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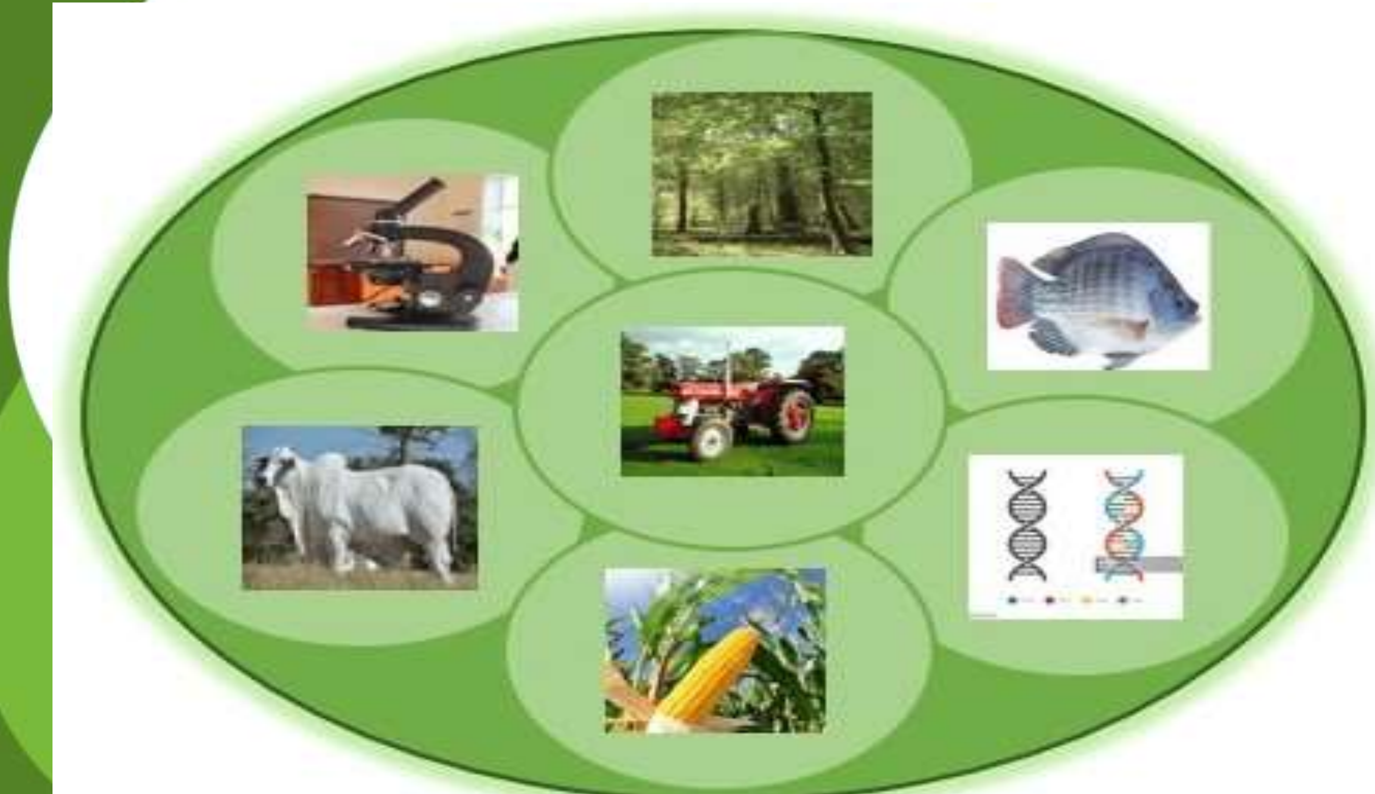

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This official scientific publication of the Faculty of Agriculture, Abdullahi Fodio University of Science and Technology Aliero, is a non-profit, open access, double-blind peer-reviewed Journal publishing four issues (January, April, July and October) per annum. The Journal is a platform open to collaborations with researchers, authors, institutions, research agencies and private companies related to Agriculture. The Mission of the Journal is to disseminate scientific knowledge through the publication of original research articles, research notes, book reviews, letters to the editor and reviews of Literature, representing a contribution to scientific and technological knowledge in respective areas covered by the Journal. The Kebbi Journal of Agriculture and Natural Sciences seeks to validate and disseminate new knowledge, making it public in order to strengthen the human capacity, constitute a link in the scientific community to the society and encouraging the expansion of University and academic researches.

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The Kebbi Journal of Agriculture and Natural Sciences has the sole aim of providing an intellectual platform and ideas for scholars, by promoting interdisciplinary studies related to agriculture and natural science through publishing the latest scientific research findings that are of direct policy implications and beneficial to the research community. Consequently, the journal covers all aspects of Crop Science, Animal Science, Agricultural Economics, Agricultural Extension and Rural Development, Food Science, Fisheries and Aquaculture, Biotechnology, Soil Science and Agricultural Engineering, Forestry and Environment, Wildlife, Agricultural Education, Agro-allied Industries as well as all Natural Science researches related to Agriculture.

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MITIGATION PRACTICES FOR CLIMATE CHANGE AMONG SMALL SCALE CROP FARMERS IN SAKI ADP ZONE, OYO STATE, NIGERIA.

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ABSTRACT

This study investigates climate change mitigation practices among small-scale crop farmers in the Saki ADP Zone of Oyo State, Nigeria. The primary objectives include examining the socioeconomic characteristics of these farmers, assessing the impacts of climate change on their farming practices, identifying existing mitigation strategies, and understanding the driving factors behind these efforts. Data were collected from 245 farmers using a multistage sampling strategy, structured interviews, and focus group discussions. The findings reveal that most respondents are male (53.62%) and married (87.83%), with a significant portion lacking formal education (31.30%). Climate change poses a considerable threat, with 78.84% of farmers citing drought as a major concern, alongside food scarcity (69.85%) and extreme temperatures (70.43%). Various mitigation methods have been implemented, notably crop rotation (Mean: 3.91) and cover cropping (Mean: 3.91), indicating strong support for these practices. However, challenges such as limited access to education and financial resources hinder broader adoption. Factors like gender ($p = 0.001$), household size ($p = 0.020$), and credit availability ($p = 0.008$) significantly influence climate adaptation, showing that larger families and those with better financial access are more likely to adopt mitigation strategies. While farmers' awareness of climate change is increasing, socioeconomic barriers restrict their responses. Recommendations include improving educational programs on climate-smart practices, enhancing financial access, strengthening agricultural extension services, promoting community initiatives, investing in local infrastructure, and supporting policies that empower smallholder farmers. These strategies are vital for enhancing the resilience and sustainability of small-scale farmers in the region.

Introduction

For roughly a thousand years, human societies have transitioned from hunter-gatherer lifestyles to settled agricultural practices, leading to the domestication of various plants and animals. This evolution allowed communities to remain in one location, fostering agricultural development. However, this shift has also placed significant pressure on the environment, contributing to climate change and its profound consequences. Agriculture is inherently dependent on climatic conditions, with factors such as rainfall, sunlight, and temperature directly influencing crop distribution and productivity (Sokoto *et al.*, 2016). The land, a critical resource for agriculture, faces increasing scarcity due to biophysical factors and unsustainable land management practices, including deforestation and soil nutrient depletion (FAO 2015). These practices result in severe consequences like overgrazing, desertification, and soil erosion, all contributing to a decline in available land for farming. Furthermore, human activities that release greenhouse gases (GHGs)—such as methane, nitrous oxide, and carbon dioxide—are accelerating climate change, which is linked to the potential depletion of the ozone layer (IPCC 2007; Mboera *et al.*, 2012).

Climate change manifests through unpredictable weather patterns, rising temperatures, and extreme events like droughts and floods, all of which threaten agricultural productivity. In developing nations, the agriculture sector bears a significant burden, suffering nearly 22% of total climate-related damages (FAO 2015). In Nigeria, where about 80% of the rural population relies on agriculture, farmers face numerous challenges, including soil degradation, climate variability, and insecurity stemming from conflicts (Komolafe *et al.*, 2022; Eniola *et al.*, 2016). These challenges have led to decreased crop yields, increased vulnerability to pests and diseases, and diminished land fertility, resulting in food shortages and economic instability (Gabriel *et al.*, 2023). Small-scale farmers, in particular, are the most affected due to limited access to resources, climate information, and productivity-enhancing inputs (Owusu and Yiridomoh, 2021; Amare and Balana, 2023). Given these pressing issues, it is essential to enhance farmers' awareness of climate change and develop effective strategies for mitigation. This study aims to explore these dynamics and propose actionable solutions for improving resilience among farmers in the face of climate change. It is undeniable that the majority of people in Nigeria's rural communities, where almost 80% of them depend on agriculture for their living, rely heavily on it (Komolafe *et al.*, 2022). Nigerian farmers raise a variety of crops, including yam, cassava, maize, millet, cocoyam, cowpea, guinea corn, and vegetables, due to the land's suitability for farming. However, issues including soil deterioration, deforestation, the high cost of external inputs, climate change, and insecurity through herders appear to be threatening farmers' desire to produce large amounts of food (Eniola *et al.*, 2016).

Unpredictable rainfall patterns, high temperatures, increased flooding during the rainy season, decreased crop yields, increased crop diseases and pest infestations, decreased farm land fertility due to excessive erosion and soil microbial destruction, and an increase in drought occurrence are all signs of climate change (Bolarin *et al.*, 2022). Low harvest, food shortage, starvation, unemployment, short life expectancy, and sluggish economic growth were the outcomes of these consequences (Gabriel *et al.*,2023). Due to their limited institutional and infrastructure hurdles to using climate information, lack of productivity-enhancing inputs, and unequal access to financial resources, small-scale farmers are now the most vulnerable to climate extremes and associated risks (Owusu and Yiridomoh, 2021) as well as low educational attainment and insufficient access to resources needed to lessen the effects of climate change (Amare and Balana, 2023).

The modification of climate patterns is known as climate change. Emissions of greenhouse gases (GHGs), which trap heat and contribute to global warming, are the only factor causing climate change. The primary causes of greenhouse gas emissions into the atmosphere are human activity and natural processes. Natural occurrences include things like wetlands, earthquakes, forest seas, and permafrost, whereas man-made GHG emissions include things like changes in land use, industrial operations, and energy production (Yue and Gao, 2018). By altering the average quantity of rainfall, sunlight, and temperature needed for effective crop production, climate change has a detrimental

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impact on agricultural development. Additionally, the amount of ground-level ozone, atmospheric carbon dioxide, and food nutritional value have all fluctuated due to climate change (Macdiarmid and Whybrow, 2019). To lessen the effects of climate change, people worldwide have implemented adaptation and mitigation strategies against greenhouse gas emissions. To combat the negative impacts of climate change on the majority of human needs, people all over the world have implemented adaptation and mitigation strategies against greenhouse gas emissions. While adaptation refers to steps to lessen sensitivity to hazards that may arise from climate change, mitigation refers to acts to minimize and reduce emissions of greenhouse gases.

Nigerian farmers have taken a number of steps in the agriculture industry in recent years to lessen the effects of climate change. Several writers have enumerated a variety of indigenous and climate-smart adaption techniques that farmers in Nigeria's southern and western areas employ when cultivating crops. Drought-tolerant seed planting, fadama irrigation, afforestation, and organic methods including applying manure, adjusting planting dates for timely crop harvesting, mulching, and fallowing are a few of these techniques (Adeagbo, Ojo, and Adetoro, 2021; Oyelere *et al.*,2020). Unfortunately, a lack of technical expertise, a high rate of illiteracy among farmers, a lack of funds, a poor comprehension of weather forecasts, and a lack of knowledge of the effects of climate change have all put the execution of climate mitigation measures at danger impacts among farmers (Hamidu, 2021). There is no doubting that Oyo State's agricultural development, especially in the area of crop production, is suffering as a result of the long-discussed issue of climate change. The vast majority of Nigerian farmers are smallholders with little access to capital and little ability to adopt expensive farming methods. Strong floods, winds, torrential rains, and thunderstorms are examples of extreme weather occurrences (climate change) that pose major dangers to human health, livestock, and crop productivity. Reduced land-based food production and a rise in disease and insect infestations are common indicators of climate change (Bolarin, Adebayo, and Komolafe, 2022).

The main objective was to examine climate change adaptation practices among small scale crop farmers in Oyo State. The specifically investigation was examine the socioeconomic characteristics, of the small scale farmers in the study area, **examine the effect of climate change on the small scale crop farmers, identify the climate change mitigation practices currently adopted by crop farmers, and to identify the factors influencing climate change among the small scale farmers.**

Methodology

Study area

Research in the areas of agriculture, socioeconomic development, and environmental sustainability is particularly appealing in the Saki Agricultural Development Program (ADP) Zones of Oyo State, Nigeria, where the study was conducted. Its diversified landscape, which includes hills, valleys, and rich plains, places it at roughly 8.0800° N latitude and 4.5500° E longitude. Depending on the season, the area's average temperatures range from 24°C to 30°C (75°F to 86°F), while its relative humidity usually falls between 60% and 85%. Crop productivity and agricultural techniques in the region are greatly influenced by these climatic elements. Many people in the study region depend on farming as their primary source of income, making it the area's most important economic activity. The region's main crops include vegetables, maize, yam, and cassava. High agricultural output is made possible by the rich soil and suitable climate, which makes it the perfect place to research agricultural inventions and methods. Rich cultural traditions and a diverse population may be found in Saki ADP. Local festivals and customs impact agricultural methods, community involvement, and community identity. Effective outreach and intervention tactics in agricultural development require an understanding of these cultural factors.

Sampling procedure

The study used the multistage sampling method. Among the five ADP zones in Oyo State, Saki ADP zone was chosen at random in the first stage. Two Local Government Areas (LGAs) were then chosen at random from the ADP zseveralone: Saki ADP Zone and Oorelope LGAs. These LGAs were chosen due to the concentration of crop production; additionally, about five wards were chosen at random from each LGA, for a total of ten wards. After that, 15% of crop farmers were chosen at random from each ward, for a total of 245 crop farmers, which made up the study's sample size. Data were collected with aid of structured, questionnaire, interview schedule and FGD was also conducted to make a ratification of various responses during the interview.

The primary descriptive statistical methods used in the analysis of the collected data were frequency counts, percentages, means, and rankings. Using ordered probit regression, the variables impacting climate change were identified. This is expressed subtly as:

Y = Level of climate change strategies

x_1 = Age (Years)

x_2 = Sex (Dummy, Male = 0, Female = 1)

x_3 = Marital status (Dummy, 1 = Married; 0 = Unmarried)

x_4 = Religion (Dummy, 1 = Christian; 0 = Islam)

x_5 = Years spent in school (Years)

x_6 = Years of farming experience (Years)

x_7 = Source of information (Dummy, yes = 1, No = 0)

x_8 = Farm size (hectares)

e = error term

The Likert type measurement instrument is presented as by the formula:

$x = (\Sigma f x) / n$, when:

x = mean score

Σ = summation sign

f = frequency

n = No of responses

5 different scaling statements were used namely, very high, high, moderate, low, and very low. The mean of the scaling statement was found as:

$(5+4+3+2+1)/5=15/5=3$

Therefore, 3 is the weighted mean of the scaling statement.

Decision rule: Any mean value greater or equal to 3 is high; any mean value less than 3 is low.

Result and Discussion

Socio-economics characteristics of the Respondents

The demographic information supplied gives a thorough picture of the Saki ADP Zone population, emphasizing a number of attributes such gender, age, marital status, education, family size, occupation, farm size, experience, and average monthly income. Males (53.62%) slightly outnumber females (46.38%) in terms of gender distribution, indicating a fairly equal representation that could affect communal decision-making and agricultural practices. The largest age group (43.48%) is 41–50 years old, suggesting a potentially seasoned workforce that would be more inclined to embrace new agricultural technologies and practices.

According to marital status, a sizable majority (87.83%) are married, which could promote stable family structures and support cooperative farming.

However, a significant percentage (31.30%) do not have a formal education, indicating the need for educational initiatives to improve skills and provide access to cutting-edge agricultural practices. The majority of households (46.96%) have six to ten people, which suggests a higher demand for resources and influences farming choices. Farming is the most common occupation (62.90%), according to occupation data, highlighting the significance of agricultural policy and support networks in raising livelihoods and productivity. The majority of responders (46.38%) farm between 6 and 10 hectares, indicating a mix of medium-sized and smallholder farms that might need specialized assistance. According to the experience distribution, the largest group (50.00%) has 21–30 years of farming experience, suggesting that the workforce may be better equipped to adjust to changes in farming methods. Last but not least, the average monthly income distribution reveals economic vulnerability, with a large percentage of households earning less than N30,000 (17.48%) and more earning between N41,000 and N50,000 (48.42%). To improve livelihoods, this necessitates access to resources and financial assistance.

Effect of Climate Change

The information shows a distinct hierarchy of climate change-related worries, arranged by frequency and percentage from highest to lowest. The majority of respondents (78.84%) cited drought as the most important consequence of climate change, demonstrating the widespread awareness of its detrimental effects on water supplies and agricultural productivity. Food scarcity is the next most important concern, as highlighted by 69.85% of respondents. This worry highlights the possible danger to food security, as it reflects worries that local food systems may be disrupted by changing climate conditions. Seventy-four percent of respondents reported experiencing extreme temperatures, suggesting that many are aware of the dangers heat stress poses to crops and livestock and how it could jeopardize agricultural sustainability. About 63.77% of the population acknowledges that there is less water available, highlighting the significance of efficient water management techniques to deal with dwindling resources needed for daily life and agriculture. 60.87% of respondents cited a lack of labor, indicating worries about the availability of workers, which may be related to migration or changes in agricultural methods that could make farming operations more difficult. 58.26% of respondents admitted a decrease in crop productivity, indicating concerns about farming's long-term viability in the face of climate change. 54.78% of respondents said they have seen more severe storm destruction, indicating worries about the rising frequency and severity of storms that could seriously harm infrastructure and agriculture. Finally, 44.35% of respondents expressed concern about excessive precipitation, suggesting that even though it isn't emphasized as much, it is still a major problem. The requirement for adaptive agricultural operations is indicated by the possibility that planting and growing conditions would be disturbed by severe rainfall.

Table 1: Socio-economic characteristics of the respondents

Variables	Characteristics	Frequency	Percentages
Gender	Male	185	53.62
	Female	160	46.38
Age	<30 years	58	16.81
	31-40 years	79	22.90
	41-50 years	150	43.48
	51-60 years	50	14.49
	>60	8	2.32
Marital status	Single	17	4.93
	Married	303	87.83
	Widowed	16	4.64
	Divorced	9	2.61
Education level	No formal education	114	31.30
	Primary school	108	33.04
	Secondary school	68	19.71
	Tertiary	55	15.94
Household size	<5 members	159	46.09
	6-10 members	162	46.96
	>10 members	24	6.96
Occupation	Farming	217	62.90
	Civil servant	24	6.96
	Artisan	104	30.14
Farm size	<5 ha	118	34.20
	6-10 ha	160	46.38
	>10 ha	67	19.42
Experience	<10 years	47	12.50
	11-20 years	74	19.68
	21-30 years	188	50.00
	>30 years	67	17.82
Average monthly income	<N30,000	61	17.48
	N31,000 - N40,000	84	24.07
	N41,000 - N50,000	169	48.42
	N51,000 - N60,000	35	10.03

Source: Field Survey (2025)

Table 2: Distribution based on the Effect of Climate Change

Effect of climate change	Frequency	Percentage
Drought	272	78.84
Reduction in water availability	220	63.77
Scarcity of food	241	69.85
Lack of labour	210	60.87
Reduction in crop yield	201	58.26
More severe storm destruction	189	54.78
Extreme temperature	243	70.43
Extreme precipitation can prevent crop from growing	153	44.35

Source: Field Survey (2025)

Climate change mitigating practices

The community has a high appreciation for crop rotation and cover crops (Mean: 3.91, Rank: 1st), demonstrating significant support for their ability to mitigate climate change. This implies that farmers are aware of how these methods can improve soil fertility and agricultural resilience. A favorable attitude toward lowering soil erosion and enhancing water retention is also demonstrated by the widespread acceptance of conservation tillage (Mean: 3.82, Rank: 3rd). Given its high ranking, it appears that farmers understand its significance for sustainable farming. A willingness to embrace methods that enhance ecological balance is seen by the support for intercropping (Mean: 3.73, Rank: 4) as a useful tactic for boosting biodiversity and optimizing land usage.

The positive perception of integrated pest management (IPM) (Mean: 3.70, Rank: 5) highlights a move away from chemical-dependent systems and demonstrates an awareness of the necessity for sustainable pest control techniques. Although it rates lower than others, the usage of organic fertilizer (Mean: 3.55, Rank: 6) is positively rated, which may indicate access issues or gaps in understanding about the use of organic fertilizer. Moderate support is shown for irrigation (Mean: 3.53, Rank: 7th), underscoring its perceived significance as a response to shifting water supplies and climatic patterns. Although they are acknowledged, enhanced seed varieties (Mean: 3.42, Rank: 8) are not given as much priority as others, indicating potential to expand access to improved seeds and education.

Although mulching and inorganic fertilizer use are perceived similarly (Mean: 3.28, Rank: 9th), differing attitudes regarding the environmental impact of inorganic fertilizers are shown by conflicting sentiments. The least preferred option is crop diversification (Mean: 3.23, Rank: 12th), suggesting either a lack of awareness of its advantages or possible obstacles to its adoption. The lowest mean score was given to shifting cultivation (Mean: 2.55, Rank: 13th), indicating strong opposition or doubt over its efficacy in sustainable farming.

Table 3: Distribution based on mitigation practices adopted by the crop farmers

Climate change mitigation practices	SA	A	U	D	SD	Mean	Rank
Mulching	36(10.43%)	129(37.39%)	98(28.41%)	58(16.81%)	24(6.96%)	3.28	9th
Intercropping	81(23.48%)	146(42.32%)	73(21.16%)	33(9.57%)	12(3.48%)	3.73	4th
Crop rotation	142(41.16%)	91(26.38%)	63(18.26%)	37(10.72%)	12(3.48%)	3.91	1st
Use of organic fertilizer	63(18.26%)	134(38.84%)	87(25.22%)	49(14.20%)	12(3.48%)	3.55	6th
Use of inorganic fertilizer	57(16.52%)	122(35.36%)	81(23.48%)	30(8.70%)	55(15.94%)	3.28	9th
Integrated pest management (IPM)	79(22.90%)	150(43.48%)	58(16.81%)	50(14.49%)	8(2.32%)	3.70	5th
Crop diversification	50(15.87%)	167(53.02%)	31(9.84%)	36(11.43%)	31(9.84%)	3.23	12th
Irrigation	33(9.57%)	184(53.33%)	81(23.48%)	26(7.54%)	21(6.09%)	3.53	7th
Conservation tillage	110(31.88%)	120(34.78%)	69(20.00%)	35(10.14%)	11(3.19%)	3.82	3rd
Shifting cultivation	69(19.94%)	49(14.15%)	40(11.56%)	30(8.67%)	158(45.66%)	2.55	13th
Contour farming	66(19.13%)	197(57.10%)	62(17.97%)	16(4.64%)	4(1.16%)	3.88	11th
Cover cropping	135(39.13%)	104(30.14%)	57(16.52%)	37(10.72%)	12(3.48%)	3.91	1st
Improved seed varieties	68(19.71%)	122(35.36%)	68(19.71%)	55(15.94%)	37(15.94%)	3.42	8th

Source: Field Survey (2025)

SA= strongly agree A= agree U= undecided D= disagree SD= strongly disagree

Factors influencing climate change

According to the ordered probit regression, the following are the major factors related to climate change: A high correlation with gender (p = 0.001) suggests that gender influences the adoption of climate change initiatives. The significance of household size (p = 0.020) indicates that larger households are more likely to implement climate change initiatives. A possible trend where occupation may influence the adoption of climate change methods is indicated by occupation (p = 0.067), which is marginally significant. Education shows a substantial negative correlation (p = 0.000), indicating that lesser adoption of some climate policies may be associated with higher education levels. Credit availability shows a substantial negative correlation (p = 0.008), suggesting that the implementation of climate change initiatives is impeded by low credit availability. The significance of belonging to an association in encouraging the adoption of climate change strategies is highlighted by association (p = 0.000). Mulching is acknowledged and has a good correlation with climate change adaptation (p = 0.010). Last but not least, adaptive agricultural practice (p = 0.039) indicates that using particular agricultural practices increases the possibility of implementing more comprehensive climate change measures.

Table 4: Distribution based on factor influencing climate change

Climate change strategies	**Coeff**	**Std.err**	**z**	**p>/z/**
Gender	0.4236716***	0.1295598	3.27	0.001
Age	0.005615	0.0220878	0.25	0.799
Marital status	0.1474977	0.2046201	0.72	0.471
Household size	0.2310098**	0.990651	2.33	0.020
Occupation	0.0523577*	0.0720025	0.73	0.067
Education	-0.5324214***	0.0975171	-5.46	0.000
Farm size	-0.5613027	0.5633074	-1.00	0.319
Access to credit	-0.632363***	0.238025	-2.66	0.008
Association	0 .8143728***	0.1812169	4.49	0.000
IPM	-0.0231514	0.0774696	-0.30	0.765
Intercropping	-0.0965729	0.0690507	-1.40	0.162
Crop rotation	-0.0913009	0.0614635	-1.49	0.137
Mulching	0.130316	0.0508174	2.56	0.010
Credit	-0.057986	0.0728726	-0.80	0.426
Adaptation_agricultural_practice	0 .1852938	0.089739	2.06	0.039

Source: Field Survey (2025)

Conclusion and Recommendation

The study's conclusions highlight the substantial effects of climate change on Oke-ogun's small-scale crop farmers and demonstrate the intricate relationship between environmental issues and farming methods. According to the statistics, although farmers are aware of climate change and have begun implementing mitigation strategies, socioeconomic issues, such as restricted access to resources and technical expertise, frequently limit their efforts. The identification of particular issues, such food insecurity and drought, highlights the necessity of focused interventions to help these farmers adjust to climate change and increase their total output.

Thus, the analysis suggests: Implement education and awareness campaigns about the effects of climate change and strategies for adaptation. The advantages of climate-smart practices and workshops on sustainable farming methods should be part of this. Provide small-scale farmers with easier access to loans and funding so they can invest in technologies and practices that reduce pollution. This can entail collaborations with government initiatives and financial entities. Increase agricultural extension services' reach and capability to give farmers timely, pertinent information on best practices, pest control, and weather forecasts. And to share resources, expertise, and assistance, farmers should be encouraged to work together. Forming farmer associations can improve group efforts to implement new methods. Enhance local infrastructure, like storage facilities and irrigation systems, to help farmers manage the consequences of climate change and lower post-harvest losses.

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