Rice Farmers' Perception of Climate Change and its Effects on Rice Production and Livelihoods in Kura Local Government Area of Kano State, Nigeria

Bichi, A. A.[1] , Abdulkadir, M.[2], Hassan, M. B.[3,] Kanoma, M. I.[4] Halliru, S. L.[5] and Muhammad, A. S.[6]

[1,2,3&4]Department of Geography, Federal University, Gusau

[5&6]Department of Geography, Federal University of Education, Kano

Corresponding author: abubakarbichi@fugusau.edu.ng 07064297546

Abstract

This study examined the perception of rice farmers' on climate change, its pattern of change and how it affects rice production and livelihoods in Kura Local Government Area in Kano State, Nigeria. A survey research design was employed using semi structured questionnaire. Four hundred (400) respondents were selected randomly from the selected 10 wards based on their availability for the study. The data obtained was analyzed using descriptive statistic in the SPSS version 20.0. The study revealed that rice farmers in the area have very good knowledge on climate change, its pattern of change and effects on rice yield. The study further revealed that the existence of climate change due to its effects on rice yield in the area makes farmers in the area to have a positive perception on the changing pattern of climate change and their effects on rice production. Also the study established that the farmers' positive perception on the presence of changing pattern of climatic variables in the area affects the growing yield of rice in the inputs and the outputs. The study recommends that Kano state government and non-governmental organizations should gear up towards motivating the farmers to actively adopt mitigating measures of climate change for sustainable rice farming system and sustenance of livelihood options in the area. The rice farmers association and the agric department of the local government in collaboration with government at both state and federal should put more efforts in providing drought resistance seedling to farmers and adopt effective mitigation measures through early warning to control loss of farm products during harvesting. Creating awareness on effects of climate change and crop management practices to control dreadful crop loss in the area was also recommended.

Keywords: Climate Change, Crop yield, Rice Farmers, Perception and Livelihoods

1.0 Introduction

The threat of climate change, manifested in the increase of extreme weather condition such as drought, deforestation and flood, has been recognized as a global priority issue (Sabine, 2004). Climate change is a sustainable development challenge, with broad impact not only on the environment, but also on economic and social development. The effect of climate change varies among regions, and between different generations, income groups and occupations as well as between women and men (Odjugo, 2010). A number of countries in Africa already face

semi-arid conditions that make agriculture challenging, and climate change will most likely reduce the length of the growing season as well as force large regions of marginal agriculture out of production (IPCC, 2007). Due to their lower adaptive capacities, developing countries and people living in poverty are likely to experience a significant impact (Salick *et al*., 2007). Nigeria is already experiencing a range of impacts from climate change including more frequent heavy rainfall episodes, erratic rainfall and unpredictable onset/retreat of rain and increasing air temperature which threaten the ecosystem, food production, livelihoods and infrastructure (Babatolu & Akinnubi, 2016). These changes are not uniform in the country as some areas are severely impacted and hence, more vulnerable to climate change than others.

Agriculture which is highly vulnerable to climate change is an important sector in the economy of most developing countries, particularly Nigeria. Smallholder farmers constitute the single most important occupational group in Nigeria and contribute significantly to the national economy. It employs over 70 percent of the population, contributes about 41 percent to gross domestic product (GDP) (Falaki, Akingbe & Ayinde, 2013), accounts for 5 percent of total export and provides 88 percent of non-oil earnings in Nigeria.

Rice is valued as the most important staple food for over half of the world population (Food and Agricultural Organization FAO, 2003). In Nigeria, it has become a staple food such that every household; both the rich and the poor consume a great quantity (Godwin, 2012). In terms of local production, rice is now one of the major cereals produced by Nigerian farmers; it is cultivated in virtually all the agro-ecological zones of Nigeria. It covers both the upland and the swamps, depending on the variety, (Kano State Agricultural and rural development Authority, KNARDA, 2007). Rice production needs to increase to meet future population growth needs. Any decline in rice production through climate change would thus critically impair food security in the country. Agricultural production and food security are severely hampered by climate change in many African countries. Most local farmers lack basic scientific knowledge of how the environment works, including awareness of climate and even modern farming techniques. While some farmers are conscious and aware of the apparent change in climate and weather characteristics in their geographical environment, some other farmers, especially in rural localities have negative perception about the phenomenon. This could largely be attributed to their literacy level and other socio-economic dispositions. This study interrogates rice farmers' perception of climate

change and its effects on rice production and livelihoods in Kura Local Government Area of Kano State, Nigeria.

Kura Local Government Area of Kano State is vulnerable to climate change which adversely affects its agricultural productivity. The existence of warming and rainfall variety leads to reduction in the agricultural production of the farmers. Therefore, the area is seriously affected by climate change and weather variability which has pushed farmers, especially rice farmers to adopting a number of strategies to mitigate the adverse effect of climate change.

On the basis of this background that this study intend to assess the rice farmers' perceptions of climate change, its pattern of change and how it affects rice production and livelihoods in Kura LGA in order to ascertain their dynamic knowledge on the effects of climate change and how they cope with climate change and finding means to sustain it.

2.0 Description of study area

Kura Local Government Area of Kano State is located between Latitude 8^0 25'49" N and 8^0 49' 09'' N of Greenwich Meridian and Longitude 11^0 41' 07" E and 11^0 54' 17" E of the equator covering an area of about 206km^2 (80m^2) of cultivable land. It shares common boundaries with Garun Malam Local Government Area from the west, Madobi Local Government Area from the North, Dawakin Kudu Local Government Area from the East and Bunkure Local Government Area from the South as shown in Figure 1. It is geographically located in the southern part of the State along the Zaria-Kano express way which is a distance of about 35km from the State capital. The climate of the area is part of the Hot Dry Tropical Climate obtainable in Northern Nigeria, generally characterized by warm rainy season and cool/hot dry season. The temperature regime is warm to hot almost throughout the year, even though there is a slightly cool period between November and February which is referred to as the harmattan (Olofin, 1987).The rainfall pattern of the area is characterized by only four wet months, (June-September). However, the first rain is usually recorded in early May. The vegetation of the study area is part of the open savannah woodlands of Northern Nigeria.

But the vegetation pattern has changed considerably due to human activities such as frequent bush burning, farm clearing, and tree cutting for fuel wood and over grazing.

The study area is part of Kano Closed Settled Zone lying on the portion of a dissected pene-plain development on the crystalline pre-Cambrian rocks of the basement. Soil in the area consists of young alluvial soils which are strongly layered in the lower parts of the profile. The dominant texture is loamy sand, although very sandy or sandy loam layers are often present.

The drainage system of the study area is part of the general drainage of the Kano River. It is directed to the Kano and the Shimar River. The later river ultimately joins the former, after which it is called Hadejia system. The study area is part of the Kano River Project Area, which is intensively cropped. The main crops grown on the well-drained soils are sorghum, millet, rice, maize, groundnuts, vegetables and cowpeas. Mixed cropping is generally practiced with inter-planting of millet and groundnuts or millet and sorghum.

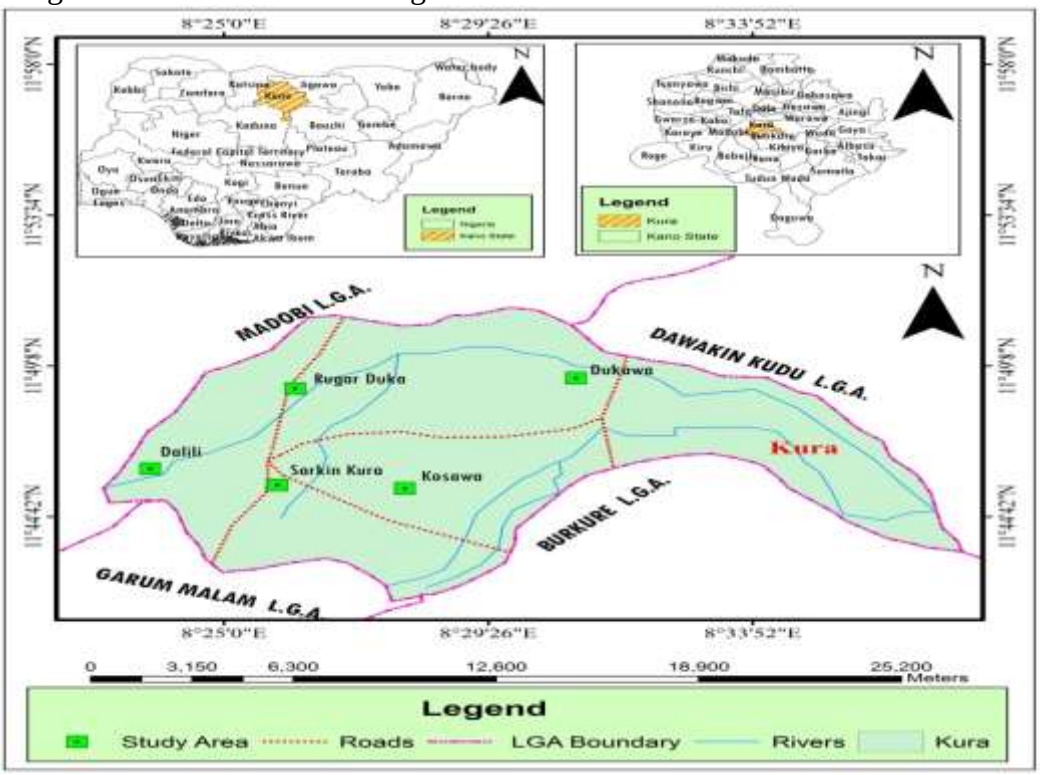

Fig. 1: Map of Kura Local Government Area, Kano State
(Source: Cartography laboratory, Geography Department, Federal University of Education, Kano)

3.0 Materials and Methods

This research adopted a survey design conducted to farmers living around the selected areas in order to have good and clear perspective of their perceptions of climate change and how it affects rice production and livelihoods in Kura LGA, in order to ascertain their dynamic knowledge on the effects of climate change on livelihood for sustainable agricultural practice. Four hundred (400) respondents were drawn from the 10 rice-farming communities such as; Karfi, Imawa, Gajingiri, Dalili, Guraza, Bugau, Domawa, Kosawa, Kadani and Fegin Malu, in Kura LGA using stratified sampling frame for the study based on their availability.

The data obtained for the study pertaining to the perception of farmers on climate change were sourced from primary data using self-administered questionnaire survey designed on five Likert scale. The questionnaire was open ended questions and was divided into three sections, the first section deals with demographic characteristics of the respondents (gender, age, level of education, length of residency, household size, size of the farmland, means of acquiring the farmland and net income). Section two addresses the farmer's perception on climate change and its changing pattern. The section three addresses their perception on climate change effects and how it affects rice production as well as their livelihoods. The data obtained was analyzed using descriptive statistics using Statistical Package for Social Sciences (SPSS) version 20 where the level of their perception on climate change, its changing pattern and its effects on rice production as well as their livelihoods based on a scale of 1-5 (Strongly agree 5, Agree 4, Undecided 3, Disagree 2, Strongly disagree 1) were identified. Frequencies and percentages were used to analyze the demographic variables of the respondents. The mean values and standard deviations were used to analyze the farmer's perception on climate change, its changing pattern and how it affects rice production as well as their livelihoods. Data obtained from the mean value on each farmer's perceptions on a scale of 1-5 (Very good 4.0-5.0, Good 3.00-3.99, Fairly Good 2.00-2.99, Poor 1.00-1.99, Very poor 0.00-0.99) was also used to judge the positive and negative perceptions on the farmer's perception on climate change, its changing pattern and how it affects rice production as well as their livelihoods.

4.0 Results and Discussion

4.1. Demographic characteristics of the respondents

The results obtained from Table 1 on the demographic characteristics of the respondents indicates that almost 9 out of every 10 of the respondents (93%) were male due to the influence of culture in the state which shoulder the responsibility

of family feeding on men and were limited in association with people other than their family members. The higher percentage of male respondents serves as factor in explaining the reason of high level of farmer's perception of climate change and its effects on livelihood in the area. This finding is in agreement with the study of Browna and Brabyn, (2012) in New Zealand where more proportion of male respondents participated in the study than female, and not in compliance with the study of both Stockton (2011) and Niekerk (2016) conducted in Morro Bay, California and South Africa respectively, where females have the dominant proportion of responses.

Table 2: Demographic characteristics of rice farmers in Kura LGA

		Frequency	Percent	Cumulative Percent
Sex	Male	373	93.3	93.3
	Female	27	6.8	100.0
	Total	400	100.0	
Age	21-30	76	19.0	19.0
	31-40	142	35.5	54.5
	41-50	147	36.8	91.3
	51 and Above	35	8.8	100.0
	Total	400	100.0	
Level of Education	Primary	105	26.3	26.3
	Secondary	157	39.3	65.5
	Tertiary	80	20.0	85.5
	Others	58	14.5	100.0
	Total	400	100.0	
Length of Residency	Less than 10years	31	7.8	7.8
	11-20 years	53	13.3	21.0
	21-30years	152	38.0	59.0
	31 and above	164	41.0	100.0
	Total	400	100.0	
Household Size	1-5	117	29.3	29.3
	6-10	196	49.0	78.3
	11-15	48	12.0	90.3
	16 and above	39	9.8	100.0
	Total	400	100.0	
Size of the farmland	Less than 5 hectares	167	41.8	41.8
	6-10	171	42.8	84.5
	11-15	33	8.3	92.8

	16 and above	29	7.3	100.0
	Total	400	100.0	
Means of acquisition of the land	Inheritance	203	50.8	50.8
	Purchase	136	34.0	84.8
	Lease	53	13.3	98.0
	inheritance and Purchase	8	2.0	100.0
	Total	400	100.0	
Bag of rice produce	Less than 20 bags	61	15.3	15.3
	21-39 bags	189	47.3	62.5
	40--59 bags	67	16.8	79.3
	60 bags and above	83	20.8	100.0
	Total	400	100.0	
Net income	Less than N 50000	34	8.5	8.5
	N 51000- N100000	151	37.8	46.3
	N101000- N150000	115	28.8	75.0
	N150000 and above	100	25.0	100.0
	Total	400	100.0	

Source: Fieldwork, 2022

Table 1 further indicates that 36.8% of the respondents were between the ages of 41 to 50 years. This shows that they are at their youthful age and are in a better position to explain. However, 35 out of 400 of the respondents with age of 51 and above years are the most advantage group with more knowledge of climate change and its effects on livelihood. The result of the study as indicated in Table 2 revealed that 74% of the respondents can read and communicate in the formal language to appreciable level. The level of access to formal education by the respondents enhances their awareness levels relating to their perception of the changing pattern of climatic variables and their effects in the area. In terms of Length of Residency of the respondents in the area as contained in table 2, 4 out of 10 farmers lived in the area for over 30 years while almost 5 out of the 10 respondents have family size between 6-10. However, 4 out of the 10 respondents in the area have farmland size between 6 to 10 hectares of land and almost half (5 out of 10) of the total farmers in the area acquire their land through inheritance. Also, the table 2 further indicated that due to limited number of the acquired farmland of between 6 to 10 hectares of land in the area makes only 47.3% of the farmers to be able to produce 21-39 bags of rice throughout the farming season. As indicated in the table the low level of rice production by individual farmers in the area makes almost every 4 out of the 10 farmers to earn between N51,000 to N100,000 in a year as net income.

4.2 Perception of farmer's on climate change

The results of the study from table 2 on the perception of farmer's on climate change reveals that farmers in the area have very good perception of mean value of 4.2425 on the knowledge of changes in rainfall pattern compared to 1980 due to changes in climate variability. It was further revealed that over the last 40 years farmers in the area have very good perceptions on observed changes of the Onset of the rainfall and Cessation period of rainfall received with mean value of 4.0375 and 4.3100 respectively. Based on the findings the Onset of rainfall in the area and the general pattern of the onset of rainfall in the state, the Onset of rainfall deviate from what was observed in the past where rainfall start from end of March to early April. But today the Onset of rainfall begins late usually from May and early June and ceases early which consequently have direct bearing on the Hydrological growing season in agricultural productions.

Table 2: Farmers Perception on Climate Change

	N	Mean	Std. Deviation	Variance
Farmer's Perception of Climate Change				
Have you noticed any change in rainfall pattern compared to 1980	400	4.2425	0.76167	0.580
Onset	400	4.0375	1.11992	1.254
Cessation	400	4.3100	0.80344	0.646
Intensity	400	3.8675	0.94189	0.887
Observed August peak	400	3.8550	1.13455	1.287
Noticed of any change in heat wave	400	1.0575	0.23309	0.054
Farmer's Perception on the Changing Pattern of Climate Change				
Drought	400	4.0000	1.26253	1.594
Floods	400	3.5075	1.40530	1.975
Off seasonal rainfall	400	3.6875	1.02590	1.052
High wind	400	3.7075	1.14465	1.310
Cold	400	3.9825	1.14694	1.315
Higher rainfall	400	3.7475	1.02781	1.056
Heat	400	3.9350	.89598	0.803
Dew	400	3.5825	1.08911	1.186
Effects of Climate Change on Livelihood				
Reduce crop yield	400	4.4900	0.87281	0.762
Spoilage of farm produce	400	4.5600	0.81120	0.658

Increase in pests and diseases	400	4.5575	0.77343	0.598
Food shortage	400	4.6550	0.59317	0.352
Increase cost of Input	400	4.5375	0.84876	0.720
Shortage of Income	400	4.5225	0.93363	.872
Valid N (listwise)	400			

Source: Fieldwork, 2022

The findings supported the study of Ekoh (2020) which shows that the Onset and Cessation of annual rainfall in Northern Nigeria is relatively distant from the early Onset in recent time which makes the area to relatively experience dryness. In table 2, it was further established that the farmers have good perception on the Intensity of the rainfall and peak August period. The findings from the August peak period reception of rainfall corroborate with the findings of Ogunrinde *et al*., (2019) who reported that Kano recorded low rainfall in July, August and September, with values of 6.30, 9.29 and 12.57 mm/year, respectively. The August break observed in the area is conspicuous period to farmers and it is significant because it allows re-tending certain crops which require frequent tending. Also from the table 2, observed changes in heat wave enjoyed poor perception by the farmers with mean value of 1.0575. The farmers' opinions toward pattern of observed change in heat-wave in the study area tilt towards total of highly decrease.

4.3 Farmer's Perception on the Changing Pattern of Climate Change

On the observed pattern of drought over time in the area, the result from table 2 indicated that the perceived mean value of drought occurrence in the area is very good (4.0000). This indicated that the pattern of observed occurrences of droughts in the area over time shows that the phenomenon occurs very often options in all the 10 sampled communities in the local government due high level of the respondents' knowledge of what drought is. The finding of the study on drought agree with the findings of Chukwudi and Adebowale (2018) who revealed that Kano is at higher risk of more than near normal drought situations for the 6-month time scale and will likely increase human vulnerability.

The perceived occurrence of flood in the area based on table 2 revealed that the mean value of the farmers' perception on the incidence of drought is found to be Good (3.5075). This indicated that the changes of climatic elements that causes flood in the area is evidently visible by the respondents. Similarly, the findings from table 2 on Off-seasonal occurrence of rainfall in the area based on the farmers good perception of mean value of 3.6875 of the incidence of Off-season of rainfall in the

area adjudge to be evidently visible. This indicated that Off-seasonal rainfall occurs outside the range of the usual rainy days, either at beginning (onset) or at the end (cessation) of the days.

From table 2, it was revealed that strong winds often damage cereals crops especially at eve of harvesting period due to climate change. The perceived knowledge of farmers' perception on the changing pattern of climate change in the area perceived to be good with mean value of 3.7075. This indicated that strong winds often occur in the study area over time. The result of the study was supported by Onyewole, (2018) that the mean wind speed in Kano varied between 8.9ms-^{1} to 12.4ms-^{1}which occurred in September and January respectively, and as at October, it was 7.88ms-^{1}, the least in all the months. On the Observed Pattern of change in cold (harmattan) over time in the area, the farmers perception on the changing pattern of the cold season indicate Good perceived value of 3.9825 on the changes. The farmers in the area observed that there is change in the patterns of cold (harmattan) season towards the extremeas a result of change in climate. From table 2, of the observed pattern of higher rainfall over time in the area, the result indicated that the farmers have good perception on the changes of higher rainfall with mean value of 3.7475. The finding shows that there is observed evidence of higher rainfall amount received in the area which had been occurred often in the area.

Meanwhile on the observed Pattern of Change in Heat over time in the area, the findings of the study from 2 revealed Good mean perceived value of 3.9350 due to their good awareness of climate change. The table further shows that there is Good farmers' perception of the observed pattern of dew (*raba*) over time as indicated by the mean value of 3.5825. The observed changes in dew in the area occurred due to the importance of dew (*raba*) for the maturity and amount of yield for certain crops and is greatly further affected by other elements of weather such as rainfall and wind. A study by Elemo *et al*., (2021) in Abuja indicates that the dew point temperature and the relative humidity (RH) for each month of the year 2020 showed that the peak of the relative humidity was at 51%, while the peak of the Dew point temperature (D) was at 18˚C.

4.4 Effects of Climate Change on Crop Yield over time

The farmers' opinions on the effects of climate change on increased crop yield over time were observed in the area. The result of the study from table 2 established that the effects of climate change on crop yield is evidently observed and experienced to be Very good by the farmers as the effects causes spoilage of farm produce,

increase in pests and diseases, food shortage, increase in cost of inputs and shortage of income with mean value of 4.4900, 4.5600, 4.5575, 4.6550, 4.5375 and 4.5225 respectively.

Generally, the view of respondents on the effects of climate change on reduced crop yield, spoilage of farm produce, increase in pests and diseases, increase in cost of farm input and shortage of income have multiplier effects of farmers livelihood due to prolonged incidence of climate change in the area. It can be deduced from the findings that the effects of climate change on crop yield could have a profound influence on both pre-harvest and post-harvest periods of farmers in relation to his livelihood standard as all the affected variables where they occurred are very good manifestations of climate change.

5.0 Conclusion and Recommendations

From the foregoing discussion, it could be deduced that rice farmers in Kura local government area have very good knowledge of climate change, its pattern of change and effects on rice yield. The ranges of farmers' perception from Good to Very good clearly voiced their understanding, perceptions of climate change and its attendant consequences on rice cultivation. The existence of climate change due to its effects on rice yield in the area makes farmers in the area to have a positive perception on the changing pattern of climate change and their effects on rice production. The farmers positive perception on the changing pattern of climate change are evidently visible on drought, occurrence of flood, off-seasonal occurrence of rainfall, strong winds, change in cold (harmattan), changes of higher rainfall, change in heat wave over time in the area and changes in dew (*raba*) over time. The study further revealed that the presence of changing pattern of climatic variables in the area affects the growing yield of rice in the inputs and the outputs. These can be seen in the positive perception of farmers on the observed and experienced effects on the spoilage of farm produce, increase in pests and diseases, food shortage, increase in cost of inputs and shortage of income which consequently create an un-sustainable farming system in the area and have direct effect on the rice production and invariably the livelihoods of the rice farmers in the area. Following the findings in this study, the following recommendations were made:

1. Government (at both Federal and State levels) and non-governmental organizations should gear up towards motivating the farmers to actively adopt mitigating measures of climate change for sustainable rice farming system and sustenance of livelihood options in the area.

2. The rice farmers association and the agric department of the local government in collaboration with government should put more efforts in providing drought resistance seedling to farmers and adopt effective mitigation measures through early warning to control loss of farm products during harvesting.
3. Kano state ministry of agriculture and ministry for rural development in collaboration with farmers associations and related non-governmental organizations should be engaged in creating awareness on effects of climate change and crop management practices to control dreadful crop loss in the area.
4. Farmers' perception should always be considered when designing climate change coping and adaptation strategies for effective implementation.

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