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Awareness of the Effects of Climate Change and Use of Amelioration Techniques Among Rural Farmers in Akinyele Local Government, Oyo State

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Abstract: This study investigated farmers' awareness of the effect of climate change and the use of amelioration techniques in Akinyele Local Government, Oyo State. A multistage sampling technique was employed to survey 150 farmers using a well-structured questionnaire; only 117 were retrieved. The data collected were analysed using descriptive statistical tools, while the chi-square was used to test the hypothesis. According to the analysis, 44.4% of respondents were in the 31-40 age bracket, 53.8% had access to early childhood education, and 97.4% were aware of the impact of climate change on productivity. The respondents obtained information from the media (63.2%), extension worker visits, and government officials. The chi-square analysis revealed a significant relationship between respondents' socioeconomic characteristics and their awareness of climate change. Results showed that the amelioration technique used to adapt to climate change was affected by Gender ($x2=56.077$, $p< 0.005$), Age (x2-59.581, $p<0.005$), Religion ($x2=9.308$, $p<0.005$), Marital status ($x2=61.077$, $p <0.005$), and educational level (x2-36.974, $p<0.005$). The recommendations were that effective adaptation measures should be subsidised and accessible to all farmers experiencing problems. There is also a need to organise more targeted programs and sensitisation on climate change to strengthen climate change adaptation, especially in rural areas.

Keywords: *Awareness, Climate Change, Amelioration Techniques, Rural Farmers*

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1. Introduction

Climatic Amelioration refers to strategic actions aimed at improving climate conditions, focusing on reducing greenhouse gases and regional heat loads. It also encompasses local initiatives to enhance the habitability and productivity of socio-ecological systems, such as drought-resistant agriculture, urban green infrastructure, and the restoration of coastal wetlands. These strategies aim to reduce vulnerabilities and support ecosystem services (Prism-Sustainability Directory, 2024). Addressing climate change is essential to mitigate negative consequences and enhance adaptive capacity, as both strategies are linked to numerous benefits for biodiversity conservation and human well-being. It is imperative to foster environmental responsibility by assessing current levels of awareness before implementing necessary adaptation and mitigation strategies (Agboola, 2023).

Climate change poses a significant threat to economic activities, human health, food security, natural resources, physical infrastructure, agriculture, population growth, and productivity (Pradhan, 2002; Ziervogel et al., 2006; Giri et al., 2023). While its global impact is evident, developing countries, particularly in Africa, are most vulnerable due to limited coping capabilities (Nwafor, 2007; Jagtap, 2007). It is the primary hazard to sustainable development in both urban and rural environments, contributing significantly to human suffering, impoverishment, and limited opportunities (Okude & Ademiluyi, 2009). The IPCC (2007) has observed noticeable impacts of climate change on plant production, insects, disease, and weed dynamics.

As the planet warms, rainfall patterns shift, and extreme events such as droughts, floods, and forest fires become more frequent (Zoellick & Robert, 2009). Additionally, rising atmospheric CO2 concentration, higher temperatures, changes in annual and seasonal precipitation patterns, and increased frequency of extreme events are characteristic features of climate change phenomena (Brussel, 2009).

The impacts of climate variability differ in scale and across regions. While some areas may have localised impacts, global climate change largely harms developing and poorer nations. Among the various sectors of every economy, the agricultural sector, especially food production, seems to be significantly affected (Agboola, 2023). According to Jones and Thornton (2002), projections indicate that Africa's crop yield may decrease by 10-20% by 2050, with a potential for up to a 50% reduction due to climate change. The major reliance on rain-fed agriculture in Africa leaves many farmers vulnerable to the impacts of climate-related changes. Evidence from the IPCC indicates that by 2100, areas of the Sahara are likely to be the most vulnerable to climate change, with potential agricultural losses estimated at up to 7% of the affected countries' GDP. In Western and Central Africa, losses may range from 2% to 4%, while Northern and Southern Africa could see losses between 0.4% and 1.3% (Mendelsohn et al., 2000).

In Nigeria, climate change is expected to alter the dynamics of drought, rainfall, and heat waves, and has already begun to do so in some areas. This alteration triggers secondary stresses such as the spread of pests, increased competition for resources, the collapse of financial institutions, and biodiversity losses (Enete & Amusa, 2010). While some farmers may benefit from longer growing seasons and higher yields, the continent's overall consequences are expected to be adverse. This is particularly concerning for the poor and marginalised populations who lack the means to adapt to shocks and changes. Khanal (2009) also highlighted the potential for heat stress to hinder crop development and reduce yields. In recent years, several regions in Nigeria have experienced higher-than-average rainfall and shifts in the start and end dates of the rainy season, resulting in unstable rainfall patterns.

These observable impacts of climate change in Nigeria may be accompanied by a widespread lack of understanding of the underlying causes and even outright denial of climate change. To effectively raise awareness about climate change, it is crucial to assess public awareness, as this information is essential for developing long-term policies and planning. Climate awareness significantly influences the adoption of agricultural technologies (Nhemachena & Hassan, 2008).

The study's general objective is to determine the farmers' awareness of the effect of climate change and the use of amelioration techniques among rural farmers in the Akinyele Local Government of Oyo State. The specific objectives of the study are:

1. To determine the socioeconomic characteristics of the respondents.
2. To establish the source of information on climate change.
3. To ascertain rural farmers' awareness of climate change and its likely effect.
4. To examine amelioration strategies by rural farmers.
5. To examine the level of preparedness of rural farmers.

Hypothesis

The Hypothesis for this study is “There is a significant relationship between the socio-economic characteristics of respondents and their use of amelioration techniques”.

The Null Hypothesis: “There is no significant relationship between the socio-economic characteristics of respondents and their use of amelioration techniques”.

2. Materials and method

2.1 Study Site

Akinyele, formed in 1976, is a local government area in Oyo state, Nigeria. With its headquarters in Moniya, Akinyele is one of 34 local government areas that comprise Oyo State and 11 local government areas that make up the Ibadan metropolis (Oyo State Government, n.d.). Akinyele Local Government occupies a land area of 404,892 square km and is bordered by the Ido Local Government Area to the west, the Lagelu Local Government Area to the east, the Afijio Local Government to the north, and the Ibadan North Local Government Area to the south. Akinyele Local Government Area is located at latitudes 70 26`23” N to 70 40`30” N, and longitudes 30 47`4” E to 40 05`00” E (Bamigbade et al., 2021). Akinyele Local Government was established in 1976, with Ido Local Government being separated from it in 1989, leaving Akinyele with 12 wards and its headquarters in Moniya. The region has a tropical wet-and-dry climate, with a long wet season from March to October and a dip in rainfall in August. It lies within the rainforest region and is characterised by tall trees and dense undergrowth, and is considered part of the dry forest belt (Bamigbade et al., 2021).

2.2 Sampling procedure and sample size

Akinyele local government is divided into 12 electoral (political) wards, namely Ikereku (Ward 1), Labode/Oboda/Olanla (Ward 2), Arulogun (Ward 3), Onidundu/ Amosun (Ward 4), Moniya (Ward 5), Akinyele (Ward 6), Iwokoto/Amosun (Ward 7), Ojoo/Ajibode/Orogun/Owe/Kankon (Ward 8), Ijaye (Ward 9), Alabata (Ward 10), Okegbemi/Mele (Ward 11) and Iroko (Ward 12). The study area experiences a tropical type of climate. Akinyele Local Government recorded a mean annual temperature of about 320C. The relative humidity can be as high as 95% in the area, and the mean annual rainfall is about 1250 mm. From the 12 wards, 3 wards were selected, and 5 villages were randomly selected from each ward. 10 respondents were given questionnaires, and a total of 150 questionnaires were distributed randomly. The

major occupation of the people is agricultural, and the population is predominantly of one ethnic group, which is over 95% of the total population of the area. The questionnaire was mainly distributed to the rural farmers. A total of 150 questionnaires were distributed, and 117 were retrieved.

Table 1: List of Local government wards and wards selected

LOCAL GOVT.	WARD	WARD NAME(S)	WARD SELECTED
AKINYELE	1	Ikereku	
	2	Labode, Oboda, Olanla	
	3	Arulogun, Aroro, Eniosa	
	4	Amosun, Olode, Onidundu	
	5	Moniya, Ojo-Emo	**MONIYA**
	6	Akinyele, Irepodun, Isabiyi	**AKINYELE**
	7	Idi-oro, Iwokoto, Talonta	
	8	Ajibode, Laniba, Ojoo	
	9	Ijaye, Ojedeji,	
	10	Ajibade, Alabata, Elekuru	**ALABATA**
	11	Mele, Olorisa-Oko, Okegbemi	
	12	Iroko	

Selected wards were:		Akinyele Ward (6)	Alabata Ward (10)	Moniya Ward (5)
	Villages:	Onidundu	Oke balogun	Aba ounlu
		Iroko	Aba opa	Alase
		Kara	Baba sango	Apomode
		Aba alagbede	Alabata	Omikoro
		Akingba	Aba balogun	Asanmojana

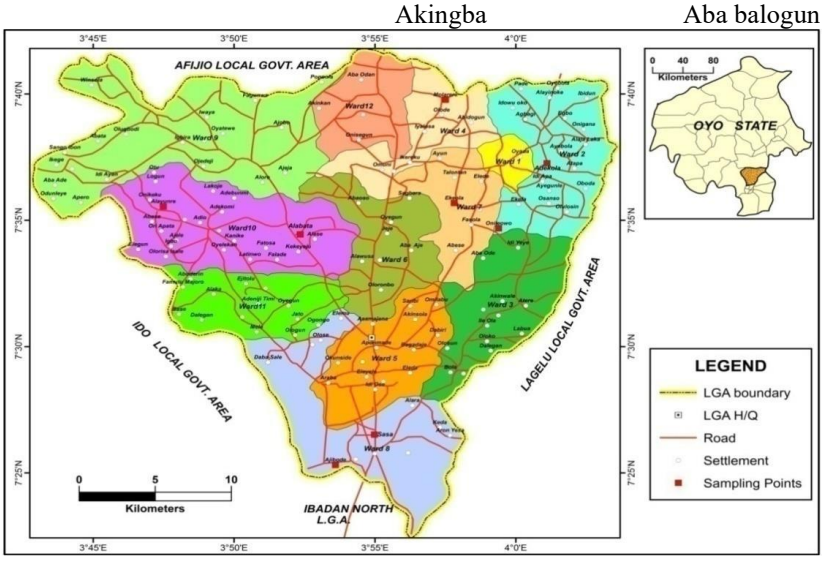

Figure 3: Map of Akinyele local government showing major rural settlements
Source: Bamigbade et al, 2021 (Map of Akinyele Local Government. GIS LAB, UNIVERSITY OF IBADAN

2.3 Statistical methods

All data collected were analysed using descriptive analysis, frequency, percentage, and chi-square to analyse the relationship between the socioeconomic characteristics of respondents and their use of amelioration.

3. Results and Discussion

3.1 Socio-economic characteristics of the respondent

Table 3.1: Socio-economic characteristics of the respondent

Variable	Frequency	Percentage (%)
Gender		
Male	99	84.62
Female	18	15.38

Total	117	100
Age (Years)		
20-30	11	9.40
31-40	52	44.44
41-50	48	41.03
51-60	6	5.13
Total	117	100
Religion		
Christian	42	35.90
Muslim	75	64.10
Total	117	100
Marital Status		
Single	40	34.20
Married	73	62.40
Divorced	4	3.40
Total	117	100
Education		
Primary	63	53.85
Secondary	44	37.60
Tertiary	10	8.55
Total	117	100

Source: Field survey, 2016.

Table 3.1 presents the socio-economic characteristics of the participants. A total of 117 respondents completed the questionnaire. 84.6% of respondents were male, while 15.3% were female. Many of the respondents were between the ages of 31-40 (44.4%). This means that this active age bracket was more involved and could be the most enlightened and social age group. Most respondents are Muslims (64.1%), and Christians account for about 35.5%.

Married people dominated the communities (3.4%). The education level of respondents is primarily early education (53.8%), then secondary education (37.6%), and tertiary education (8.5%).

3.2 Rural farmers' awareness of climate change

Table 3.2: Level of rural farmers' awareness of climate change

Variable	**Frequency**	**Percentage (%)**
Have you ever heard about climate change?		
Yes	114	97.44
No	3	2.56
Total	117	100
What is climate change?		
The average weather conditions of a place	61	52.14
Change in the atmosphere	44	37.61
Change in the rainfall pattern	12	10.25
Total	117	100
How can the problem of C.C. be minimized		

Stop bush burning	44	37.60
More teaching about how to minimize C.C	43	36.75
Stop deforestation	20	17.01
Alternative energy source	10	8.54
Total	117	100
How does the problem of C.C. affect you?		
Lead to hotness of the body	4	3.14
Cause ill health	7	5.90
Leads to change in the environment	47	40.17
Excessive heating	4	4.20
It reduces the amount of rainfall	39	33.30
It affects human skin	0	0
It causes pollution of the environment	15	12.82
Total	117	00

Source: Field survey, 2016.

Table 3.2 explained the level of awareness of climate change among rural farmers. The results show that the majority of the respondents in the study area are aware of and have heard about climate change. 97.4% of respondents said they had heard about climate change, while 2.5% said they had not. The results also showed that the respondents believed climate change to be the average weather condition of a place (52.1%), 37.6% accepted that climate change as changes in the average atmosphere, while 10.2% of respondents described it as a change in the rainfall pattern. The respondents also identified possible ways to minimise the problem of climate change in their opinion. 37.6% agreed that stopping bush burning would help minimise climate change, 36.7% opined that to minimize climate change, there should be more education on how to minimize climate change, 17% said that stopping deforestation would minimize the effects of climate change, and 8.5% identified that alternative energy sources should be used in minimising climate change. Finally, the table showed that 40.1% of the respondents agreed that climate change leads to changes in their environment, and 26.4% agreed that the effects had reduced the expected level of rainfall. The respondents also reported some impacts on their bodies: 5.90% believed it had led to ill health, 7.34% experienced extreme heat, and 12.8% felt that climate change had caused pollution in their immediate environment.

3.3 Farmer's source of information on climate change

Table 3.3: Source of information on climate change

Variable	Frequency	Percentage (%)
Television	13	11.11

Radio	74	63.25
Newspaper	6	5.13
Group discussion	24	20.51
Total	117	100

Source: Field survey, 2016.

The study revealed that 63.3% of respondents reported getting their information from the radio, 20.5% from group discussion, 11.1% from television, and 5.1% from reading the newspaper. Information from group discussions consisted of formal and informal discussions with extension workers and fellow farmers.

3.4 Perceived effects of climate change on agricultural production

Table 3.4: What are the likely effects of climate change on agricultural production?

Variable	Frequency	Percentage (%)
Do you think the problem of climate change affects you?		
Yes	99	84.62
No	7	5.98
No response	11	9.40
Total	117	100
If yes, how?		
Low yield/productivity	64	54.70
Low income	37	31.62
No rainfall	16	13.68
Total	117	100
What is the effect of climate change on your agricultural production?		
Low yield	88	75.21
Delay planting date	10	8.54
Stunted growth	16	13.60
Animal response is low	3	2.55
Total	117	100
How do you think an individual can help overcome the problem of climate change?		
By prayer	47	40.20
Enlightenment campaign	35	29.91
Be prepared to face it	20	17.09
Stop air pollution	15	12.80
Make sacrifices to the gods	0	0
Total	**117**	**100**

Source: Field survey, 2016.

The results from Table 3.4 showed respondents' perceptions of whether climate change affects rural farmers, and they overwhelmingly said yes (84.6%). However, 5.9% of respondents do not agree that climate change affects them, while 9.4% gave no response. Of the 84.6% who agreed that climate change affects their productivity, 54.7% said it led to low yield/productivity, 31.6% said it led to low income, and 13.7% said it affected rainfall. FAO's (2007) report supports this perception that climate change affects agriculture and productivity. The observed effects of climate change on farmers' agricultural production, as reported by respondents, include poor crop yields/production (75.2%), delayed planting dates (8.54%), stunted growth (13.6%), and low animal response (2.55%). The respondents contributed that to overcome climate change problems, farmers need to be more prayerful (40.1%), some suggested enlightenment campaigns (29.9%), and 17.1% said farmers should be equipped to face it.

3.5 Awareness of amelioration strategies

Table 3.5: Are there any amelioration strategies put in place?

Variables	Frequency	Percentage (%)

Are you aware of amelioration strategies?		
Yes	99	84.62
No	18	15.38
Total	117	100

Source: Field survey, 2016.

Table 3.5 demonstrates that rural farmers understand the various amelioration strategies they can implement. A total of 84.6% of respondents claimed they are aware of strategies to mitigate the effects of climate change, while 15.4% said they are not aware of any strategies to put in place to mitigate its effects.

3.6 Strategies in ameliorating the effects of long-term climate change

Table 3.6: What are the strategies you use in ameliorating the rate of long-term climate change?

Variables	Frequency	Percentage (%)
Switching to low low-carbon energy source	35	29.91
Expanding forests to remove greater amounts of carbon from the atmosphere	34	29.05
Enlightenment by the government	15	12.82
Stop deforestation/bush burning	17	14.52
Not sure if there are any strategies	16	14.60
Total	117	100

Source: Field survey, 2016.

Table 3.6 presents strategies for coping with the long-term effects of climate change. Many of the respondents (29.9%) accepted that switching to lower-carbon energy sources (such as solar power, wind power, hydropower, geothermal energy, and biomass) is a better solution, and 29.1% said that expanding deforested areas through tree planting will remove a greater amount of carbon from the atmosphere. 14.5% suggested stopping deforestation and bush burning. Some farmers also suggested government enlightenment (12.8%), while 13.6% of respondents said they were not aware of any amelioration strategies.

3.7 Consequences of climate change on farming activities

Table 3.7: What are the likely consequences of climate change on your farming activities?

Consequences Of Climate Change	Frequency	Percentage (%)
It leads to Drought	9	7.60
It leads to Heat waves	9	7.60
It leads to Flooding	10	8.55
It leads to delaying the planting date	25	21.64
It leads to Low-yield harvested	64	54.71
Total	117	100

Source: Field survey, 2016.

Table 3.7 presents respondents' perceptions of the likely consequences of climate change for farmers and their farming activities. The highest consequence recorded was low yield during harvest season (54.7%), and the lowest was drought and heat waves (7.6%). These consequences were also reported in the findings of Enete and Amusa (2010) and Enete et al. (2012

3.8 Coping strategies with mitigation activities

Table 3.8 Coping strategies with mitigation activities

Mitigation Activities	Frequency	Percentage (%)
Improved agricultural practices	37	31.62
Irrigation	38	32.45

Mulching	22	18.80
Fertilizer application	6	5.13
Crop rotation	14	11.70
Total	117	100

Source: Field survey, 2016.

Table 3.8 presents various coping strategies for mitigating the effects of climate change. The majority of respondents (32.5%) believe that an Improved irrigation system is a good coping strategy for climate change. Mulching (18.8%) and crop rotation (11.7%) were also identified as suitable strategies for climate change adaptation

3.9 Preparedness for the effects of climate change

Table 3.8 Farmers' preparedness for the effects of climate change

Variables	**Frequency**	**Percentage (%)**
Steps you have taken to protect crops/livestock against flooding		
Setting up irrigation/dam	9	7.70
Make ridges, heaps and beds	21	17.94
Grow lemongrass to prevent erosion	3	2.56
Drainage	76	64.90
The animal house should not be close to the river/dam	8	6.80
Total	117	100
How frequently do you listen to programs?		
Always	90	76.92
Occasionally	27	23.08
Total	**117**	**100**
How often do you apply the information given to you?		
Always	58	49.57
When necessary	59	50.43
Total	117	100
Do you grow early maturing crops?		
Yes	107	91.4
No	10	8.5
Total	117	100
How frequently do farmers meet and talk?		
Weekly	37	31.62
Monthly	17	53.85
Always	63	14.53
Total	117	100
Farming systems farmers use to protect their crops		
Crop rotation	48	41.03
Mixed farming	24	20.51
Mulching	23	19.66
Intercropping	5	4.20
Building a proper structure for animals	17	14.60
Total	117	100
What are the inputs put in place for rapid growth?		
Quality seed stock	71	60.70
Fertilizer	36	30.77
Herbicide and pesticide	10	8.53
Total	117	100

Source: Field survey, 2016.

Table 3.9 presented the level of preparedness of farmers on the effect of climate change. The results show diverse steps taken by farmers to protect their crops/livestock against flooding.

The different steps adopted include Setting up irrigation/dam (7.7%), Making ridges, heaps and beds (17.9%), Growing plants known to prevent erosion such as Lemongrass (2.6%), Drainage to reduce nutrient loss (64.9%), and making sure that there is a good distance between the animal house and rivers/dams (6.8%). The participants were asked about their frequency of listening to programs, particularly those focused on climate change, to assess how much information they gathered from the media. 76.9% reported always listening to programs, and

23.1% reported listening occasionally. Also, respondents were asked how often they apply the information provided by extension workers or government officials. 49.6% of respondents claimed they always applied the information they obtained, while 50.4% said they applied it only when necessary. When asked how frequently they meet as farmers to discuss issues, including climate change effects, 31.6% said they meet weekly, 14.5% said they meet monthly, and 54.0% said they set a date in a month to have their meetings. 53.8% said they meet regularly (Always) for different discussions. The respondents were asked about the farming systems they practice to protect their crops from different climate change impacts. 41% of the respondents practice crop rotation which involves planting crops with different feeding habits to reduce soil depletion. 20.5% of the respondents practice mixed farming, where they grow crops and raise animals on the same land; The manure produced by the animals is used on the farm to promote organic farming. According to these farmers, adding manure to the soil replenishes nutrients and improves soil structure. About 19.7% of farmers use mulching by covering the soil with organic materials like grass, crop residues, and corn cobs. This practice helps regulate soil moisture and enhances soil health, contributing to more sustainable agriculture. 4.2% of farmers practice intercropping, which involves planting two crops in the same field. In this method, one crop is harvested before the other, allowing for efficient use of space. This mixture of crops helps cover the soil, thereby controlling erosion and preventing topsoil depletion. 14.6% reported that they construct proper structures for their animals to safeguard them from all types of attacks.

The table also showed respondents' answers regarding growing early-maturing crops to adapt to climate change. 91.4% of respondents said they plant early-maturing crops, while 8.5% said they do not. To ensure rapid growth, some respondents resorted to planting high-quality seed stock (60.7%), while others chose to use fertilisers (30.8%) to boost production, and a minority opted for herbicides and pesticides to control crop pests and increase growth.

3.10 Hypothesis testing

Table 3.10 Chi-square analysis on socio-economic characteristics of the respondents

VARIABLES	X^2	p-value	Decision
Gender	56.077	0.000	S
Age	59.581	0.000	S
Marital Status	9.308	0.002	S
Religion	61.077	0.000	S
Education	36.974	0.000	S

Source: Field survey, 2016.

H01: There is no significant relationship between the socio-economic characteristics of the respondents and their use of amelioration techniques.

X2 value = Chi-Square value

NS = Not Significant [p> 0.005]

S = Significant [p< 0.005]

The chi-square analysis revealed a significant relationship between the respondent's socioeconomic characteristics and their level of awareness of climate change.

This implies that climate change is affected by Gender (x2=56.077, p< 0.005), Age (x2-59.581, p<0.005), Religion (x2=9.308, p<0.005), Marital status (x2=61.077, p <0.005), and educational level (x2-36.974, p<0.005).

Therefore, we reject the null hypothesis that "There is no significant relationship between the socio-economic characteristics of the respondents and their use of amelioration technique".

3.11 Discussion

The results from the socio-economic characteristics of the respondents showed that the majority of farm labour in Nigeria is performed by male respondents, thus supporting the study by Nicholls (2004), which showed that major agricultural production activities are predominantly labour-intensive due to low levels of mechanization, making it challenging for women to balance farming with their other non-farm responsibilities. The active age bracket from the study (31-40) was more involved and could be the most enlightened and social age group. This asserts the contribution of McGranahan et al. (2007), who found that the people in this age bracket were most likely the innovative group. Married people dominated the communities (3.4%), and according to Akinbile (2007) that marriage confers responsibility. The education level of respondents was early education (53.8%), and this factor is important because people with a higher educational level could quickly access and adopt innovation. This low educational level could limit respondents' access to information, which might be of great assistance to them, especially in the adoption of new farming activities (Mortimore & Adams, 2001).

The results show that the majority of the respondents (97.4%) in the study area are aware of and have heard about climate change. From the responses recorded, they had the basic information confirmed by Kurukulasuriya et al. (2006) in their study, referring to climate change as the long-term changes in average weather conditions. However, their low responses to how they perceive Climate change has affected them and how it could be minimized showed that the generality of the question about climate change may not truly capture the awareness level of climate change and its effects on their well-being, supporting the findings of Hundera et al. (2019) from their study.

Most of the respondents claimed that they got information about the climate change phenomenon from the Radio (63%) and Television (11%), supporting the findings of Nzeadibe et al. (2011) in their study. The results from the different sources of information about climate change corroborate the findings of Nwachukwu (2003), who emphasized the use of radio stations to run agricultural programmes that improve and influence the activities of farmers towards agricultural advancement. The study findings also imply that the use of media (radio) should be more active in disseminating information to farming societies to boost productivity and adoption of innovations towards alleviating climate change effects.

Many of the respondents (29.9%) accepted switching to renewable energy options like solar, wind, hydropower, geothermal energy, and biomass, which can help reduce greenhouse gas emissions and reliance on fossil fuels. 29.1% favoured expanding deforested areas through tree planting. This approach would increase forest cover, which can absorb more carbon dioxide from the atmosphere, thereby helping to combat climate change. 14.5% suggested stopping deforestation and bush burning. It is common knowledge that many farmers see nothing wrong with bush burning because it is the easiest way to prepare the land for farming activities. This means that awareness is serious and needed in the area (Levino et al., 2011). Stopping these activities can conserve existing forests, which play a crucial role in carbon sequestration and maintain biodiversity. Overall, the responses emphasized the importance of adopting sustainable practices and enhancing natural carbon sinks as effective measures needed to cope with the impacts of climate change.

The respondents favoured an Improved irrigation system (32.5%) as a good coping strategy for climate change, corroborating the findings of Enete and Amusa (2010), who highlighted the need to migrate from reliance on rain-fed food production to adequate provision of irrigation, which is crucial for climate change adaptation. Mulching (18.8%) and crop rotation (11.7%) were also identified as suitable strategies for climate change adaptation, similar to recommendations from Bamigbade et al. (2021) and Ayanwuyi et al. (2010). 5.1% claimed that fertilizer application is a great means of coping with climate change impact. Most rural farmers are aware that the stress on their local environment and livestock has increased over the years, and a low capacity for adaptation can lead to serious issues.

The chi-square analysis revealed that there is a significant relationship between the socioeconomic characteristics of the respondent and their level of awareness about climate change.

The result showed that climate change is affected by Gender ($x2=56.077$, $p< 0.005$), Age ($x2-59.581$, $p<0.005$), Religion ($x2=9.308$, $p<0.005$), Marital status ($x2=61.077$, $p <0.005$), and educational level ($x2-36.974$, $p<0.005$). Each of these factors has a p-value of less than 0.005, indicating strong evidence against the null hypothesis.

This analysis suggests that factors such as gender, age, religion, marital status, and education level significantly influence how aware farmers are about climate change. For instance, different age groups or educational backgrounds may have varying levels of knowledge or concern regarding climate issues.

Rejection of Null Hypothesis

The null hypothesis states that "There is no significant relationship between the socio-economic characteristics of the respondents and their use of amelioration technique". Based on the analysis, there is a very strong association between the socio-economic characteristics of farmers and the amelioration techniques being adopted by them. Thus, the null hypothesis has been rejected.

This means our analysis has shown that socioeconomic factors do impact the methods that farmers choose to adopt in response to climate change challenges. The findings highlight the importance of considering socio-economic characteristics when addressing climate change awareness and the adoption of practical solutions among farmers. This could help in developing targeted strategies that consider the specific needs and circumstances of different groups to enhance their adaptation and mitigation of climate change.

4. Conclusion

From the findings, it is evident that rural farmers are largely aware of climate change and its impacts, and have some coping strategies. The analysis has revealed that rural farmers still request more enlightenment about climate change and how it can be minimised, since climate change is an environmental, social, and economic challenge on a global scale. Virtually all respondents were aware not only of climate change but also that some of its variables, such as changes in weather conditions/rainfall patterns, and uncertainties in the onset of the framing season, have been on the increase. In addition, they were aware of the effects of climate change on their agricultural production, including delayed planting dates, low yields and production, stunted growth, and reduced animal response. Some of the amelioration strategies by farmers include stopping bush burning, deforestation, and the expansion of the forest. Some of the variables/coping strategies adopted by farmers in preparation for climate change include crop rotation, mixed farming, mulching, intercropping, planting early-maturing crops, quality seeds, and selective livestock keeping in areas where rainfall declines. The major factor identified as driving farmers' awareness of climate change is educating them more about it and how it can be minimised. The study reveals that rural farmers are aware of climate change and its effects. It also reveals adaptation measures to cope with and mitigate the effects of climate change, while amelioration is designed to reduce the severity and/or prevent global warming.

Therefore, it is recommended that:

- Awareness/education on the issues of climate change still needs to be created by the government to expand the level of awareness of farmers.
- Information on climate change should be made available to farmers and other natural resource

users to create more awareness of the further effects of human activities (such as bush burning) that contribute to climate change.

- The government should organise programs on climate change to strengthen climate change adaptation, especially in rural areas.
- Participation of local farmers in decision-making and planning will ensure cooperation of local people in change awareness.

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