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CLIMATE CHANGE ADAPTATION STRATEGIES AND AGRICULTURE IN ANAMBRA STATE, NIGERIA

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ABSTRACT

Most crop farmers experience low crop yields due to extreme weather conditions such as high and fluctuating rainfall patterns, flooding, droughts, high temperatures, and other disparaging weather conditions caused by climate change. The study specifically examined the use of climate change adaptation strategies among these farmers, analyzed the determinants of crop farmers' involvement in climate change adaptation practices in the state, estimated the effects of climate change adaptation practices on their income and, determined factors affecting the volume of investments in climate change adaptation practices in the study area. The study adopted a survey design. The multi-stage sampling technique was used to select 100 respondents. Data were analyzed using probit and Ordinary Least squares multiple regression. The climate change adaptation strategies were the use of wetland (18.14), afforestation (27.73), while the use of resistant varieties (-121839.60), increased use of fertilizers (96642.13), moving to a different site (291119.50), and erosion control (102061.3) significantly affected their income. The socioeconomic factors that significantly influenced the volume of investments to the climate change adaptation practices among the crop farmers included: age of the crop farmers (-0.03), marital status (6467.17), educational level (1442.87), household size (1193.01), primary occupation (188.99), farm size (1824.09) and income (24258.42). It was recommended that crop farmers use indigenous climate change adaptation practices.

Keywords: Economic Assessment, Climate Change, Adaptation Strategies, Crop Farmers

INTRODUCTION

The agricultural sector is important to Nigeria's economy and that of other developing countries of the world. It contributes significantly to the Gross Domestic Product and employs a greater percentage of the labour force (Babatunde, 2020). In Nigeria, agricultural production remains the primary source of income and employment for most rural communities in the region; therefore, adaptation of the sector to climate change is imperative to enhance its resilience, protect the livelihoods of people experiencing poverty, and ensure food security (Agesa *et al,* 2019). Agriculture is one of the sectors sensitive to global warming; most farmers make low crop yields due to the incidents of extreme weather conditions such as high and fluctuating rainfall patterns, flooding, droughts, high temperature, and other disparaging weather conditions caused by climate change (Ibe and Amikuzuno**,** 2019). Climate change also leads to a rise in the sea level with the consequences of fiercer weather conditions, increased frequency and intensity of storms, floods, hurricanes, and droughts (BNRCC, 2008; NRDC, 2024; FAO, 2024). Sea levels rise because of high temperatures, glacial retreat, and increased rainfall in some areas and in turn results in agricultural land loss, erosion, submergence of shorelines, and salinity of the water table due to the increased sea level, which affects agriculture through inundation of low-lying lands (MOEFRN, 2003; NRDC, 2024).

This knowledge is of great importance because Agriculture is one of the sectors highly vulnerable to the impact of climate change, especially in a country like Nigeria, where agriculture is almost entirely rain-fed and practiced at the subsistence level (Falaki *et al*, 2010). The concern about the impact of climate change on sub-Saharan African agriculture stems from its potential to undermine the local economy and livelihoods in farming communities that heavily depend on crop production for food and incomes (Chete, 2019). The seasonality of most agricultural activities and limited use of inputs in Nigeria make it especially vulnerable to weather or climate-related challenges across the various stages of the production cycle (Odekunle, 2004; Adejuwon, 2006; Gold and Anagun, 2026; Ofoegbu, 2025).

Climate change refers to a change in climate that is attributed directly or indirectly to human activities, which alters the composition of the global atmosphere and is observed over comparable periods (IPCC, 2007; Osuafor and Ude, 2021). Climate change is a global phenomenon that results in global warming, droughts, flooding, and depletion of natural resources (Naqvi and Sejian, 2011). it has also been identified as one of the most crucial factors negatively affecting sustainable agricultural production (Elijah *et al*., 2020) and the scope for reducing poverty in Nigeria. Therefore, any climate change is bound to impact the agricultural sector and other socio-economic activities in general (Ejechi *et al,* 2016). Climate change has thus become the most important topical development policy and global governance issue in the 21st century (African Development Bank (AfDB), 2010). The harsh seasonal variations in rainfall and temperature resulting from climate change expose farmers, primarily those in rural areas, to intense risks, which, in turn, have a significant bearing on the production outcome. Because a larger proportion of the local population in Nigeria operates under rain-fed agriculture, rainfall and temperature variations have severe implications on production (Awe *et al,* 2020).

The world has witnessed a distinctive change in climate parameters such as rising temperature, shift in rainfall patterns, melting of glaciers and snow, and rising global mean sea level, among others. These changes are expected to continue, alongside extreme weather events resulting in hazards such as floods and droughts which will become more frequent and intense globally. Nigeria has had its share of the deleterious effects of the global climate change phenomenon. These are evident in disrupted seasonal cycles and ecosystems. These disruptions have taken a toll on agriculture, food production, farmers' income, and livelihoods. Crop farmers face prospects of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition, and diseases (FAO 2023; World Bank, 2024). It is projected that crop yield in Nigeria may fall by 10-20% by the year 2050 or up to 50% due to climate change.

Nigeria therefore needs to make concerted efforts at adapting to the expected impacts of anticipated climate change, and this requires a significant level of conscious response to climate change (Oladipo, 2010). Most farmers in Nigeria, particularly in Anambra state, depend on rain-fed agriculture and hence are fundamentally dependent on the vagaries of weather. This phenomenon threatens to deepen vulnerabilities, erode hard-won gains, and seriously undermine prospects for development (Ejechi *et al*, 2016). Thus, there is a need for crop farmers to engage in climate change adaptation strategies and assess their effect on their income.

Crop farmers who grow varieties of food crops in Anambra state have complained of a drastic reduction in soil fertility, and that they can no longer predict the rainfall, as the soil is becoming drier and harder to cultivate. These changes are causing severe threats. These unpredictable changes in the onset of the rain have led to situations where crops planted with the arrival of early rains get smothered in the soil by an unexpected dry spell that may follow early planting. That crop smothering and the late arrival of rains due to climate variability, resulting in crop failures in ecosystems that rely on rain-fed agriculture (Okeke, 2009). There is therefore a need to gain as much insight as possible from the positions of rural farmers and their needs, what they know about climate change, and how they cope with it. Thus, human responses are 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 to estimate climate change mitigations and responses (Apata *et al*, 2009; Spore, 2008; BNRCC, 2008; Agila and Kiraz, 2025; Hussein et al., 2024). To reduce the effect of climate change and variability, adaptation measures are veritable tools for mitigating the untold effects of climate change on the yield and income of crop farmers.

Studies have identified several climate change adaptation measures, including using new crop varieties and livestock species better suited to drier conditions, irrigation, crop diversification, adopting mixed crops and livestock farming systems, and changing planting dates. However, the dimensions of using these measures have not been effectively explored, particularly in Anambra State. This is important since farmers cannot adapt effectively to climate change and will suffer most severely. From the foregoing, this study examined the effect of adaptation strategies to climate change on crop farmers' income in Anambra State, Nigeria. Specifically, it examined the use of climate change adaptation strategies by crop farmers; analyzed the determinants of crop farmers' involvement in climate change adaptation practices, estimated the effects of climate change adaptation practices on crop farmers' income and determined factors affecting the volume of investments in those adaptation practices in the study area.

MATERIALS AND METHODS

The study was conducted in Anambra State. The state is located in the Southeast geopolitical zone of Nigeria, between latitudes $5^0 40^1$ North and $6^0 48^1$ North and between longitudes $6^0 35^1$ East and $7^0 30^1$ East. The state has a land area of about 4,415.54 square kilometres (Anambra State Government, 2007) and a population of 4,182,032 (NPC, 2006). The state has twenty-one local government areas (LGAs) grouped into four agricultural zones, namely: Anambra zone, Awka zone, Aguata zone, and Onitsha zone. It has an equatorial climate with two seasons, viz the rainy season, which lasts from April to October, and the dry season, which lasts from November to March.

A multistage random sampling technique was adopted in the research. At the first stage, five LGAs were randomly selected from the zones. One LGA was randomly selected from Awka zone, Aguata zone, and Anambra zone, while two LGAs were selected from Onitsha zone (due to the large population of this zone). The second stage involved randomly selecting two autonomous communities in each of the sampled local government areas. This gave a total of ten (10) communities for the study. In the third stage, ten (10) crop farming households were selected from each of the ten communities already sampled. The list of crop farming households was obtained from the Anambra State Agricultural Development Programme (ANADEP). One hundred crop farm households were selected, and the questionnaires were administered.

Primary data were used for this study. The data were collected using a set of structured questionnaires. The questionnaires were administered to the heads of crop farming households, eliciting information on socio-economic and institutional characteristics, climate change adaptation strategies adopted by them, and the farming system of the household. The data collected were analyzed using descriptive statistical analysis and inferential statistics. Objectives (i) was achieved using descriptive statistics, objective (ii) was realized using the Probit model, while objectives (iii) and (iv) were analyzed using multiple regression model analysis.

Model Specification

Probit Model

The Probit model was employed to estimate the factors that influence the level of involvement of the crop farmers in climate change adaptation practices in the study area.

The explicit form of the model is:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + e$$

Where:

Y conditional probability estimates with one as highly involved and zero as less involved in climate change adaptation practices.

$\beta0$ = the intercept

$\beta1 – \beta10$ = coefficients of independent variables

X1 - X10 = factors influencing the level of involvement of a farmer in adaptation practices, e = stochastic error term.

The factors influencing the level of involvement of the farmers in adaptation practices include:

X1 Gender (1 if male, zero if female)

X2 Age (in years)

X3 = Farming experience (in years).

X4 = Marital status (1 if married, zero otherwise) X5 = Education level (in years).

X6 =Household size (number of persons) X7 Number of farms

X8 = Farm size (Hectare) X9 = Farmers' income (N)

X10=Major occupation (Farming=1, otherwise =0) e = Stochastic error term

Multiple Regression Analysis

The multiple regression model was used to analyze the influence of climate change adaptation strategies on farmers' income from crop production. The implicit form of the regression model to be used is:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}) + U$$

Where:

Y: Amount of money realized from crop production (N)

X1 = Purchased water for irrigation (in Naira)

X2 = Mulching
X3= Use of wetland
X4 Afforestation (planting of trees)
X5 Use of resistance varieties
X6 Processing crops to minimize post-harvest loss
X7 Expansion of cultivated land (in hectares)
X8 Increased use of fertilizer
X9 = Intensive application of manure
X10 Use of chemical herbicides for pest control (in Naira)
X11 Multiple cropping/intercropping
X12 moving to a different site
X13= Erosion control
U = Stochastic error term.

Multiple Regression Analysis

The multiple regression model was also used to analyze the factors influencing farmers' investment volume in adaptation to climate change. The implicit form of the regression model to be used is: Y = f (X1, X2, X3, X4, X5, X6, X7, X8) U

Where:

Y: Amount of money invested in climate change adaptation (N)
X1 Sex (1 if male, zero if female)
X2 Age (in years)
X3 Marital status (1 if married, zero otherwise).
X4 Education level (Years of schooling).
X5 = Household size (number)
X6 = Primary occupation (Farming =1, otherwise =0)
X7 Farm size (Hectare)
X8 = Farming experience (in years)
X9 = Farmers' income (N)
U = Stochastic error term

RESULTS AND DISCUSSION

Climate Change Adaptation Practices used by Crop Farmers and their Extent of Use

Table 1 revealed the climate change adaptation practices used by crop farmers in the study area to cushion the effects of climate change on their crop production. The climate change adaptation practices used by crop farmers based on their percentage are multiple cropping (92%), mulching (86%), use of chemical herbicides (69%), increased use of fertilizer (68%), use of resistant varieties (65%), processing of crops to minimize post- harvest losses (65%), intensive application of organic manure (57%), erosion control (52%), use of wetland (11%), purchased water for irrigation (8%), expansion of cultivated land (7%), afforestation (7%) and move to a different farm (5%) as seen in table 1.

The extent of use of multiple cropping was 92 per cent, which means that most crop farmers practiced multiple cropping to adapt to climate change. Most crop farmers engage in multiple cropping because it spreads risk, since different crops have different resistance. Mulching was also widely used by crop farmers, especially those growing yams, as 86 percent of them mulched the soil to avoid harsh weather conditions and to prevent heavy rains from washing away the ridges and heaps. As the farmers mulch the soil, they can adapt to climate change and reduce its effects. The farmers who used chemicals such as herbicides and pesticides in controlling weed growth and pests, respectively, were 69 per cent. The use of herbicides in controlling weeds is very effective and fast. Sixty-eight per cent of respondents increased the use/application of fertilizer to have higher yields and for their crops to grow and mature fast. Also, increasing the yield of crops is so as to cover the cost of damage done by climate change. Resistant varieties were used by 65 percent of the crop farmers. They planted crops that can resist harsh weather conditions. Sixty-five per cent adapted to climate change by processing crops to minimize post-harvest losses. Fifty-seven per cent also applied organic manure intensively to increase the productivity of their crops. Fifty-two per cent of them used erosion control to adapt to climate change, such as excess rainfall, which can lead to flooding.

Only 11 percent used wetlands, e.g., FADAMA, to grow their crops to adapt to climate change. Eight percent of the respondents purchased water for irrigation as a means of climate change adaptation strategy. Expansion of cultivated lands was employed by only seven percent of the crop farmers. Seven per cent of them practiced afforestation, which is, growing trees to break the wind's speed, reducing soil erosion, and providing shade on the farm. This assisted them in adapting to harsh climatic conditions. Moving to a new site was employed as a strategy to adapt to the change in climate by six percent of the total sample size.

Table 1: Climate Change Adaptation Practices used by Crop Farmers

Indigenous Climate Change Practice	Percentage (%) N=100
Multiple cropping/intercropping	92
Mulching	86
Use of chemical herbicides	69
Increased use of fertilizer	68
Use of resistant varieties	65
Processing of crops to minimize post-harvest losses	65
Intensive application of organic manure	57
Erosion control	52
Use of wetland	11
Purchased water for Irrigation	8
Expansion of cultivated land	7
Afforestation	7
Move to a different farm site	5

Source: Computed from field data, 2025.

Determinants of Crop Farmers' Involvement in Climate Change Adaptation Practices

Table 2 presents the results of the probit model used to identify factors influencing the level of involvement to climate change adaptation practices among crop farmers in the study area. The log-likelihood ratio (LR) Chi^2 of 68.43 with Prob>Chi^2 of 0.0000 is highly significant at 1% probability, suggesting the model has a strong explanatory power. The pseudo (R^2) was 0.5243, which means that the explanatory variables accounted for 52.43 percent of the dependent variable. Seven variables were significant factors influencing the level of involvement in climate change adaptation practices. These are farming experience, education level, household size, number of farms, farm size, farmers' income, and primary occupation.

The farming experience was positively related to the level of involvement in climate change adaptation practices at 5% significance, as shown in Table 2. The implication is that increasing the farming experience would increase involvement in climate change adaptation strategies. A unit increase in farming experience of the respondents would lead to a 0.2091 increase in the probability of the level of climate change adaptation practices involvement, as seen in Table 2. Well-experienced crop farmers would have had good knowledge of climate change and its effect on their productivity and, therefore, used the appropriate adaptation/coping strategies. Education level also has a positive and significant relationship with the probability of involvement in climate change adaptation practices at 1% level of significance, as shown in Table 2. This is in line with the *a priori* expectation. A unit increase in years of education would increase the probability of level involvement in climate change adaptation strategies by 1.5398, as shown in Table 2. This aligns with the findings of Awe *et al.* (2020) and Enete *et al*. (2011). It implies that the higher the crop farmers' educational level, the higher their involvement in climate change adaptation practices. An educated farmer has access to information about climate change and its implications. Ndamani and Watanabe (2016) stated that education plays a significant role in farmers' adaptation to climate change, and farmers with higher levels of education are more likely to use improved technologies to adapt to climate change. Therefore, educated farmers would engage in more adaptation practices.

The household size was negatively and significantly related to the probability of involvement in climate change adaptation practices at 5% significance level, as seen in Table 2. This contradicts the findings of Awe *et al*. (2020), who reported that household size positively influenced climate change adaptation practices. The number of farms was also negatively and significantly related to the probability of the level of involvement of climate change adaptation practices at 1% significance level, as seen in Table 2. The implication is that the higher the number of farms, the lower the number of climate change adaptation practices by crop farmers. A farmer with many farms may not need to engage in many climate change adaptation strategies because, as his farms are not located in a single place, climate change effects would not be simultaneous. Having many farms is a means of adapting to climate change.

Farm size was positively significant at 5%, which implies that a crop farmer having a large farm is likely to practice many climate change adaptation strategies. Because they invest more in their large farm sizes, they will also be engaged in many climate change adaptation practices. Farmers' income was also positively significant at a 5% significance level, which is in line with the findings of Awe *et al*. (2020). This means that the higher the farmer's income, the higher their involvement in climate change adaptation practices. A higher-income farmer would have enough money to engage in more climate change adaptation practices. Lastly, the primary occupation was positively significant at 10%. This implies that crop farmers, with farming as their primary occupation, will practice more climate change adaptation strategies concertedly. Because they do not have other livelihood means, they must find ways of adapting to climate change to reduce its adverse effects.

Table 2: Parameter Estimates of the Determinants of Crop Farmers' Level of Involvement in Climate Change Adaptation Practices

Variables	Coefficient	Standard Error	t-value
Gender	-0.817788	0.9274586	-0.88
Age	0.0045352	0.0436695	0.10
Farming experience (years)	0.2090614***	0.0828309	2.52
Marital status	0.1846949	0.3623186	0.51
Education level	1.539763***	0.4761507	3.23
Household size	-0.3181944**	0.1538176	-2.07
Number of farms	-0.4405456***	0.1511242	-2.92
Farm size	0.8874626***	0.3575102	2.48
Farmers' income	1.964211**	0.9781843	2.01
Primary occupation	0.5207648*	0.3160557	1.65
Constant	-16.63189	5.893261	-2.82
LR Chi^2 Prob>Chi^2 Pseudo R-squared	68.43***	0.5243	

*** p<0.01, ** p<0.05, * p<0.1

Source: Computed from field data, 2025.

Effect of Climate Change Adaptation Strategies on Farmers' Income

Table 3 shows the climate change adaptation practices that influence farming income. The result showed that the explanatory power of the specified variables was 0.8503. This means that the explanatory variables explained 85.0% of the dependent variable. Other works with similar coefficients of determination include Haruna (2019) and Enete & Onyekuru (2011). The overall goodness of fit, as reflected by the F-value of 2.73, was highly significant at 1 1% probability level.

Six variables (use of wetland, afforestation- planting of trees, use of resistant varieties, increased fertilizer use, moving to a different site, and erosion control) were significant factors influencing the farmers' income from farming in the study area. Use of wetland in cultivating crops was positively and significantly related to the farmers' income at 5% significance level, as shown in Table 3. This implies that the more the farmer uses wetland in cultivation, the higher the yield or output will increase, and the farmer's income will increase. Afforestation (planting trees) was positively significant at 1%, which was related to the farmers' income. Farmers who used afforestation to adapt to climate change derived more income from farming. The increased income could be from the higher productivity of the farming activities. The use of resistant varieties was negatively significant, at 10%, and was related to the farmers' income. This is unexpected since the use of resistant varieties should reduce the level of effect of climate change. The negativity of the coefficient could, however, be due to the high cost of this resistance variety of crops, as its high cost would increase the cost of production.

Increased fertilizer use was positively significant at 10%, which was related to the farmers' income. As crop farmers increased fertilizer use to adapt to climate change, the crop yield increased. This higher yield will then lead to an increase in farming income. Moving to a different site was positively significant at 5%, which was related to the farmers' income. Moving away from a site highly affected by climate change, such as an area with excess rainfall or a too-dry area, to a better site with less effect of climate change increases the income derived from crop farming. Erosion control was positively significant at 10%, which was related to the farmers' income. Controlling erosion to avoid flooding as a climate change adaptation strategy will reduce the damage caused to the crop. As this is done, the crop farmers would have high productivity, which will in turn increase the farmers' income.

Table 3: Effect of Climate Change Adaptation Strategies on Farmers' Income

Variables	Coefficient	Standard Error	t-value
Purchased water for irrigation	-124403.2	89914.74	-1.38
Mulching	65946.5	83169.55	0.79
Use of wetland	181406.3**	85027.76	2.13
Afforestation (planting of trees)	277327***	102322.2	2.71
Use of resistance varieties	-121839.6*	69387.69	-1.76
Processing crops to minimize post-harvest loss	-23400.11	62581.35	-0.37
Expansion of cultivated land	-106848.3	95271.53	-1.12
Increased use of fertilizer	96642.13*	57948.98	1.67
Intensive application of manure	-13812.57	58769.44	-0.24
Use of chemical herbicides for pest	38552.09	60232.42	0.64
Multiple cropping/intercropping	64929.1	104166.6	0.62
Moving to a different site	291119.5**	116756.6	2.49
Erosion control	102061.3*	56807.79	1.80
Constant	162697.4	105257.3	1.55
R-squared F value Prob > F	0.8503	2.73	0.0028
P value	*** p<0.01	** p<0.05	* p<0.1

Source: Computed from field data, 2025.

Factors Affecting the Volume of Investments in Climate Change Indigenous Adaptation Practices

Table 4 revealed the socioeconomic factors influencing the level of investments in the indigenous climate change adaptation practices among the crop farmers. The analysis in Table 4 shows that the explanatory power of the specified variables was high (0.722) enough to explain the dependent variable. This means that the explanatory variables explained 72.2% of the dependent variable. The overall goodness of fit, as reflected by the F-value of 2.74, was, however, highly significant at 1% significance level. The result revealed that age, marital status, educational level, household size, primary occupation, farm size, and income were the significant factors influencing the volume of investments in indigenous climate change adaptation practices.

The age of the crop farmers was negatively significant, with the volume of investment in climate change adaptation practices being at a 10% probability. It implies that the lower the age of the farmers, the higher the volume of investments in climate change and *vice versa*. A younger farmer is likely to spend more on adapting to climate change, which could result from older farmers being risk-averse while younger farmers are risk-takers. This is in line with *a priori* expectation. Marital status was positively significant at 5%, which implies that married farmers invest more in climate change adaptation practices. This is in line with the theoretical criteria. The educational level was positively significant at 5% with the investment volume in climate change adaptation practices. This is in line with the findings of Enete et al (2011). The implication is that as the years spent in school increase, the investment volume will also increase. An educated farmer will spend more time adapting to climate change. Household size was positively significant at 10% with the investment volume in climate change adaptation practices. This implies that the investment volume will also increase as the household size increases. This shows that households with larger sizes will invest more in adapting to climate change. The primary occupation was also positively significant at 1%, implying that crop farmers who have farming as their primary occupation invest more in adapting to climate change. Another significant variable was farm size, with a positive coefficient at 5% probability level. This implies that the higher the farm size, the higher the investment volume among the crop farmers. Farmers with large farms tend to spend more on climate change adaptation practices than those with small farms. Lastly, income was also positively significant at 5% with the investment volume in climate change adaptation practices. As the farmers' income increases, they have more money to invest in climate change adaptation strategies.

Table 4: Factors Affecting the Volume of Investments in the Indigenous Climate Change Adaptation Practices

Variables	Coefficient	Standard Error	t-value
Gender of the Household head	6269.757	4913.052	1.28
Age	-0.0324901*	0.0172542	-1.88
Marital status	6467.176***	2569.052	2.52
Educational level	1442.872***	520.5917	2.77
Household size	1193.01*	624.0791	1.91

Variables	Coefficient	Standard Error	t-value
Major occupation	188.9939***	57.93881	3.26
Farm size	1824.087***	701483	2.59
Farming experience	284.005	243.6784	1.17
Income	24258.42***	9301.537	2.61
Constant	-152752.7***	55531.41	-2.75
R-squared F value Prob > F	0.722	2.74	0.0022

*** p<0.01, ** p<0.05, * p<0.1

Source: Computed from field data, 2025.

CONCLUSION

The study concluded that the crop farmers were aware of climate change due to the different indigenous strategies they used in adapting to climate change in the area. It was also concluded that the indigenous climate change adaptation practices were profitable and their effects on farmers' income cannot be overemphasized. These indigenous climate change adaptation practices have been proven effective in managing climate change among the crop farmers in the study area. The study therefore recommends in line with the findings of this study, the use of indigenous climate change adaptation practices by crop farmers, considering its positive impact on net return. Also a farmer to farmer paradigm that targets the teaching of relevant practices to older farmers by younger farmers is highly effective as a lasting doorway to the use of more indigenous climate change adaptation practices and the effectiveness will be a function of the extent to which farmers are able to read and write. Subsidizing fertilizers to crop farmers and controlling erosion are key drivers of better farm income in the study area as seen. Finally, Indigenous climate change adaptation practices like the use of wetland, planting of trees (afforestation), and moving to less prone farm sites are to be encouraged among the crop farmers in the study so that their income can be enhanced.

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