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Assessment of Climate Change and Food Security Status of Cassava Farming Households in Imo State, Nigeria

[1]Umoh, E.E., [2]N.C. Ehirim and [3]Ikheloa, E.
[1]Department of Agricultural Extension and Management,
University of Uyo, Uoy Akwa Ibom State, Nigeria
[2]Department of Agricultural Economic, Federal University of Technology, Owerri, Imo State, Nigeria
[3]Department of Agricultural Economics and Extension Management, Ambrose Ali University, Ekpoma, Edo State
*Corresponding Author; Email: ehinadykus@yahoo.com
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Abstract

This study analyzed climate challenges and food security status of cassava farmers in Imo State, Nigeria. The study arose from the ever increasing challenges posed by climate change to the farmers as they endeavor to keep their households food secured. Specifically this study described the level of challenges posed by climate change as perceived by farmers in the study area. It also estimated the food security status of the individual farming household as well as the factors affecting food security level of households in the study area. Data were obtained using multi stage sampling techniques. A total of 180 respondents selected from 9 communities were used for the study and primary data were collected by means of structured questionnaire. Descriptive statistics was used to describe both the socioeconomic characteristics of the farmers and farmers' perception of climate change challenges; the food security level of the households was proxies by daily calories intake and cassava demand gap for the household while the determinants of food security were estimated using the Probit regression technique. The results revealed that farmers were informed about seasonal indicators, environmental challenges and manmade challenges arising from climate change. Moreover, majority of the households in the area were food insecure, while educational status, off farm income and farming experience increased the probability of a household being food secured conversely, age of household head and household size influenced household food security status negatively. The study recommended an increase in awareness campaigns to improve farmer's perception of climate change. It also advocated the provision of more income earning opportunities for farmers in the rural area to enhance their off farm income generation and improve household food security status.

Key words: *Cassava, Climate change, Food security and Farming Households*

Introduction

IISD (2007) noted that with the significant changes in statistical distribution of weather patterns over a period of time, usually three decades to millions of years, around the average weather condition (with more or fewer extreme weather events), there is climate change. The resultant global weather distributions are seriously fingered in not only in the prevailing low agricultural productivity and sever poverty, but also in the health challenges of farming households and environmental degradation (Hussen, 2000). Climate change is a global issue with major government policy concern targeted at food security and poverty reduction (Apata et al, 2009). Available natural resources lying side by side with environmental degradation and the drastic distortion in the natural and global food production systems is a serious issue in the study area.

The study area has many economic activities, with massive energy demand that depend on heavily on the burning of fossil fuels. Frequent burning of fossil fuels and heavy release of more Green House Gases (GHGs), mainly Carbon monoxide (CO), Methane (CH4), N_2O and NO, which cause climate change, can no longer be degraded because the natural environment has exceeded its assimilative capacity. This suggests that climate change is synonymous with human activities on the globe (Hassen, 2000). Climate change has a drastically altered the atmospheric components living adverse effects on agriculture (Kurukulasuriya and Mendelsohn, 2006). The long shift in the weather variation for instance is seen in the changes in rainfall or precipitation, temperature, relative density and cloud cover (Lobell *et al*, 2008) as the Greenhouse gases (CO2, CHO_4, NO, N_2O) that attack the protective layer of the atmosphere called Ozone, is dropping a massive heating effect on the gases, dissolving ice on the globe, which further degrade the environment.

The concept of food security is one that has evolved during the 1990s far beyond traditional focus on supply of food at the national level. Although it was given general definitions in the past to mean availability of food, it is recently referred to the availability of food and one's ability to gain access to it. In that case a household is considered food secure when its occupants do not live in hunger or fear of starvation. Food security is thus beyond food self sufficiency. Conversely, food self-sufficiency refers to a state of not requiring any food aid, support and/or interaction for survival. It is a term, which applies to a variety of sustainable living in which nothing is consumed outside what is produced by the self-sufficient individual. The definitions above did not consider households' food preferences and the food quality. Food security therefore, exists when everyone at all times have physical and economic access to safe and nutritious food to meet up their dietary needs, and their food preferences are enough to meet the active healthy life (World Summit, 2008).

No natural environment has all the required food preferences just as the quality of food produced is affected by externalities of productive economic activities by man (Hassen, 2000). Hence, the relationship between climate change and food security is a complex one. Climate change affects all the four dimensions of food security namely: food availability, food accessibility, food utilization and food system stability. Increasing frequency of extreme weather outcome such as flood drought, hail and heat waves also affect food security and the vulnerable are likely to be most affected. Climate change effects have caused more damage to rural infrastructure like roads as well as feeder market and water thus impeding urban food supply in Imo State. Livelihood activities that are agricultural based became even more vulnerable with serious consequences on food security, crop failure, new patterns of pest and diseases, lack of appropriate seeds and planting materials and loss of livestock. The emphasis on climate change threats to food security and natural ecosystems is the driver of increasing hunger in the state. Although empirical evidence suggests that climate change threats are global, the adverse effects in the developing countries especially Africa is serious, due to sever poverty poor coping capabilities (Nwafor, 2007; Jagtap, 2007).

The concern for climate change is heightened given its linkage with the agricultural sector and poverty. In particular, it is anticipated that adverse impacts of climate change on agricultural activities will exacerbate the incidence of rural poverty. Impacts on poverty are likely to be especially severe in Nigeria where the agricultural sector is an important source of livelihood for a majority of the rural population. Over 80 percent of Nigeria's population have agriculture and or fishing as their primary occupation and with the Nigerian agriculture been rain-fed, food production systems will be adversely affected by the variability in timing and amount of rainfall, frequent outbreaks of crop pests and diseases and heat stress (Olatona, 2007).

Food shortages will increase and many farmers could lose their sources of livelihood due to climate change (Nwaiwu et al., 2010). Although farmers in Nigeria have made some efforts to adapt to these changes and mitigate the risks, efforts in Nigeria are still rudimentary especially when compared with the intending catastrophe. This study therefore seeks to address the challenges posed by climate change to the agriculture especially as it concerns the perception of the farmers as it concern the challenges posed by climate change, and the food security of the farming households. The objectives of the study are therefore; 1 to describe the socioeconomic characteristics of the farmers; 2.to describe the level of challenges posed by climate change as perceived by farmers in the study area; 3.to estimate the food security of the individual farmer member of the farming household in the study area; 4. To estimate the factors affecting food security level of households in the study area.

Methodology

The study was carried out in Imo State, Nigeria. Imo State is located in the south eastern agro-ecological zone of Nigeria. The administrative capital of the State is capital. It State lies between latitudes 4°45^{1}and, and longitude 6°50^1 and 7°25^1 East of the Greewich meridian. It occupies the area between the Lower River Niger and upper middle Imo River. It is bounded to the east by Abia, to the south by Rivers State and AkwaIbom State and Anambra State to the North.

The population of the State is 3, 927,563 persons and it occupies an area of 5289.49 sq. kilometers. It has a population density of 743 persons per square kilometers (NBS, 2007). The climate of the State has two distinct seasons; dry season which lasts from October to March and Rainy season which lasts from April to September. The State is a humid forest zone with an average minimum temperature of 22.5°C and maximum temperature of 33.5°C, a relative humidity of above 74 percent and average rainfall of 2400mm (Imo Fadama III, 2011). The main occupation of the people is farming although a sizeable percentage of the population engage in other profitable professions such as teaching, trading, civil service, artisan among other occupation. The major crops produced in the State include: maize, cassava, yam, cocoyam, melon, okra and pumpkin.

Primary data used for the study were obtained by means of structured questionnaire on the socioeconomic characteristics of the farmers and climate change and its effect on farmers in the area. Data sourced include socio economic features of the farmers, perceived effect of climate change, expenditures on food, farm inputs used in cassava production and quantities of output.

The data collection periods span in two seasons; the off season period of between February and April 2023 and November to December 2023. To ensure that accurate data were obtained for the study, a detailed enquiry was made on the measures and cost of cassava products consumed or sold in the area. Garri was sold in cups and other unstandardized measures. The equivalent measures per kilogram were obtained. 5 cups of garri is equivalent to a kilogram, a 4 litre paint measure gave an average of 19 cups with a mean weight of 3.2 kilograms. In the case of fufu, 5 wraps is about 1.0kg and a paint measure is approximately 4.0 kg. These were used to standardize the measure of cassava products produced and consumed in the data.

A measuring scale was used to get the standard measure before all the conversions were made during data analyses. Household cassava consumption demand is converted to Kcal by multiplying household cassava consumption demand to conversion factors in Kcal. A Kcal is obtained by multiplying 1.0kg of processed cassava products such as cassava flour, garri and paste with the conversion factor of 3570kcal/kb (Olomu, 1995).

The degree of perceived climate change indicators were measured using a nominal 5 – points likert type of scale , which measured from less severe to most severe depending on how each indicator has affected the farmers farm in the area. The scale is graduated from 0 for most severe to1 for severe, 2 for moderately severe, 3 for less severe and 4 for not severe at all. The aggregation for each indicator gave an index of perceived index climate change challenge to the farmer.

Other variables of interest included such socio economic features of the farmers were measured based on their attached unit of measurement. Farmers' age were measured in years while sex, marital status, etc. were measured using dummy variables. These variables were explicitly expressed in the research instrument, which were validated for reliability using test and re-test method. A reliability index of 0.92 was obtained using a simple correlation analysis. The research design is a descriptive survey of information obtained from a population of cassava farming households in the state and analyzed using both descriptive and inferential statistics.

Data for the study were drawn from a sample of cassava farming households using multi stage sampling procedures. It was considered appropriate because with this technique, every cassava farming household in the study area had equal chance of being of being selected into the study. In the first stage, three local government areas (LGAs) one from each zone was randomly selected for the study. In the second stage, three (3) communities were randomly selected from each of the three selected LGAs making a total of nine (9) communities sampled. In the 3rd stage, a list of all the cassava farmers in the nine (9) selected communities was obtained from Imo

ADP, and twenty (20) cassava farming households were selected at random from the list provided by ADP, making a total of 180 cassava farmers sampled for the survey.

Data collected were subjected to qualitative and quantitative analysis. Descriptive statistics was used to analyze the socioeconomics of the farmers. The food security level of the households was proxied by daily calories intake and cassava demand gap for the household. The daily calorie intake was estimated by obtaining an equivalent kilo-calorie daily demand of cassava product of each member of the household in the area. The daily cassava consumption demand (CDD) is expressed as

$$CDD = C/H;$$

While cassava consumption demand gap is the difference between cassava consumption demand and the recommended energy requirement. This is expressed as

$$CCD – L$$

Where,

CCD = Cassava Consumption Demand in Kcal

C = Total cassava demand by the household in Kcal

H = Household size measured as nominal scale

L = Recommended energy requirement in Kcal

Household cassava demand is converted to Kcal by multiplying a kilogram of processed cassava products such as cassava flour, garri and paste by a conversion factor of 3570Kcal/Kg. The recommended energy requirement of cassava products required by an ith member in the household ranges between 2260Kcal to 2450 Kcal for young and adult members of the household (Babtunde et al, 2007; Oluyole et al, 2009). The study took a mean value of 2355 Kcal for an ith member of the household.

The food security status of the cassava farming households was estimated using the Food Security Index, (Z) as specified by Oluyole et al (2009).The index was generated from the Cost-of-Calorie (COC) function as proposed by Greer and Thorbecke (1986). This method was adopted based on its simplicity and ease of computation. Food security here is a function of food accessibility and affordability which food expenditures, market and prices can explain. The food security index is stated as

$$\ln X = a + bCCD$$

Where

X = Food expenditure on cassava (N)

CCD = Cassava Calorie consumption of an ith household member (Kcal)

From the COC function, food security index (Z) was calculated. The food security index was obtained from the parameters of interest in the COC function such as: “a”; the average food expenditure or the constant and the product of marginal food expenditure (b) and the mean calorie consumption level. The mean calorie consumption is replaced by the recommended daily energy level (L). The model is expressed as:

$$Z = e^{(a+bL)}$$

Where,

Z = Cost of minimum recommended energy level

L = Recommended daily energy level (Kcal)

a = intercept

b = coefficient of the calorie consumption

Based on the estimation, any household whose average cost of daily calorie consumption (Z) is equal to or more than z is said to be food secure, while any household with average cost of daily calorie consumption which is lower than Z is said to be food insecure. The level of food energy, Y is expressed as a dummy variable where a household that is food secured is expressed as Y = 1 and zero otherwise.

The Probit model was used to identify the factors influencing the achievement of food security among the respondent households. The Probit model could be expressed as:

$$Y = \sum \alpha X + e_i$$

Where,

Y = vector of dependent variable (1 for food secure households; 0 for food insecure households);
X = vector of explanatory variables (predictors);

X_1 = Gender of household heads (dummy; Male = 1, otherwise 0)

X_2 = Household size (nominal value)

X_3 = Age (in years)

X_4 = Farming experience (years)

X_5 = Non farm income (Naira)

X_6 = Farm income (Naira)

X_7 = Level of education (Years)

X_8 = Off-farm income (Naira)

X_9 = Improved variety of cassava (Dummy: 1 = Yes and 0 = Otherwise)

X_{10}= Soil management practices (Nominal)

α = Probit coefficients

ei = random error term

3.0 Results and Discussion

Socioeconomics Characteristics

Studies have shown that socio economic characteristics have some effect on farm income, food security status and efficiency of farmers. The socioeconomic characteristics of the respondents examined this study included: age, gender of household head, household size, marital status, and educational level, occupation, farming experience and farm size.

Table 1: Socioeconomic characteristics of the respondents

Socioeconomic characteristics	Frequency	Percentage
Age		
21-30	25	18.66
31-40	45	33.58
41-50	45	33.58
51-60	14	10.45
≥60	5	3.73
Total	**134**	**100**
Mean	40.20	
Gender		
Male	84	62.69
Female	50	37.31
Total	**134**	**100**
Educational Level		
Primary	36	26.87
Secondary	85	63.43
Tertiary	13	9.7
Total	**134**	**100**
Household size		
4-6	48	35.82
7-9	72	48.51
10-12	14	15.86
Total	**134**	**100**
Mean	**7**	
Marital status		
Single	34	25.37
Married	81	60.43
Divorced	19	14.20

Total	**134**	**100**
Farming as a major occupation		
Yes	96	71.64
No	38	28.36
Total	**134**	**100**

Source: Field data, 2024.

The table shows that about 52 percent of the cassava farmers were not more than 40 years old, while about 44 percent were between 41 to 60 years. The mean age of the farmers was about 42 years indicating that these farmers are still within their active productive years and should therefore be able to adopt strategies and technology that will aid them in countering or mitigating the effect of climate change while also ensuring that their families are food secure.

There were more males than females among the cassava farmers in the study area. This finding reinforces the prevailing belief thatmales dominate in agricultural activities in the area. It also goes further to show that cassava which was hitherto considered a subsistence crop grown mostly by women has since become a cash crop grown by men and women to boost income of the families. The dominance of males in cassava production in the area may also be an indication that there is a gradual displacement of the more established yam crop for the more recent but better yielding cassava crop which aids food security of the household while also generating income for farmers in the area. This finding is consistent is with Amaza*et al.* (2009) and Adebayo (2012) who reported more males than female household heads in Southern Borno State and Osun State.

The result also shows that about 90 percent of the cassava farmers had at most secondary school education. None of the farmers had no formal education, while about 10 percent attained up to tertiary level of education. This result implies that farmers in the area all attained some level of education and are thus better equipped to appreciate and tackle the vagaries of weather resulting from climate change. These farmers will also be more willing to adopt strategies and technologies that could aid them in their farming activities and help enhance output thus enabling their families to be food secure. The farmers may also be more capable of accessing valuable information on climate and thereby make informed decisions concerning their production activities.Amaza et al (2009) noted that the level of farmers' education is believed to influence the use of improved technology in agriculture and, hence, farm productivity. The level of education determines the level of opportunities available to improve livelihood strategies, enhance food security, and reduce the level of poverty

The cassava farmers had a mean household size of 7 persons. About 84 percent had household size of not more than nine persons. This result indicates that the farmers had fairly large household sizes. This large household may be an advantage if most household members are adults who could help on the farm or work in other occupation to earn income and supplement the income gotten from the farm. Conversely, a large household, especially one with many dependents may experience very high consumption rate with very little left over at the end of the season.

Level of climate change challenges as perceived by farmers in the study area

The perception of the famers as it relates to climate change challenges were analyzed. The result is presented in this section

Distribution of Farmers based on their Perceived Climate Change Challenge .

Climate Change Challenges	**No Change**	**Moderate Change**	**Rapid Change**
Seasonal indicators	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Cuts seen on parts of plants	23 (7.16)	64 (47.76)	47 (35.07)
Pest invasion	46 (34.33)	77 (57.46)	11 (8.21)
Frequent drought	17 (12.69)	20 (14.93)	97 (72.39)
Rodent invasion	33 (24.63)	87 (64.93)	14 (10.45)
Daily solar duration	69 (49.25)	45 (33.58)	23 (17.16)
Environmental Challenges	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Delay in planting/harvest time	48 (35.82)	17 (12.69)	69 (51.49)
Rapid reduction in topography	90 (67.16)	10 (7.46)	24 (17.91)
Rapid expansion of river/stream	31 (23.13)	31 (23.13)	72 (53.73)
Excessive flooding	30 (22.39)	39 (29.10)	65 (48.51)
Erosion	21 (15.67)	25 (18.66)	88 (65.67)
Excessive landslides	50 (37.31)	71 (52.99)	13 (9.70)
Excessive heat before to planting season	69 (51.49)	39 (29.10)	26 (19.40)
Man made challenges	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Poaching/illegal harvesting by thieves	50 (37.31)	78 (58.21)	6 (4.48)
Excessive weed or weeding	30 (22.39)	66 (49.25)	38 (28.36)
Bush fire	45 (33.58)	60 (44.78)	29 (21.64)
Continuous cropping	15 (11.19)	48 (35.82)	71 (52.99)
Deforestation	80 (59.70)	20 (14.93)	34 (25.37)

Source: Field data, 2024.

It can be deduced from the result that about 47.8% while about of the respondents pointed out that climate change resulted in the appearance of cuts seen on the surface of most of the crops they cultivate while about7% did not notice any cuts on the plants. These cuts which may be lesions arising from insect pest or disease attacks on the crops have the ability to cause reduced photosynthetic activities in the plants and thereby reduce output. Results in the table also show that 72.4% of the farmers to a large extent experienced frequent drought as a major climate change challenge in their area. This experience by the farmers in the area is profound when considered from the perspective of the rain-fed agriculture being practiced in the area. The frequent has the ability to interfere with plan growth leading to wilted and stunted crops with very low yield. According to IPCC (2007), climate change exerts multiple stresses on the biophysical as well as the social and institutional environments that underpin agricultural production. That is socioeconomic factors, technological development as well as policy choices will determine the pattern and impact agro-climatic changes will have on agriculture (Brussel, 2009).

Furthermore, about 57.5% of the farmers perceived climate change challenges in the form of increased pest invasion on their farm. This could be as a result of the existing climatic condition in the area at a particular point in time been favourable for the reproduction as well thriving of some known pests in the area. The result is in line with the assertion of Wiggins and Wiggins (2006) that climate change may result in significant environmental threats like; rising temperature and drought, increased likelihoods of hazards such as floods, landslides, pest and disease invasion and severe cycloids. The increased pest infestation of agricultural farms and farmstead also portends great danger for not just the crops and animal reared, but also for the farming household in the light of recent rise in zoonotic diseases and epidemics being spread by these pests.

The result in the table also shows that over 49.25% of the respondents strongly agree that climate change (CC) resulted in decrease in temperature as a result of abnormal daily solar radiation. About 51.5% strongly agreed that climate change resulted in delay in both planting and harvest time of the crops generally, while57.46%agreed that some crops are moderately prone to climate change than others, this they said was made manifest in the pest attack been noticed on the surface of the crops. Farmers agreed that the frequency of drought had increased because of climate change. Mark et al (2008) highlighted some of the direct impacts of climate change on agricultural systems as:

a. Seasonal change in rainfall and temperature which could impact agro-climatic conditions, altering growing seasons, planting and harvesting calendars, water availability, pest, weed and disease populations;
b. Alteration in evapo-transpiration, photosynthesis and biomass production; and
c. Alteration in land suitability for agricultural production.

Some of these changes are expected to be abrupt, while others involve gradual shifts in temperature, vegetation cover and species distributions. However, when looking critically on plant production, the pattern of climate change has both positive and negative impacts. Rises in temperature for example helps to grow crops in high altitude areas and towards the poles. In these areas, increases in temperature extend the length of the potential growing season, allowing early planting, early harvesting and opening possibility of completing two crop cycles in the same season (Khanal, 2009).

From the Table above it can also be seen that about 67% of the farmers indicated that rapid reduction in topography of land was of low effect in the State, while majority of them (about 54%, 49% and 53%) pointed out that expansion of river banks, excessive flooding and excessive landslides were greatly perceived in their area. About 66% of the farmers also reported rapid change in erosion in the area. The effects of these phenomena on agricultural production are profoundand can be seen in the large quantity of crops and arable land that are loss annually to these activities of the elements of climate.According to Odigboh (2008),rapid climate change could harm agriculture more especially those that are already suffering from rather poor soil and climate conditions due to less time for optimum natural selection and adaptation.According to Lal and Moldenheur (2008), erosion-induced reduction in crop yields is attributed to loss of rooting depth, degradation of soil structure, decrease in plant-available water reserves, reduction in organic matter, and nutrient imbalance. Moreover, Bolarinwa et al (2014) reported that soil erosion leads to low technical efficiency and low output. In another dimension, Barbier (1997) and Scherr (1999) in Bolarinwa et al (2014) also argued that by the year 2020, the increasing wave of soil erosion may pose a serious threat to food production in rural areas as well as urban livelihoods particularly in poor and densely populated areas of the developing world including Nigeria.FAO (2016) reported that the impact of a landslide can be extensive, including loss of life, destruction of infrastructure, damage to land and loss of natural resources. Excessive flooding could cause great damage to crops and livestock. Eni et al (2011) reported that some crops are intolerant of having their root submerged for long period of time, because excessive moisture in the soil causes oxygen levels in the soil to decrease, impeding proper root respiration. Such crops will definitely find it difficult to thrive in flooded environment.This finding is in line with Brussel (2009) who noted that the degradation of agricultural ecosystems could mean desertification, resulting in a total loss of the productive capacity of the land in question. This is likely to increase the dependence on food importation thereby increasing the number of people at risk of famine and thus increasing food security.

The work also noted that lower temperatures interfere with the ability of plants to get and use moisture. Evaporation from the soil accelerates when temperatures rise and plant increase transpiration (lose moisture from their leaves) (F and D, 2008). These findings also agree with the findings of Actionaid (2009) that agriculture contributes to and suffers from negative effects of climate change.

Food security status

The food security status of the faming households was proxied by daily per capita calorie intake of households. The summary of the result of per capita calorie of the households in the study area is presented in Table 2.

Table 2: Summary statistics and food security indices of cassava farming households in the study area

Variables	Value
Constant	4.15
Slope coefficient	0.000409
Recommended daily energy level (L)	2355Kcal
Food security line, Z: cost of the minimum energy requirement per household	
Adult equivalent	₦1666.17 per day
₦ 49,985.10 per month	
₦ 599,821.20 per year	
Head count ratio (H)	
Percentage households	32.84% (for food secure households) 67.16% (for food insecure households)

Source: Field data, 2024.

Based on the recommended daily energy levels (L) of 2355 kilocalories as estimated by Babatunde et al., the food security line (Z) for the households was estimated at ₦166.17 per day per adult equivalent (that is ₦4985.10 per month per month per adult equivalent). On an annual basis, this is equivalent to ₦1819561.50 per year per adult equivalent. Results of the analysis showed that cassava farmers in the study area could be classified as being more or less food insecured, given the fact that only 32.84 of the sampled households in the study area were able to meet the recommended calorie in take of 2355 kilocalories per capita per day. About 67.17% of the households were food insecure subsisting on less than the recommended daily per capita calorie requirement of 2355 Kilocalories. This result agrees with Kuwornu et al (2013) who reported that 68.75% of farming households in the Central region of Ghana were food insecure. The household food insecurity will invariably impinge on its productivity and output thereby further lowering welfare and standard of living.

Determinants of food security among cassava farming households

The Probit regression model was used to estimate determinants of food security among farming households in the study area.

Table 3: Probit coefficient of factors affecting the food security of the cassava farmers

Food security variable	Coefficient	Standard error	Z	p> [Z]	Confidence interval
Gender (X_1)	0.299783	.0084209	3.56	0.003	.7446758
Household size (X_2)	-1.373815	.3251547	-4.23	0.000	-.7365238
Age (X_3)	-2034767	.1731078	-1.18.	0.240	.5427618
Farming experience (X_4)	.214714	.0107897	1.99	0.042	.4533752
Non farm income (X_5)	.0002121	.0002248	0.94	0.348	.0006546
Farm income (X_6)	-.0001714	.0002248	-0.76	0.446	.0002692
Education (X_7)	.2389978	.1207063	1.98	0.049	.7739248
Off farm income (X_8)	.000134	.0000494	2.71	0.012	.0000234
Improved varieties (X_9)	.0082298	.0040388	2.04	0.030	.721556
Soil mgt practices ($X1_0$)	.0002975	.26723	0.89	0.371	.762758
Constant	2.624	1.146338	2.29	0.022	4.87203
Pseudo R^2	0.729				
Ccci	-1.632878	.0285442	-5.72	0.000	-.1073422

Source: Field data, 2024.

The result shows the probability of a household being food insecure given some explanatory variables. The functional parameters such as the log likelihood and chi square (X^2)are significant at $P \leq 0.05$ critical level. The pseudo R^2 is 0.729 which implies that the food security status of the farming households can be likely explained by the included explanatory variables such as climate changes, socioeconomic features, values of -139.9 and 89.83 respectively and farming activities.

The gender of household head had a positive coefficient and was significant at 0.01 % critical level. This shows that male headed households have the probability of being more food secured than female headed households. This implies that the probability of a household been food secured increases with male headed households. This finding is consistent with FAO, (2011) which stated that male farmers are skillful and can easily adjust their source of livelihood to cope with climate change conditions. They can switch to other off farm activities to ensure their households withstand the challenges of climate change and food security problems in the area.

Larger household sizes are associated with negative food security status. Larger household sizes require increased food expenditure and competition for limited resources. The household size has negative but significant coefficient at a critical value P≤0.05. It implies that the probability of food security status of the farming households increases with reduction in household size of the farming households. The negative parameter could be as result of an increase in the dependency ratio in larger households. Astudy by Babatunde*et al*. (2007) concluded that larger household sizes are most likely to be food insecure than smaller households.Ukoha*et al*. (2007) also asserted that the larger the household size the more difficult it would be to meet the basic requirements of household members. Adebayo (2012) also reported an inverse relationship between household size and household food security status.

Farming experience is the number of years the household head has engaged in farming. All things being equal an experienced household head is expected to have more insight and ability to diversify his or her production to minimize risk of food shortage. From the result in the table the coefficient of farming experience was seen to be positive and significant; this means that the probability of a household been food secured increases with increase in farming experience. This result is expected because a more experience farmer is likely to have higher productivity, good knowledge of weather and hencebe able to provide more food for his household members than one who is inexperienced as confirmed by research findings of Faleke*et al*, (2003); Oluyole*et al* 2009 which revealed a positive relationship between farming experience and food security status. Kuwornu et al (2013) assert that all things being equal, an experienced household head is expected to have more insight and ability to diversify his or her production to minimize risk of food shortage.

The Table also shows that the value of the Probit coefficient of level of education is positive and significant at P≤0.05 critical level. This implies that the probability of a household being food secured increases with increase in the level of education of the household head. Education is a social capital which is expected to have positive influence on household food security. This finding is consistent with Shaikh (2007) who asserted that educated individuals have capacity to process and apply the information passed on to them. Lower educational levels impede access to better job opportunities in the labour market and hamper more profitable entrepreneurship (FAO, 2002). Adebayo (2012) also reported positive significant relationship between educational level of farmers and household food security status.

The coefficient of off farm income was positive and significant at P ≤0.05% criticallevel. This implies that the household heads tend to diversify their livelihood by working as daily labourers, petty traders, artisans, and by working as daily construction labourers thereby generating an alternative source of income for their households. This finding agrees with Adebayo (2012) and Akajiaku (2002) who noted that income from these off farms activities is also invested in agriculture to increase production and food availability at the householdlevel.

The coefficient of increased varieties was positive and significant at P≤0.05% critical level. This implies that the probability of a household been food secured increases with increase in the cultivation of improved cassava varieties. This finding is in line with Onuoha, (2005) who stated that cultivation of improved varieties which are able to withstand certain harsh climatic and weather conditions as well as possessing improved yield so as to boost farmers' production ensure food security of his household. Oguniyi (2015) also reported that adoption of improved cassava varieties have the potentials to improve food security status.

The coefficient of age of household head was found to be negative and non significant. This implies that the probability of household been food secured decreases with increase in the age of the household head. This could be attributed to the fact that the productivity of an old household head will decline as he gets older thereby implicating on their food security status. This result is in consonance with Agbola*et al* (2004) who noted that increase in age of household head decreases the chances of the household being food secure due to the fact that as age increases, most farmers would be unable to be going to the farm to engage in cultivation.Kuwornu*et al* (2013) also reported an inverse relationship between age of household head and household food security status.

Non-farm income is the sum of earnings of the household from both off farm and on farm activities (Babatunde*et al*, 2007). The Probit coefficient of this variable is positive but non-significant at P≤0.05%. This result agrees with that of Arene and Anyaeji (2010) who out that the more household heads engage in gainful employment besides their farming activities, the higher he/she earns income and the greater the chances of being food secured. The income is expected to increase household's food production and access to more quantity and quality of food. Omotesho et al. (2006) also reported a positive relationship between non farm income and food security

The household farm income is important because it determines how much is being generated from the farm business as well as how much can be spent on various needs of the household. The quantity and quality of a household's expenditure patterns are highly and positively related with the purchasing power of the household. A household's farm income is the total income generated from the household farm stead in a given season. The coefficient of farm income as shown in the table was negative. This implies that the probability of a household being food secured reduces with increase in farm income. In other words, as the farm income of a given household continues to decrease, (may be due to climate change challenges with concomitant harsh effect of climate change), so does their chances of being food insecured increases. This finding is not consistent with similar studies on food security. Bashir *et al* (2010) found a positive effect of income on food security. Onianwa and Wheelock (2006) also noted that there is a positive relationship between a household's food security status and household income. The disparities with their findings may be due to methodology, area of study and concept of climate change challenges that was used to factor food security in the study. Farm income actually has a negative implication on food security in the area because climate change challenges are forcing a decline in income the farmers generated.

The result in the table further shows that the coefficient of soil management practices was positive and non-significant at P≤0.05%. This implies that the probability of a household being food secured increases with increase in their carrying out good management practices. This finding is in line with that of UNFPA (2012), who pointed out that agricultural production systems are expected to produce food for a global population of about 9 billion people by 2050 and as such a good knowledge of soil management, pest and disease management is pertinent for thee to exist food security.

Conclusion and Policy recommendations

This studyhas elucidated the various challenges posed by climate change as perceived by farmers in the study. It is obvious from the study that farmers in the area are aware of climate change and its subtle effects on their livelihood and their environment. The study also went further to show vividly the food security status of the respondents and its findings revealed that farmers in the area are basically food insecured. Moreover there is high probability of farming household with high off farm income and high educational status being food secured. Also, households headed by older household heads and households that are large are more likely to be food insecured. Based on these findings the study recommended as follows:

1. Stakeholders in agriculture and the environment should as a matter of urgency step up awareness campaigns to consolidate on the already existing level of awareness among farmers while also introducing more suitable and practicable mitigation measures that could be adopted by the farmers.
2. Since households with diversified sources of income tend to be more food secured, it is important for government and other stakeholders to provide opportunities for farmers in the rural areas to diversify their sources of income. In this guise, skill acquisition centres and trainings targeted at developing the entrepreneurship skills of these farmers should be established in the rural areas to achieve this purpose.
3. Improved cassava varieties increased the food security status of cassava based farmers in the area. The study therefore recommends that the farmers should further seek to use only the improved cassava varieties to ensure that maximum output. Extension service personnel in the area have to make this more responsive by strengthen the linkage between the research institutes and the farmers to ensure that only improved plants varieties with good agricultural practices (GAP) are been adopted by the farmers. This will go a long way in enhancing food security.

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