)	12(36)	0(0)	0(0)	273	0.761	4.27
Grand mean								**4.28**
Benchmark								**3.00**

Source; Field survey data, 2024. SA (Strongly agree), A (Agree), UN (Undecided), D (Disagree), SD (Strongly Disagree)

Table 2: Mean frequency distribution of respondents according to perceived effects of climate change by farmers

Perceived effects	**SA (5)**	**A (4)**	**UN (3)**	**DA (2)**	**SD (1)**	**Sum**	**SD**	**Mean**
Decreased soil	24(120)	27(108)	11(33)	2(4)	0(0)	265	0.814	**4.14**
Premature ripening of fruit	30(150)	27(108)	7(21)	0(0)	0(0)	279	0.675	**4.36**
Reduced production cycle	36(180)	20(80)	8(24)	0(0)	0(0)	284	0.710	**4.44**
Prolonged production	29(145)	26(104)	8(24)	0(0)	0(0)	279	0.721	**4.36**
Yield reduction	26(130)	31(124)	6(18)	1(2)	0(0)	274	0.700	**4.28**
Reduction in farm income due to reduced yield	31(155)	22(88)	8(24)	1(2)	2(2)	281	0.809	**4.39**
Reduction in storage quality	23(115)	27(108)	11(33)	2(4)	1(1)	266	0.840	**4.16**
Destruction of wild life	41(205)	19(76)	3(9)	1(2)	0(0)	292	0.664	**4.56**
Streams drying up	26(130)	30(120)	4(12)	0(0)	4(4)	286	0.712	**4.46**
Reduction in fish production	30(150)	18(72)	15(45)	1(2)	0(0)	269	0.858	**4.20**
Reduction in farm size	34(72)	19(76)	8(24)	3(6)	0(0)	276	0.871	**4.31**
Loss of pastures	30(150)	24(96)	10(30)	0(0)	0(0)	276	0.732	**4.31**
Change timing of rain	27(135)	27(108)	8(24)	2(4)	0(0)	271	0.792	**4.23**
Shift in time of planting	33(165)	22(88)	5(15)	2(4)	2(2)	278	0.796	**4.41**
Erratic rain reduces crop yields	29(145)	23(92)	10(30)	2(4)	0(0)	271	0.831	**4.23**
Grand mean								**4.32**
Benchmark mean								**3.00**

Source; Field survey data, 2024. SA (Strongly agree), A (Agree), UN (Undecided), D (Disagree), SD (Strongly Disagree)

Table 3: Tobith regression estimate of the influence of socioeconomic characteristics on use of climate change adaption strategies the study area.

Parameters	**Estimate**	**Std. Error**	**t- value**
Gender	.558	.502	1.237
Age	.029	.023	7.606***
Education	-.166	.254	.430
Marital Status	.141	.363	.152
Household size	-.091	.128	.501
Farming experience	.017	.031	3.316***
Income	3.771E-5	2.721E-5	1.921**
Information Source	.279	.316	.780
Awareness	.080	.397	.040
Climate	-.162	.875	.034
-2 Log Likelihood	*306.251*		
Cox and Snell	0.219		
Chi-Square	*807.945****		

Source: STATA, RA Result from Field Survey. Key: * Significance at 10%, ** Significance at 5%, *** Significance at 1% ***, + = Lead Equation and the values in bracket are the t-value.