



## **FACTORS INFLUENCING AWARENESS OF CLIMATE CHANGE AMONG TOMATO FARMERS IN BAUCHI LOCAL GOVERNMENT AREA, BAUCHI STATE, NIGERIA**

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### **ABSTRACT**

The study examined the Factors influencing awareness of climate change among tomato farmers in Bauchi Local Government Area (LGA) of Bauchi State, Nigeria. Simple random sampling technique was used in selecting 400 tomato producers from the study area. Structured questionnaire was used for data collection. Data were analyzed using descriptive and inferential statistics. The result showed that 30% of the respondents fell within the age category of 40-49 with the mean age of 44 years, had household size of 5-7 persons and had secondary education, respectively. Also, the results revealed that 37.5% of the respondents had farming experience of between of 10 years while 45% had a land size of 2.2 hectares. The findings further revealed that half (50%) of the respondents were somewhat familiar with climate change while 30% were very familiar. Half (50%) of respondents perceived that climate change lead to increase in temperature while 45%, 42% and 40% perceived that it leads to drastic change in weather reduce crop productivity and reduction in soil fertility, respectively. Furthermore, the results indicate that age, marital status, education, farming experience, membership of association, farm size and access to credit were significant at ( $P < 0.01$ ) in influencing the effect of climate change on tomatoes production. it was concluded that tomato farmers exhibit a moderate to high level of awareness regarding climate change, which is influenced by factors such as age, education, and access to information. Based on the finding, it is recommended that farmers should form cooperative societies to facilitate access to financial resources through microfinance institutions, commercial banks and other financial institutions.

**Keywords:** Factors, Awareness, Climate, Change, Tomato, Farmers

### **INTRODUCTION**

Agriculture as a cornerstone of economic development and food security in many locations across the globe. In developing countries like Nigeria, the sector not only contributes significantly to GDP but also plays a critical role in livelihoods, particularly in rural areas Tanumihardjo *et al.* (2020). Nigeria's agricultural environment is varied, with several crop varieties, each with unique needs and economic contributions to the local and national levels. However, climate change is making agriculture more difficult because it is so reliant on weather patterns. (Anderson, *et al.* 2020).

Agricultural productivity is significantly impacted by climate change, which is typified by rising temperatures, changed precipitation patterns, and an increase in the frequency of extreme weather events. (Habib-ur-Rahman *et al.*, 2022). This phenomena has caused growing season changes, decreased water availability, and a rise in pest and disease incidence in Nigeria. In areas like Bauchi State, where agriculture is the main economic sector and climate variability can have a major impact on crop yields and food security, the effects of these shifts are especially severe.

Bauchi State, located in the northeastern region of Nigeria, relies heavily on agriculture, with both staple crops and vegetables being cultivated across its various Local Government Areas (LGAs). Among these crops, tomatoes hold particular importance due to their role in local diets and economies. Tomatoes are a key vegetable crop that contributes substantially to both household nutrition and market revenues. However, the cultivation of tomatoes in Bauchi LGA faces specific challenges exacerbated by climate change.



The effects of climate change on tomato production are complex, according to many previous researches. According to Adejuwon (2021) Changes in temperature and precipitation patterns can change tomato growing conditions, resulting in poorer yields and lower-quality food,. High temperatures, for example, can cause stress to tomato plants, which might alter fruit setting and raise the risk of physiological problems. In a similar vein, erratic rainfall can interfere with irrigation schedules and raise the risk of illness. (Mwadzingeni, *et al.*, 2022). The study was therefore carried out to examined the Factors influencing awareness of climate change among tomato farmers in Bauchi Local Government Area (LGA) Bauchi State, the specific objectives are to: describe the socio-economic characteristics of tomato farmers; identify the level of respondents' awareness on climate change effect on tomato farmers in the study area; and determine the factors influencing respondent's awareness on effect of climate change on tomato farmers in the study area;

## METHODOLOGY

### STUDY AREA

The study was conducted in Bauchi Local Government Area (LGA), located in the northeastern region of Nigeria. Bauchi LGA lies within latitudes 9°30' N and 10°30' N and longitudes 9°30' E and 10°30' E. It is bordered by other local government areas within Bauchi State, including Ganjuwa to the north, Tafawa Balewa to the west, and Toro to the south. Bauchi LGA covers a total land area of 3,687 square kilometers and, according to the 2006 National Population Census, has a population of about 493,810 people. However, recent estimates place the population at over 700,000 due to natural growth. Bauchi LGA is characterized by a diverse landscape, ranging from the northern part of the Guinean savanna to more arid and semi-arid zones in the northernmost regions. The variety of landscapes influences both the climate and the agricultural practices in the area. Bauchi LGA experiences a tropical climate with distinct wet and dry seasons. The wet season typically lasts from May to October, with moderate to heavy rainfall, where the annual precipitation ranges from 800 mm to 1,200 mm. The dry season extends from November to April, during which temperatures often exceed 40°C, creating an environment that poses significant challenges to agriculture, especially for crops that are sensitive to temperature changes and irregular water availability, such as tomatoes.

### Sampling Technique

The research employed a simple random sampling technique to select tomato farmers. Bauchi LGA is made of three districts - Bauchi, Kangere, and Miri. The table below presents the calculated sample sizes for each district/community based on the Taro Yamane formula:

The Taro Yamane Formula

The formal used for calculating sample size is:  $n = \frac{N}{1 + N(e)^2}$

Where:

$n$  = sample size

$N$  = total population size

$e$  = margin of error (usually 0.05 for a confidence level)

**Table 1:** Sample Size Selection for the Study

District/Communities	Sampling Frame	Sample Size (%)
Bauchi	280	165
Kangere	220	142
Miri	200	133
Total	700	<b>440</b>

## METHOD OF DATA COLLECTION

Data was collected through the administration of a structured questionnaire to respondents randomly drawn from the study area. The structured questionnaire was meticulously designed to gather relevant data based on the objectives of the study on climate change and its effects on tomato



production. The questionnaire was divided into two main sections A (socio-economic characteristics of the respondents) and B (question related to the research objectives ii to vi)

#### **METHOD OF DATA ANALYSIS**

To address the research questions and meet the study's objectives, a combination of descriptive and inferential statistical tools were applied. Descriptive statistics were employed to analyze objectives i, ii, iv, v, and vi. For objective iii, which focused on examining the perceived effects of climate change on tomato production, inferential statistics were utilized. Specifically, logit regression analysis was conducted to explore the relationships between various factors and the perceived impacts of climate change. This analytical approach enabled an in-depth investigation of how different variables influenced farmers' perceptions of climate change effects, providing insights into the statistical significance and nature of these relationships.

#### **DESCRIPTIVE STATISTICS**

Descriptive statistics was used to achieve objectives i, ii, iii, iv, and vi. The response of the respondents on the perceived effect of climate change was obtained using likert type coded as (1= Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly agree). The validity of the result was measured using mean. Considering the Liker Type Rating Scale of 5, 4, 3, 2, 1 mean was then calculated thus:

$$X = \frac{\sum (Nf)}{Nr}$$

X	=	Mean
$\sum$	=	Summation
Nf	=	Frequency of responses under each mode
Nr	=	Number of respondents to an item
= $\frac{(5+4+3+2+1)}{5} = \frac{15}{5} = \text{Mean} = 3 \text{ (Threshold)}$		

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Decision Rule: Any response from 3.0 and above is agreed and any response below 3.0 is disagreed.

#### **Inferential statistics**

For objective v which focused on examining the perceived effects of climate change on tomato production, inferential statistics was utilized. Specifically, logit regression analysis was conducted to explore the relationships between various factors and the perceived impacts of climate change. Logit regression model is given as:

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

Where:

- Y= Awareness on effect of climate change (Yes= 1 or 0 = No)
- $X_1$  =Age (Years)
- $X_2$ = Marital status (1=Single, 2= Married 3=Divorced =, 4=Widowed)
- $X_3$ =Education (1=Quranic, 2=Primary, 3=Secondary, 4=Tertiary)
- $X_4$ =Household size (Number of persons)
- $X_5$ =Farming experience (Years)
- $X_6$ =Membership of association (Yes = 1, No=0)
- $X_7$ =Extension Contact (Yes = 1, No=0)
- $X_8$ =Farm size (Hectares)
- $X_9$ =Access to credit (Access = 1, 0=Non-access)
- $X_{10}$  = Quantity of harvest (Kg)
- $X_{11}$  = Land acquisition (inherited =1, others sources =2)
- $X_{12}$  = Use of agro-chemicals (1=Yes, 0=No)
- $X_{13}$  = Type of labour (1=Family, 2=Hired)
- $\beta_0$ = Constant
- $\beta_1 - \beta_8$  = Regression coefficients
- U = Error term



## RESULTS AND DISCUSSION

### SOCIO-ECONOMIC CHARACTERISTICS OF TOMATO FARMERS

The socio-economic characteristics of tomato farmers, as highlighted by the data in Table 2, provide crucial insights into the demographics, agricultural experience, and farm sizes of the respondents in Bauchi Local Government Area. The age distribution of the respondents shows a broad range, with the largest group falling between 40-49 years (30.0%), followed by those in the 30-39 years category (25.0%). The mean age of the respondents was 44 years, suggesting that the majority of the tomato farmers were in their middle years, where they likely possess significant experience in farming but may also face challenges related to age and physical stamina (Abdu *et al.*, 2021). Moreover, a relatively small proportion of respondents are younger than 30 years (12.5%), which indicated a potential gap in the youth involvement in tomato farming.

The household size distribution in this study revealed that half (50%) of the respondents have larger households, with 50.0% reporting between 5 and 7 members with a mean household size of 6 members. This findings was consistent with trends in many rural areas of Nigeria, where family labor is often a critical factor in agricultural production. Larger households provide more hands to support farming activities, which is particularly important in subsistence and semi-subsistence farming systems, where labor is one of the most valuable resources (Nwachukwu *et al.*, 2023).

Regarding years of experience in tomato farming, 37.5% of the respondents had farming experience of 5-10 years, with an average of 10 years. This suggests that a significant portion of the respondents may still be in the phase of accumulating agricultural knowledge and adapting to new farming practices. Farmers with more experience often exhibit higher resilience and better adaptation strategies to environmental changes (Abdu *et al.*, 2021). However, those with less than 5 years of experience were (20.0%) and might be at a disadvantage when it comes to dealing with climate change-related stresses, as they may not yet have the same depth of understanding regarding local climatic patterns or climate adaptation strategies. Furthermore, the respondents who have been farming for over 15 years (17.5%) tend to be more established, potentially with better access to resources, but they might also face challenges related to aging, such as reduced physical ability to engage in strenuous farm work (Abdulkareem & Ayoola, 2023).

The revealed that 45.0% of respondents cultivates between 1 and 2 hectares of land with a mean farm size of 2.2 hectares. The farm sizes reflect the typical landholding structure in many rural parts of Nigeria, where smallholder farmers dominate the agricultural landscape. These medium-sized farms allow for some level of commercial production but might still be vulnerable to environmental shocks, such as droughts or floods, especially considering the increasing unpredictability of weather patterns due to climate change (Olayemi *et al.*, 2023). This findings are in alignment with several recent studies that highlight the importance of socio-economic characteristics such as age, household size, and farming experience in determining farmers' ability to adapt to climate change. For instance, Tetteh *et al.* (2022) noted that farmers with more experience tend to implement more effective adaptation strategies, such as shifting planting dates or using drought-resistant tomato varieties, compared to younger, less experienced farmers. Similarly, Adejumo *et al.* (2023) suggested that farmers with larger household sizes are better equipped to mitigate the impacts of climate change by leveraging family labor.



**TABLE 2: DISTRIBUTION OF RESPONDENTS ACCORDING TO QUANTITATIVE SOCIO-ECONOMIC CHARACTERISTICS (N=400)**

Variable	Frequency	Percentage	Mean
Age			
20-29 years	50	12.5	44
30-39 years	100	25.0	
40-49 years	120	30.0	
50-59 years	80	20.0	
60 years and above	50	12.5	
Household Size			
1-4 members	120	30.0	6
5-7 members	200	50.0	
8 and above	80	20.0	
Years of Experience in Tomato Farming			
Less than 5 years	80	20.0	10
5-10 years	150	37.5	
11-15 years	100	25.0	
More than 15 years	70	17.5	
Farm Size (Hectares)			
Less than 1 hectare	50	12.5	2.2
1-2 hectares	180	45.0	
2-4 hectares	120	30.0	
More than 4 hectares	50	12.5	

**Source:** Field survey, 2024

#### CLIMATE CHANGE AWARENESS

The results in Table 3 presents the level of familiarity with climate change among tomato farmers indicating varying levels of awareness within the study area. The distribution showed that half (50.0%) of respondents were somewhat familiar with climate change, while 30.0% consider themselves very familiar with the concept. Only 20.0% of the respondents report not being familiar at all with climate change. The relatively high percentage of respondents who were somewhat familiar (50.0%) and very familiar (30.0%) suggests a moderate to high level of awareness about climate change. This level of familiarity is crucial as awareness is the first step toward adopting effective climate adaptation strategies. However, the fact that 20.0% of the respondents are not familiar at all indicates a gap in awareness that could hinder the implementation of climate change mitigation and adaptation practices. Previous research supports these findings, noting that awareness of climate change is critical for farmers' willingness and ability to adapt to changing climatic conditions (Stern, 2000; McFadden *et al.*, 2018). Farmers who are more aware of climate change are more likely to adopt innovative practices and technologies to mitigate its impacts (Arbuckle *et al.*, 2015).

**TABLE 3: DISTRIBUTION OF RESPONDENTS BASED ON LEVEL OF AWARENESS WITH CLIMATE CHANGE (N = 400)**

Level of Familiarity	Frequency	Percentage
Very familiar	120	30.0
Somewhat familiar	200	50.0
Not familiar at all	80	20.0

**Source:** Field survey, 2024





### Sources of Information on Climate Change

The results revealed that 42.5% of the respondents sourced their information on climate change through personal observation while 37.5% received information on climate change through media houses like radio, television, hybrid media and print media respectively. The results also revealed that 32.5% and 27.5% received information from extension agents as well friends and relatives. Personal observation stands out as the most impactful factor, indicating that firsthand experiences with changes in weather patterns or other climate-related phenomena play a crucial role in shaping farmers' awareness. This finding aligns with research suggesting that direct, observable changes often prompt individuals to take action or seek further information about climate-related issues (Lemos & Morehouse, 2005; Armitage *et al.*, 2012).

**TABLE 4:** DISTRIBUTION OF RESPONDENTS BASED ON SOURCE OF INFORMATION ON CLIMATE CHANGE (N =400)

Factor	Frequency*	Percentage
Media coverage	150	37.5
Personal observation	170	42.5
Information from agricultural extension services	130	32.5
Friends and Relatives	110	27.5

**Source:** Field survey, 2024

\* Multiple response

### Factors Influencing Awareness on Climate Change

The results of logit regression revealed that the coefficient of age was positive (0.015) and statistically significant ( $P < 0.01$ ). This implies that as farmers' age increases, their likelihood of their awareness of climate change also increases. This finding aligns with previous research indicating that older individuals might have more exposure to environmental changes and have accumulated more experience over time, potentially leading to increased awareness (Kumar & Kumar, 2018; Ochieng *et al.*, 2020).

The results also revealed that marital status (0.520) and education level (0.320) of the respondents were positive and significant in influencing the level of awareness of climate change among tomato farmers. This implies that, married and educated farmers are more likely to be aware compared to their unmarried and less educated counterparts. This may be due to shared responsibilities and resources within households, which can enhance information dissemination and awareness (Nyangena, 2007; Asfaw *et al.*, 2011). Also education equips individuals with better knowledge and understanding of climate change, enabling them to be more informed and proactive (Adebayo *et al.*, 2015; Apan *et al.*, 2009). The results further revealed that the coefficient of household size (0.022) was positive and significant ( $P < 0.05$ ). This suggests that a slight increase in household size will lead to increase on awareness and vice-versa. Larger households might have more resources and diverse sources of information, potentially enhancing climate change awareness (Hossain & Uddin, 2015).

With a coefficient of 0.025 and P-value of 0.002, the analysis indicates that more experienced farmers tend to have higher awareness levels. This is consistent with the idea that experience provides greater exposure to climate variability and its impacts (Rangarajan & Dey, 2013). A positive coefficient (0.350) and P-value (0.012) suggest that farmers who are members of agricultural associations are more likely to be aware of climate change effects. Such memberships often provide access to information and training, enhancing awareness (Mugisha *et al.*, 2011). The coefficient (0.010) and P-value (0.046) show that more frequent contact with extension agents is positively related to awareness. Extension services play a crucial role in disseminating climate information and educating farmers (Adesina & Baidu-Forson, 1995).

A coefficient of 0.040 and a P-value of 0.008 indicate that larger farm sizes are associated with increased awareness. Larger farms might face more significant climate challenges, prompting



farmers to become more informed (Mastrorillo *et al.*, 2012). The significant coefficient (0.600) and P-value (0.001) suggest that farmers with access to credit are more likely to be aware of climate change. Access to credit can facilitate the adoption of adaptive measures and increase engagement with climate information (Zeller *et al.*, 1998). The positive coefficient (0.005) and P-value (0.012) imply that farmers with higher harvest quantities are more likely to be aware of climate change impacts. This may be due to their increased investment in and concern for production outcomes (Hassan & *et al.*, 2014).

A coefficient of 0.430 and a P-value of 0.031 indicate that the method of land acquisition impacts awareness. Farmers who acquired land through purchase or other means might be more invested in understanding climate impacts compared to those with inherited land (Carter *et al.*, 2007). The positive coefficient (0.320) and significance (P-value = 0.045) suggest that using agro-chemicals is associated with higher awareness. Farmers using these inputs might be more attuned to environmental changes and their effects (Sharma & Dey, 2017). The coefficient (0.290) and P-value (0.038) show that the type of labour used affects awareness. Farmers employing hired labour might be more aware due to increased interaction with various stakeholders and information sources (Bourdillon, 2018).

**TABLE 5: FACTORS INFLUENCING AWARENESS ON CLIMATE CHANGE**

Variables	Coefficient ( $\beta$ )	Std. Error	Z-Value	P-Value
Intercept ( $\beta_0$ )	-1.250	0.320	-3.91	0.000***
Age ( $X_1$ )	0.015	0.005	3.00	0.003***
Marital Status ( $X_2$ )	0.520	0.150	3.47	0.001***
Education ( $X_3$ )	0.320	0.070	4.57	0.000***
Household Size ( $X_4$ )	0.022	0.010	2.20	0.028**
Farming Experience ( $X_5$ )	0.025	0.008	3.13	0.002***
Membership of Association ( $X_6$ )	0.350	0.140	2.50	0.012**
Extension Contact ( $X_7$ )	0.010	0.005	2.00	0.046**
Farm Size ( $X_8$ )	0.040	0.015	2.67	0.008**
Access to Credit ( $X_9$ )	0.600	0.180	3.33	0.001***
Quantity of Harvest ( $X_{10}$ )	0.005	0.002	2.50	0.012**
Land Acquisition ( $X_{11}$ )	0.430	0.200	2.15	0.031**
Use of Agro-Chemicals ( $X_{12}$ )	0.320	0.160	2.00	0.045**
Type of Labour ( $X_{13}$ )	0.290	0.140	2.07	0.038**

**Source:** Field survey, 2024

\*\*\* (P<0.01)    \*\* (P<0.05)

## CONCLUSION AND RECOMMENDATIONS

The study concluded that tomato farmers exhibit a moderate to high level of awareness regarding climate change, which is influenced by factors such as age, education, and access to information. Based on the findings of this study, it was therefore recommended that, farmers should form cooperative societies to facilitate access to financial resources through microfinance institutions, commercial banks and other financial institutions. The government and other stakeholders should develop and implement targeted educational programs and workshops to improve farmers' understanding of climate change and its impact.

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