



PERCEPTION OF CLIMATE CHANGE EFFECTS AMONG MAIZE AND POTATO BASED FARMERS IN CENTRAL ZONE OF PLATEAU STATE, NIGERIA

¹Buhari, A., ²Sani, R. M., ¹Garba, M., ¹Dabo, N. M. and ¹Abubakar, U.

¹Department of Agricultural Extension and Rural Development,
Abubakar Tafawa Balewa University, Bauchi

²Department of Agricultural Economics, Abubakar Tafawa Balewa University, Bauchi
Corresponding Author's Email: buhari.agarga@gmail.com, **GSM:** 08163312740

ABSTRACT

The study examined the factors influencing awareness of climate change effect on maize and potato production in Kanam and Mangu LGAs of Plateau State, Nigeria. Multistage sampling technique was employed in selecting 220 respondents. Primary data were obtained through the administration of structured questionnaire and analyzed using both descriptive and inferential statistics. The result revealed that majority (70.0) of the respondents were in their active age group with a mean of 37 years. Majority (75.5%) of the respondents were male, engaged in multiple occupations, including farming (27.3%), civil servant (41.8%), and trading (14.1%). The results also showed that majority (76.4%) of the respondents were married with small household sizes as indicated by the mean household size of 8 persons. The results further revealed that 30% and 47.3% had attended secondary and tertiary as level of education. Inheritance (45.9%) was the primary mode of land acquisition. In addition, the result also showed that sex, occupation, membership of association, access to extension, agrochemical usage and type of labour were significant ($P < 0.01$) factors influencing farmers awareness of climate change effects on maize and potato production. Drought (92.3%), low literacy levels (89.5%), and poverty (67.3%) were identified as the major constraints to climate change mitigation strategies and were ranked 1st, 2nd and 3rd respectively. The study concluded that age, sex, membership of association, access to extension, agrochemical usage and type of labour were the factors influencing respondents' awareness to climate change effect on maize and potato production. Based on the findings of the study the following recommendations were made; enhance the capacity of extension agents to provide timely and relevant information on climate-smart agriculture practices, encourage the adoption of climate-resilient agricultural technologies, such as drought-tolerant crop varieties, efficient irrigation systems.

Keywords: Awareness, Climate, Change, Effect, Maize, Potato

INTRODUCTION

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is a change in the state of the climate that can be defined by changes in the mean and/or weather variability that lasts for a protracted period of time, generally decades. Changes in global warming could also be caused by human-induced variables (Ebele and Emodi, 2016). Globally, it is regarded as the most important environmental issue confronting the world, wreaking havoc on agriculture and changing life patterns and general living circumstances (FAO, 2022). It has ramifications like disrupting seasonal cycles, hurting ecosystems and water supplies, impacting agricultural farming systems and food production, raising sea levels, and so on (Elia, 2017). However, agriculture's survival is dependent on climate, and the two are intertwined since they both occur globally.

In Nigeria, climate change is having a severe influence on agricultural activity (Haider, 2019). Sweet potato production in the country has come under serious threat; as a result, both yearly and domestic output have decreased, impoverishing farmers and limiting their financial returns (Esan and Omilani, 2018). Available data shows that the last decade has been the warmest ever recorded with 2016 being the warmest year during the period (National Aeronautics and Space Administration, 2020). Furthermore, the data indicates that since the late 19th century, the average temperature of the earth's surface increased by over 1.62°Fahrenheit (0°C). Consequently, increasing concentration of greenhouse gases in the atmosphere is changing precipitation patterns, raising temperature, spurring



frequent extreme weather events, and shifting growing seasons (Egbetokun *et al.*, 2020; IPCC, 2014; MFA, 2010). Meanwhile, Nigeria's agriculture and agro-allied industries could potentially drive the economy's growth and diversification from crude oil (Gershon *et al.*, 2019). However, it is largely climate fed - depends mainly on rainfall and temperature. Moreover, infrequent fluctuations in rainfall and temperature patterns have distorted the standard April-October rainfall period and October-March harmattan weather or dry season. On the one hand, untimely rainfall and climatic extremes could threaten potential agricultural investment (Gershon and Patricia, 2019).

Climate change has, in fact, been extensively observed to have an impact on crop productivity in Africa and Nigeria, particularly sweet potato cultivation (Asrat and Simane, 2018). Despite advances in agricultural technology such as the use of inorganic fertilizers, modern land preparation, planting of early season crops, farm mechanization, the use of agrochemicals, improved seed varieties, irrigation system expansion, and genetically modified crops, among others, weather and climate continue to be major challenges to agricultural production (Diriba *et al.*, 2019). Nigeria is identified as a climate change hotspot, with an expected increase in unpredictable rainfall patterns, flooding, and drought. Nigeria is committed to doing everything possible to minimize climate change impacts on a regional scale (Madaki *et al.*, 2023). Nigeria is identified as a climate change hotspot, with an expected increase in unpredictable rainfall patterns, flooding, and drought. Nigeria is committed to doing everything possible to minimize climate change impacts on a regional scale (Madaki *et al.*, 2023). Despite efforts by the Government to improve the farming of maize and irish potato in Plateau, decreasing level of production indicated that there are constraints associated with the small and medium enterprises farmers of maize and irish potato in Central Zones of Plateau State. Major factors contributing to the low level of maize and irish potato farming in these areas includes: climate change, poor quality of maize and irish potato farming, low level of technology, inadequate capital, poor economic infrastructure, lack of adequate incentives and the likes.

The broad objective of the study is to examine climate change knowledge, effect and coping strategies among maize and potato farmers in Kanam and Mangu LGAs of Plateau State. While specific objectives were to:

- i. describe the socioeconomic characteristics of the respondents;
- ii. determine the factors influencing respondents' awareness of effect climate change effect on maize and potato;
- iii. identify the constraints associated with climate change strategies in the study area.

MATERIALS AND METHODS

The Study Area

The study was conducted in Plateau State, Nigeria. The State has 17 Local Government Areas and is divided into 3 Zones Northern, Central and Southern Zone. It is located between Latitudes 8° 24' N to 10° 30' N and Longitudes 8° 32' and 10° 38' East (NBS, 2022). Plateau State is primarily an agrarian community having a land mass of 26,026km² with a projected population of 4,717,300 (PLSG, 2021; NBS, 2022) people at 3.2% growth rate per annum with land area of 8385Km². The major food crops produced in the State are cereals like maize, sorghum, millet, acha, root and tubers like yam, cassava, sweet potato, irish potato etc, while tree crops like apple, avocado, olives among others. The major economic activities of the people are production and marketing of potato (Adamu, *et al.*, 2022).

The State is bounded to the North by Bauchi State, North-West by Kaduna State, West by Nassarawa State and South-East by Taraba State. The tribes found in the area are Ngas, Fer, Chakfem, Kadung, Bijim, Tambes, Miship, Mwagavul, Mupun, Ron, Kulere, Mushere, Berom, Afizere, Anaguta, Ganawuri, Atakar, Kwaghlah, Tarok, Hausa, Fulani, Igbo and Yoruba to mention a few. About two third of the land area is arable. The main commercial activities of the people are farming mining and trading (McKenna, 2023). The main livestock kept by the farmers are sheep, goats, pigs, rabbits, and poultry. The study area has a cold climatic condition due to its high altitude, with its highest point around the shere hills, situated about 10km east of the Jos metropolis, reaching a height of about 1,829m or 6,001ft above sea level (Zitta and Madaki 2020). The coldest period is from



December to January, while the hottest is from March to April which ushers in the rains. The rainy season which is between the months of May and October, has its peak during the month of August. The mean annual rainfall stands at 1200 mm, with a mean temperature of about 22°C (Binbol *et al.*, 2020).

Sampling Procedure and Sampling Technique

A multi-stage sampling technique was used for the selection of respondents for the study. In the first stage, three (3) Local Government Areas (LGAs) were purposively selected from Central Zone of Plateau State. Purposive sampling was used to capture LGAs with concentration of both maize and potato production in the Zone. The selected LGAs includes Bokkos, Kanam and Mangu. Second stage involved the use of simple random sampling technique in the selection of two (2) districts from each LGA making a total of six (6). In Kanam; Garga and Dengi Districts were selected, in Mangu LGA; Mangu and Kombun Districts were chosen and in Bokkos LGA; Horop and Butura were selected for the study. In the third stage two (2) villages were systematically selected from each of the selected Districts to make a total of 12 communities. The selected villages were Lugur and Kyaram (Garga District); Kafil and Namaran (Dengi District); Mangu halle and Dutse lamba (Mangu District); Nting and Millet (Kombun District); Kaban and Mijing (Horop District) and Mandar and Kuba (Butura District). Fourth stage involved random and proportional (9% and 7%) selection of maize and potato farmers from a total population of 1,248 and 1,562, respectively. Thus, a sample size of 111 maize farmers and 109 potato farmers were drawn from the study area. Hence a total of 220 respondents were used for the study.

Table 1: Sampling Technique and Sampling Size

LGA	District	Villages	Maize farmers	Potato farmers	Sample maize (9%)	Sample potato (7%)
Bokkos	Horop	Kaban	102	210	9	15
		Mijing	61	156	5	11
	Butura	Mandar	116	98	10	7
		Kuba	132	75	12	5
Kanam	Garga	Lugur	66	132	6	9
		Kyaram	94	106	9	7
	Dengi	Kafil	115	101	10	7
		Namaran	102	85	9	6
Mangu	Mangu	Mangu Halle	132	153	12	11
		Dutse Lamba	60	245	5	17
	Kombun	Nting	154	89	14	6
		Millet	114	112	10	8
Total			1,248	1,562	111	109

Source: Authors' computations

Method of Data Collection

The study used primary data only and questionnaire was employed as a data collection instrument. Data were obtained by administering the questionnaire to the respondents and supplemented with interviews.

Method of Data Analysis

Data will be analyzed using both descriptive and inferential statistics to achieve the stated objectives of the study.

Descriptive statistics

Descriptive statistics such as frequency tables, percentage and mean were used to achieve objectives i, ii, iii, v and vi of the study.

Inferential Statistics

Logit regression statistics was employed to analyse objective iv of the study area. Logit regression model will be use to estimate regression function statistics which is given as:



$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + U \quad \dots(1)$$

Where:

Y= Awareness on effect of climate change (1= Yes, 0=No)

X₁ = Age (Years)

X₂= Marital status (1=Single, 2= Married 3=Divorced =, 4=Widowed)

X₃= Education (1=Quranic, 2=Primary, 3=Secondary, 4=Tertiary)

X₄= Household size (Number of persons)

X₅= Farming experience (Years)

X₆= Membership of association (Yes = 1, 2=No)

X₇= Extension Contact (Number of times)

X₈= Farm size (Hectares)

X₉= Access to credit (Access = 1, 2=Non-access)

X₁₀= Quantity of harvest (Kg)

X₁₁= Land acquisition

X₁₂= Use of agro-chemicals (1=Yes, 2=No)

X₁₃= Type of labour (1=Family, 2=Hired)

β₀= Constant

β₁ – β₈= Regression coefficients

U = Error term

RESULTS AND DISSCUSSION

Socioeconomic Characteristics of the Respondents

The result from Table 2 describes the socioeconomic characteristics of the respondents. The finding indicated that 41.8% and 28.2% of the respondents were within the ages of 29-36 years. The result also showed that 28.2%, 12.7%, 10.5% and 6.8% of the respondents were within the age brackets of 37-44, 21-28, 45-52 and 52 years and above, respectively, with a mean age of 37 years. This finding implies that most of the respondents were within their active and youthful age of production in the study area. This finding is in line with that of Jatbong *et al.* (2018) who found that potato farmers in Plateau State were within the age of 47 years. Similarly, Adamu *et al.* (2022) reported that majority of potato farmers within the study area fell within age range of 30-39 years representing active ages of the farmers. The result further showed that majority (75.5%) of the respondents were male and 24.5% of the respondents were female. This finding implies that most of the respondents were male which is not unconnected to the male dominance in agricultural activities due to the tedious nature of activities involved in maize and potato production which is mostly practiced by men in the study area. This affirmed the findings of Gebru *et al.* (2017) also reported 88.8% were male among surveyed potato farmers in Ethiopia. Adamu *et al.* (2022) also reported that majority of potato farmers were male and married in the study area. The result also reveals that 41.8% of the respondents were civil servants while 27.3%, 14.1%, 12.7% and 4.1% of were crop farmers, traders, artisans and livestock farmers, respectively. This finding implies that most of the respondents were engaged in other forms of occupation which serves as additional sources of income among the respondents in the study area.

The result also showed that majority (76.4%) of the respondents were married while 18.2% and 5.5% were single and widowed. This finding implies that most of the respondents were married and have certain level of responsibilities in the study area. The result also revealed that more than half (52.7%) of the respondents had a household size of 1-6 persons while 25.5%, 11.8%, 6.4% and 3.6% had 7-12, 13-18, 19-24 and 25 persons and above, respectively with a mean household size of 8 persons. This finding implies that most of the respondents had small household size which indicate low or inadequate family labour among the respondents in the study area. This is similar to the finding of Ntat *et al.* (2021) who revealed that household size, age and sex of the potato farmers in Plateau State, Nigeria was 6- 10 household size had, 36-50 years range and majority were male.



Table 2: Distribution of Respondents According to their Socioeconomic Characteristics of the Respondents (n=220)

Variables	Frequency	Percentage	Mean
Age			
21-28	28	12.7	37
29-36	92	41.8	
37-44	62	28.2	
45-52	23	10.5	
52 and Above	15	6.8	
Sex			
Male	166	75.5	
Female	54	24.5	
Occupation			
Civil servant	92	41.8	
Artisans	28	12.7	
Crop farmer	60	27.3	
Livestock farmer	9	4.1	
Trader	31	14.1	
Marital status			
Single	40	18.2	
Married	168	76.4	
Widowed	12	5.5	
Household size			
1-6	116	52.7	8
7-12	56	25.5	
13-18	26	11.8	
19-24	14	6.4	
25 and Above	8	3.6	
Educational level			
Primary	4	1.8	
Secondary	66	30.0	
Certificate	36	16.4	
Tertiary	104	47.3	
Qur'anic	10	4.5	
Land acquisition			
Inheritance	101	45.9	
Purchase	57	25.9	
Rent	42	19.1	
Leasehold	4	1.8	
Government	16	7.3	

Source: Field Survey, 2024

The result further reveals that 47.3% and 30% of the respondents had tertiary and secondary levels of education. The result also shows that 16.4%, 4.5% and 1.8% of the respondents had certificates, qur'anic and primary levels of education, respectively. This finding implies that most of the respondents had attended one form of formal education or another in the study area. Adamu *et al.* (2022) reported that majority of potato farmers had tertiary levels of education in the study area. The result further showed that 45.9% of the respondents acquired their land through inheritance while 25.9%, 19.1%, 7.3% and 1.8% acquired their land through purchase, rent, government and leasehold, respectively. This finding implies that most of the respondents had access to land though the inheritance which is the cheapest form of acquiring land for agricultural production as it is transferred from one generation to another in succession.



Factors Influencing Respondents' Awareness of Climate Change Effect on Maize and Potato Production

The result from Table 3 reveals the factors influencing respondents' awareness of climate change effect on maize and potato production. The finding revealed that sex was positive ($r=3.65$) and significant ($P<0.01$) in influencing respondents awareness of the effect of climate change. This implies that increase in male respondents will lead to increase of the awareness of effects of climate change on maize and potato production in the study area, which is not unconnected to the fact that male respondents have freedom and access to extension services workshop, seminars and filed days within and outside the study area as oppose to their female Counterparts whose husbands, children or parent hinders their movement in the study area. The result further showed that occupation was positive ($r=2.62$) and significant ($P<0.01$) in influencing respondents' awareness of climate change effects on maize and potato production, this implies that increase in other forms of occupation will lead to increase in the level of awareness of climate change in the study.

Table 3: Factors Influencing Respondents Awareness of Climate Change Effect on Maize and Potato Production

Variables	Coef.	Std. Err.	Z	P z
Age	.140254	.1818715	0.77	0.441
Sex	6.367026	1.746709	3.65	0.000***
Occupation	1.215888	.4636592	2.62	0.009***
Marital status	2.719382	1.568682	1.73	0.083
Household size	-.0253893	.1264385	-0.20	0.841
Educational level	-1.21828	1.09593	-1.11	0.266
Land acquisition	-.441175	.4940457	-0.89	0.372
Farm size	.0026697	.4324499	0.01	0.995
Farming experience	.0697497	.1472521	0.47	0.636
Membership of association	2.813364	1.063986	2.64	0.008***
Access to extension	-4.915578	1.817446	-2.70	0.007***
Access to credit	.9088234	2.759794	0.33	0.742
Quantity of bags harvested	-.0933032	.0700186	-1.33	0.183
Agrochemical usage	-9.407777	2.255869	-4.17	0.000***
Type of labour	2.512938	.797803	3.15	0.002***
Annual income	-8.22e-08	1.83e-07	-0.45	0.654
_cons	-3.037295	3.963688	-0.77	0.444
LR chi ² (16)	61.94			
Log likelihood	-68.689204			
Pseudo R ²	0.3108			

Source: Field Survey, 2024 ***Significant at 1%

The result further showed that membership of association was positive ($r=2.64$) and significant ($P<0.01$) in influencing respondents awareness of the effect of climate change on maize and potato production, this implies that increase in participation or membership of association will lead to increase in awareness climate change effect on maize and potato production in the study area. In addition, the result also showed that type of labour was positive ($r=3.15$) and significant ($P<0.01$) in influencing respondents awareness of climate change effect on maize and potato production, this implies that increase in hired labour will lead to increase awareness of climate change effect on maize and potato production which could not be unconnected to the fact that most hired workers had worked on several other farms within and outside the study area.

Similarly the results showed that access to extension and agro-chemical usage were negative (-2.70 and -4.17) and significant ($P<0.01$) in influencing respondents awareness of climate change effects on maize and potato production in the study area. This implies that increase in access to extension and use of agro-chemical will lead to decrease awareness of climate change effects on maize and potato production among the respondents.



Constraints to Climate Change Coping Strategies

The result from Table 4 revealed that the constraints to climate change coping strategies. The finding showed that the major constraints to climate change coping strategies among the respondents were drought (92.3%), high illiteracy level (89.5%) and poverty (67.3%) which were ranked 1st, 2nd and 3rd respectively.

Table 4: Distribution of Respondents According to their Constraints to Adaptation of Climate Change Mitigation Strategies

Variables	Percentage	Rank
Drought	92.3	1 st
High illiteracy level	89.5	2 nd
Poverty	67.3	3 rd
Inadequate capital	60.9	4 th
Flooding	59.5	5 th
Inadequate information on climate change	58.6	6 th
Lack of government support	58.6	6 th
Fluctuation of rainfall pattern	55.5	8 th
Inadequate policy support	50.9	9 th
Inadequate extension agents	31.4	10 th

Source: Field Survey, 2024 *Multiple response

The findings further revealed that inadequate capital (60.9%), flooding (59.5%), inadequate information on climate change (58.6%) and lack of government support (58.6%) which were ranked 4th, 5th and 6th respectively. Other constraints highlighted by the respondents includes fluctuation of rainfall pattern (55.5%), inadequate policy support (50.9%) and inadequate extension agents (31.4%) which were ranked 8th, 9th and 10th respectively. This finding implies that respondents were faced with various constraints coping with climate change on effect on maize and potato production in the study area.

CONCLUSION AND RECOMMENDATIONS

The study concluded that age, sex, membership of association, access to extension, agrochemical usage and type of labour were the factors influencing respondents' awareness to climate change effect on maize and potato production.

Based on the findings of the study the following recommendations were made;

- Enhance the capacity of extension agents to provide timely and relevant information on climate-smart agriculture practices.
- Encourage the adoption of climate-resilient agricultural technologies, such as drought-tolerant crop varieties, efficient irrigation systems, and conservation agriculture practices.
- Provide farmers with access to affordable credit to invest in climate-smart technologies and inputs.

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