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CLIMATE CHANGE: CAUSES, EFFECTS AND STRATEGIES ADOPTED BY THE FARMERS' ON FARMLAND FOOD SECURITY IN KANKARA LOCAL GOVERNMENT, KATSINA STATE, NIGERIA

By

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Abstract

This research explores some of the strategies employed by the farmers toward the current changing climate in Kankara local government area, Katsina state. The objectives of the study were as follows: to identify the causes of climate change in the study area ,to examine the effect of climate change, to identify the strategies farmers adopted in minimizing the challenges related to climate change on the farmland in Kankara local government area of Katsina state, to examine the farmers' level of awareness and strategies employed in cushioning the menace, and finally to offer some possible solutions to the problems. The research used structured questionnaires, interviews and observations in the field. 240 questionnaires were administered to the selected number of respondents. The research work used descriptive statistical tools in analyzing the data. The findings indicated that majority of the farmers perceive changes in climate change and their impacts on agriculture, such as drought and desertification. The study recommends promoting climate resilient agricultural plants and providing them with modern and supportive technological know-how, which may improve sustainability of agriculture in the face of the changing climate.

Keywords: Climate change, Causes, Effects, Strategies on Farmland for Food Security.

Introduction

Agriculture is an important sector of economy in Kankara local government, Katsina state and the world at large. The impact of climate change on agriculture cut across all region of the world, from the Polar Regions to the forest land through series of marine and coastal ecosystems, the impact are pervasive and quite alarming. Various scientific reports have highlighted the negative impact of the steady change in the global climate (UNFCCC, 2006).The Intergovernmental Panel on Climate Change (IPCC) in 2007 reported that there is a statistical significant increase in the global mean state of the climate or in its variance, and further increases are expected, if carbon dioxide (CO_2) and greenhouse gas (GHG) emissions are not controlled. United nation framework convention on climate change (UNFCCC) has defined climate change as a change that attributed directly or indirectly to human activity that alter the composition of the global atmosphere and that in addition to natural climate variability observed over comparable time periods (Abaje, 2018).

The impact of climate change such as drought and flood has been more pronounced in the Arid and Semi-Arid Lands (ASALs) of the world. Katsina state is part of the semi arid region in Africa and Kankara inclusive. In addition other important climate variables such as daily temperature, precipitation, drought and desertification were also observed in the region (type, frequency and intensity), wind, relative humidity and cloud are also changing, implying the multiple aftermath of the changes worldwide (Oyekale, 2009).

Africa is generally acknowledged to be the continent that is most vulnerable to climate change. West Africa is one of the most vulnerable to the effects of the climate change as shown by the scope of the impacts of climate variability over the last three to four decades (James *et al.,* 2015). Nigeria, a country that is highly dependent on the agricultural sector which accounts for about 80% of the Gross Domestic Product (GDP) and 85% of the foreign exchange earnings, and employs about 90-95% of the population (Emmanuel, 2017).The recent food crises in Nigeria are reminders of the continuing vulnerability of the region to the impacts of climate change. The vulnerability may be due to weak institutional capacity, limited engagement in environmental and adaptation issues (Adams *et al.,* 1988).

Accordingly, there is need to gain as much information as possible and learn the position of indigenous farmers and their needs. In addition, it is imperative to understand what they know about climate change, causes and impact on the farmland areas around the world. Despite the devastating effects of climate change, some studies (Hatfield, *et al* 2014), asserted that farmers seem to misperceive either the existence or extent of climate change on their farmland. This may be due to the insidious nature of their pervasiveness. Hatfield, *et al,* (2014) concluded that over long term, farmers experience with pervasive hazard of climate change has led to psychological adjustment on the condition and knowing its effect on their agricultural products. Henceforth, a significant number of farmer's that response to climate change, is usually based on their short-term assessment.

Some Adaptation Strategies use

Adaptation could be effected at different scale, such as at individual or farmland level, at national and international level. Adaptation at farmland level involves two stages: Perceiving the change in climate, and deciding whether to adapt or not, or which adaptation strategy to choose (Maddison, 2007). It is in this view that the study was designed to assess the farmers' perception and the adaptation strategies used by the local indigenous farmers in Kankara Local Government Area of Katsina State, Nigeria.

Statement of the problem

Climate change impacts are felt on agricultural production, health, biodiversity, social and economic conditions, and affect people and the environment in general. It is predicted to worsen the incidence of drought and desertification and as a result millions of people would become refugees. The impacts of climate change are being felt by both developed and developing

countries, Nigeria and Kankara local government for example, more than two thirds of the country is thought to be prone to desertification (James, 2015). Moreover, the Sudano-Sahelian region of Nigeria has suffered a lot with decrease in rainfall in the range of 3-4 percent per decade since the beginning of the nineteenth century. This is observed in Kankara local government on which about 4 – 5 percentage rainfall reduction was observed. The concern on climate change is heightened given its linkage to the agricultural sector, drought, desertification and poverty as well as some associate insecurity that caused a serious dwindling economy.

In line with above many research were conducted to assess the impact of climate change on the farmland areas of Katsina state and Nigeria as a whole for example, Ibrahim and Abdullahi, 2022, El-ladan ,2017, Abaje, 2016, Lawal and Zayyana, 2018, Adedapo, et al, 2014. This study has advanced in assessing the farmers' perceptions on climate change and the adaptation strategies employed by the farmers in Kankara local government area of Katsina state. The **gap to fill** the identified gap are 'the impact of climate change in correlation with drought and desertification on the farmland areas of Kankara local government'. Most of the research dwells on climate change on agriculture or farmlands only, without linking with other factors like drought and desertification.

Aim and objectives of the study

The aim of this research work is to assess farmers' perception on climate change, causes and effects on drought and desertification on the farmland areas of Kankara local government, Katsina state, while the study objectives are to:

i. Assess how farmers' perceived climate change and its causes in the study area;
ii. determine the impact of climate change in the study area
iii. Examine farmers' adaptation strategies in the study area.
iv. Offer possible solutions to the problems associated to climate change in the study area

Justification / Significance

There is an urgent need for advocacy on climate change in order to enlighten people on the dynamics of climate change; this cannot be done effectively without any evidence. Research on climate change will therefore promote evidence-based advocacy. It is these facts that this research work has provided. However, due to the complex interactions between climate and environment, some important issues come in, like the issue of drought, desertification as well as general wellbeing of the people. Some the findings reveals that climate change is more harm to the environment especially the farmland areas, because is what inversely affect the food security. As such the Government Non-Governmental Organization (NGOs), policy makers, and international organizations never play with this area to achieve an international agenda on food security and house for all.

Scope and delimitation

This study focuses on climate change, causes, effect on the farmland areas of Kankara local government of Katsina state. The data collected for the study was restricted to some selected

wards, which include; Zangon Pauwa ward, Dan maidaki ward, Gatakawa ward, ketare and kurba wards, tsamiyar jino ward.

Climate Change

Climate change refers to any change in climate over time, weather due to natural variability or as a result of human activity (IPCC, 2007). The definition given by the UN Framed work convention on climate change (UNFCCC) refers to it as change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere which is in addition to natural climate variability observed over comparable time periods (UNFCCC, 2006).

Causes of Climate change

The pronounced causes of climate change in kankara local government are as follows: intensive cultivation, over grazing, deforestation as an alternative source of fuel wood use in the area. The silting of rivers and earth dams.

Effects of Climate change

The consequences of climate change on the farmland areas in Kankara local government cannot be over emphasize, because it engulf the areas of food reduction, reduction of rainfall, reduction of vegetation, increasing the level of water table, economic sector, political, social and security issues of the area are deteriorating and continuously deteriorating.

Adaptation strategies to climate change

Common adaptation methods used on the farmland/agricultural areas, it include the use of verities of method like to improve the livestock species that are more suited to drier condition, engage on the use of modern irrigation method, the use of improve seed and crop diversification, mixed cropping method, the use of livestock range land, and changing planting dates (IPCC, 2007). Agriculture in Africa is neglected, and climate change use the advantage of the government non-chalet attitude toward caution the serious menace of climate change to the farmland, environment, food security and economy at large. Adaptation is identified as one of the policy options to reduce this impact (Abaje, 2018). Adaptation to climate change is a two-step process, it initially requires the perception that climate change is real and is changing the farmland and agricultural product. This depends greatly on the adaptive capacity of an affected system, region, or community to cope with the impacts and risks of climate change (IPCC, 2001). Therefore, enhancement of adaptive capacity reduces vulnerability of any region, community or household and promotes sustainable development.

Climate change Mitigation

Climate change mitigation consists of actions to limit the magnitude or rate of long-term climate change impact. Climate change mitigation generally involves reductions in human (anthropogenic) sector, gas flaring/emissions, greenhouse gasses (GHGs). Mitigation may also be achieved by increasing the capacity of carbon sinks, e.g., through reforestation. Mitigation policies can substantially reduce the risks associated with human-induced global warming (IPCC,

2001). Examples of mitigation include reducing energy demand by increasing energy efficiency, phasing out fossil fuels by switching to low-carbon energy sources, and removing carbon dioxide from Earth's atmosphere.

Impact of climate change on agriculture

Climate change leads to reduction in soil fertility, change in the availability of feed and fodder, decreased livestock productivity, increased incidence of pest attacks and the manifestation of vectors borne diseases. Similarly, heat stress and drought are likely to have a negative impact on animal health, production of dairy products, meat and reproduction (SCBD, 2007). This in turn could have impact on food security leading to protein deficiency and malnutrition (SCBD, 2007). Changes in temperature, atmospheric carbon dioxide (CO_2), and the frequency and intensity of extreme weather could have significant impacts on crop yields.

In Africa food security constitutes a fundamental challenge for the general wellbeing of the people and economic growth. According to FAO statistics (2009), food price rose from 25 percent in 2015 to 75 percent in 2024 in the world agricultural market. The increase in the price of food is threatening food security of developing countries, Nigeria inclusive, where people spend about 80 percent to 90 percent of their budget on food, if not all. The main factor underlying the increase is decline in food stock, drought and floods linked to climate change (FAO, 2024). For any particular crop, the effect of increased temperature depends on the crop's optimal temperature for growth and reproduction. (Hatfield *et al,* 2014). In some areas, warming may benefit the types of crops that are typically planted there, or allow farmers to shift to crops that are currently grown in warmer areas. Conversely, if the higher temperature exceeds a crop's optimum temperature, yields will decline (Hatfield *et al*, 2014).

Study Area and Methodology

The Study area

kankara Local Government Area (Figure 1.1) is located in the south eastern part of Katsina State. It lies on latitude 12°2′11″N and 12°7′11″N and Longitude 7°19′4″E and 7°22′4″E. Kankara L.G.A is bordered to the north by Danmusa L.G.A, to the northwest by Tsafe L.G.A to the west by Faskari L.G.A, to the south by Bakori L.G.A and to the east by Malumfashi L.G.A in Katsina State. It covers a total land area of about 1,397/km². (Yakubu, 2014).

Climate: Kankara's climate is classified as tropical wet and dry type with average temperature of about 32.2 °C. Kankara lies within a region which has distinct wet and dry seasons. The average annual rainfall is 750 mm. Rainfall is between May – September, most of the precipitation falls in August, averaging 290mm (Yakubu, 2014).

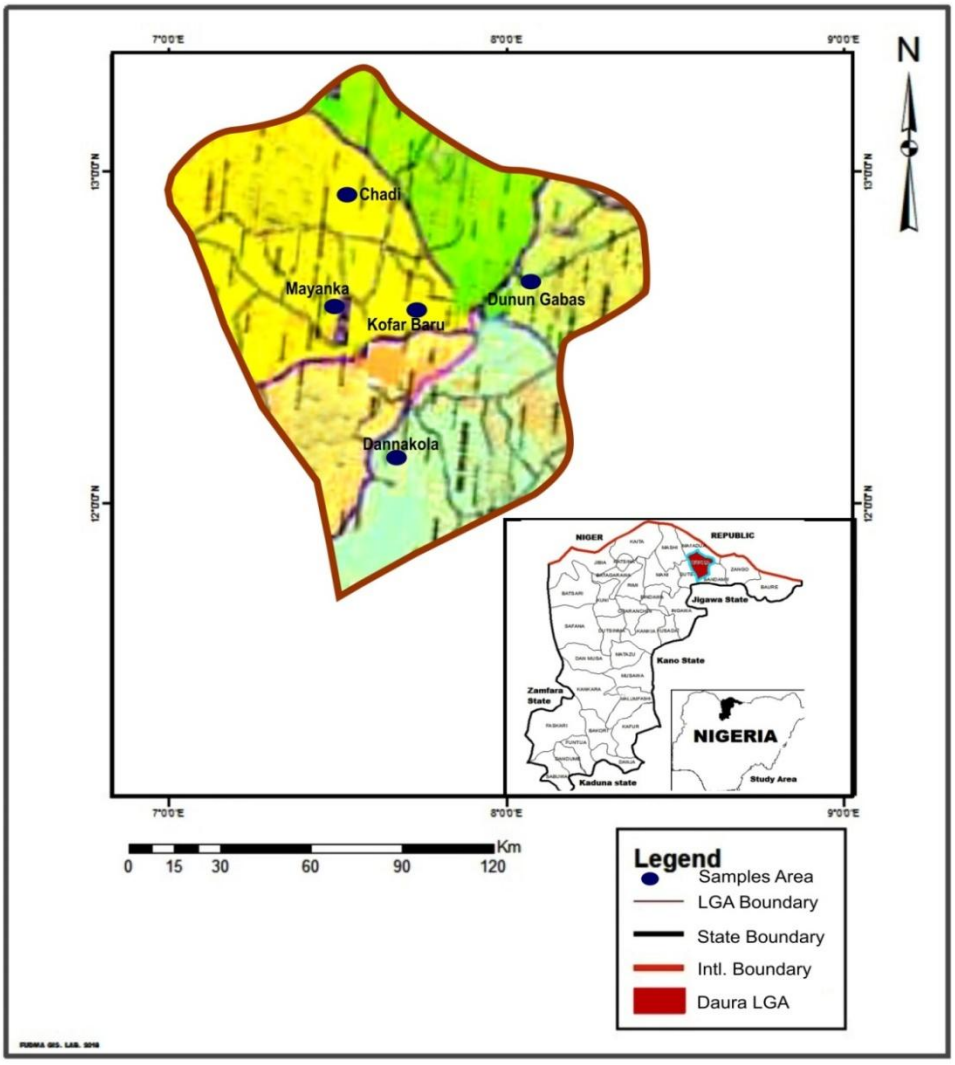

Figure 1: Map of the study area (Adopted from Yakubu, 2014)

Economic Activities: The economy is primarily based on agriculture. Farming and livestock rearing is the major economic activity in which much of the populace engage in farming. It is an important center for the marketing and processing of agricultural products.

Methodology of Data collection

The research use stratified random sampling techniques for more precise and accurate data collection. From the population size, random and stratified method is used to pick an un-bias number base on the proportionate number of males and females, old, youth and children; selected from each wards. Four wards were selected. The mode of selection was shown below;

S/No	WARDS	MALE	FEMALE	TOTAL	PERCENTAGE
1	Kankara (A and B)	15	10	25	31.3%
2	Danmai Daki Ward	12	8	20	25.0%
3	Dan Marabu Ward	10	5	15	18.7%
4	Hurya Ward	10	10	20	25.0%
	TOTAL	**47**	**33**	**80**	**100%**

Data Presentation and Analysis

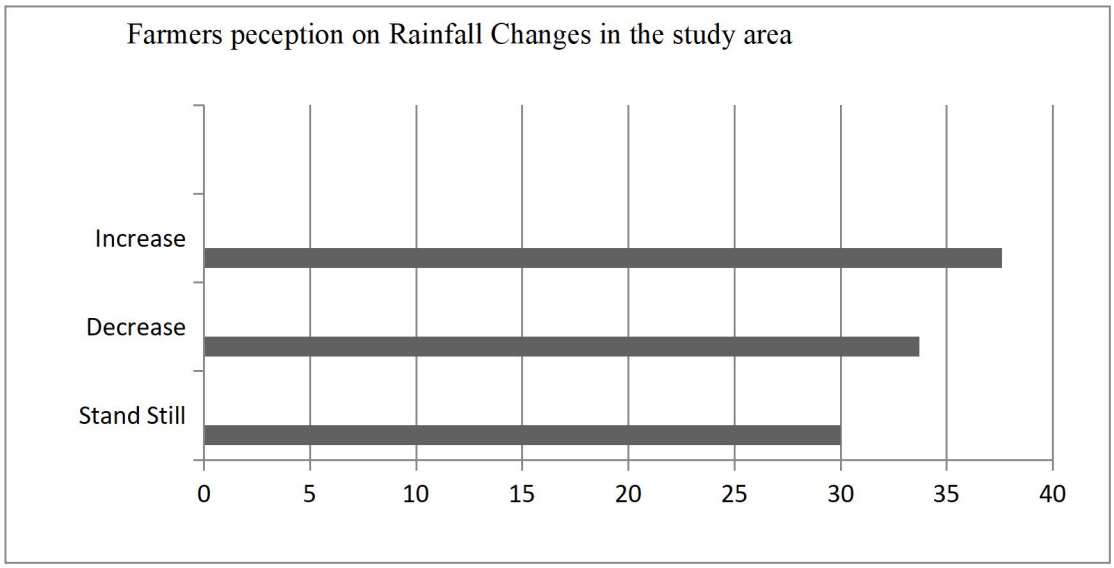

Figure 2: Farmers Perceptions on Rainfall Changes Source: field survey 2024

Based on the responses portrayed in Figure 2. above, there is a significant increase in the rainfall pattern at the study area. The results discovered is in line with the research work of Umar, (2016), Abaje et al (2016) and Usman, (2014) which revealed that the zone is experiencing wetter conditions in the recent years.

Table 1: Perception of farmers on Temperature Changes in the study area

S/N	RESPONSE	PERCENTAGE
1.	There is continuous increase in temperature	65.5%
2.	There is continuous decrease in temperature	30.8%
3.	Un-decided	3.7%
TOTAL		**100%**

Source: field survey 2024.

The highest response is on the view that temperatures continue to increase. This goes in line with Abaje (2016) where he find out that the global mean surface air temperature increases by 0.3°C to 0.6°c since the last 100 years, with the five average warmest years in the 21st Centuary. The increased in temperature according to the respondents is related to burning of fossils fuel, land use changes such as deforestation, overgrazing among others.

Table 2. Perception of farmers on Drought Occurrence in the study area

S/N	RESPONSE	PERCENTAGE
1.	Increased drought occurrences	8.9%
2.	Decreased drought occurrences	65.3%

3.	Un-decided	20.8%
TOTAL		**100%**

Source: field survey 2024

This table portrays that Majority of the respondents perceivedthat the drought occurrences is on the increase in the study area, and responses by the community dwellers is mostly as a result of irregularity in the onset or cessation of rainfall. This responds go in line with findings of Umar, (2016), which stated that there have been a decrease in theoccurrence of drought in the ecological zone.

Table 2: Farmers perceived causes of climate change

S/N	RESPONSE	PERCENTAGE
1.	Deforestation	65.3%
2.	Burning of Fossil Fuels	8.9%
3.	Green House Gas emission (GHG)	20.8%
TOTAL		**100%**

Source: Field Survey 2024

Table 2. above; shows the causes of climate change as perceived by the farmers in the study area, where deforestation appears to be the highest cause, a high proportion of the respondents believed that natural factors play a role in causing climate change while some attribute it to the release of harmful substances and combustion of fossil fuel. However, release of harmful gases to the atmosphere, combustion of fossil fuel and deforestation increases the concentration of greenhouse gasses in the atmosphere. These gases react with the ozone layer in the stratosphere tempering with the atmospheric chemistry and ultimately leading to ozone layer depletion. Ozone layer depletion is known to be as an agent of climate change, in which the end products are global warming and climate change. This response is in view with the findings of Ati, Abaje and Sawa (2014) that industrial pollution is one of the major causes of climate change.

Some of the respondents believed that bad actions of mankind (disobedience to God) triggers bad events that come as a punishment from God. This is in line with the belief of the farmers, that disobeying Gods' commandments causes draught, flood, vulcanicity and tsunami disasters and many more other environmental hazards.

Table 3: Impacts of Climate Change on the Farmland areas in Kankara and Food Security

Impact of Climate Change on Crops	Strongly agreed	Agreed	Disagreed	Strongly disagreed	Total
Rainfall is not supporting the crops	27%	50%	14%	9%	100%
Deforestation	36%	53%	5%	6%	100%
Decrease in crops yield output	31%	41%	17%	11%	100%
Increases of flood lead to destruction of	25%	73%	0%	2%	100%

farmlands					
Incidents of drought affect crop production	40%	48%	8%	4%	100%
Fluctuation in the cultivation periods	33%	34%	16%	17%	100%

Source: field survey 2024

The implication of climate change on crops production in the study area was represented in Table 3 above where majority of the respondents perceived that rainfall is no longer supporting the crops when compared to previous years and also with respects to crops infestation and disease as a result of climate change, some farmers perceived that flood has negative impacts in destructing farmland and crops production. It has been predicted by some researchers and climate expert such as IPCC that during the next decades billions of people, particularly those in developing countries, will face changes in rainfall pattern that will contribute to severe water shortages or flooding and rising or decline temperature that will cause shift in crop growing seasons. Increased intensity and frequency of storms, drought and flooding, altered hydrological circle and precipitation variance have implication for future food availability (food security) most especially in the developing world, which is already contending with chronic food problems.

Most of the respondents perceived that fluctuation in the cultivation period for example the onset and cessation of rainfall affected the cultivation periods of farms, it is no longer easy to predict the period of rainfall. 67% have less access to capital which makes it harder for them to adapt to climate change. The resource limitation and poor infrastructure have limited the ability of most rural farmers take up productions measures in response to change in climatic conditions. This finding goes in line with that of Usman, (2014), who observed that, since most smallholder farmers are operating under resources limitations, they fail to meet transaction costs necessary to acquire production measures and at times farmers cannot make beneficial use of the land and the available information they might have.

Multiple Adaptation Strategies

Table 4.below indicates that majority of the respondents employ **multiple adaptation strategies** in response to climate change altered planting schedule, crop diversification, integration of climate resilient crop varieties as adaptation strategies. use of improve water management by adopting water maximization that is practicing Irrigation/fadama farming, is practiced in a few areas because of inadequate water for irrigation, insufficient alluvial or fadama land and poor technical know-how.

Table 4: Adaptation Strategies in Response to Climate Change Employed by the Local Farmers in the Study Area

Adaptation employed by farmers in the area	High improvement	Improvement	Undecided	No improvement	Very Poor improvement	% Total
Altered planting schedule	44%	42%	3%	6%	5%	100%
Crop diversification	49%	43%	8%	0%	0%	100%
Integration of climate resilient crop varieties	53%	47%	0%	0%	0%	100%
Praying for God intervention	63%	23%	13%	0%	0%	100%
Attending enlightenment program on climate change	13%	49%	26%	6%	6%	100%
Improve water management	11%	34%	21%	12%	22%	100%
Use of resistant varieties of crops	39%	51%	7%	2%	1%	100%
Application of fertilizer/ animal dung of farm to improve crop yield	50%	45%	2%	2%	1%	100%

Source: Field survey, 2024

Some respondents adopt the use of fertilizer as climate change adaptation strategy to increase crop yields, Praying for God intervention is as the results of religious believe (the faith they have in God) and enlightenment programs. Adapting to climate change impact through the planting of improved seed varieties, i.e. resistant varieties and early maturity.

Barriers to Adaptation Strategies

Insufficient access to inputs, lack of access to credit, changes being expensive and in secure property rights are major barriers to the adaptation strategies in the study area.

Summary, Conclusion and Recommendations

Summary

The study is on farmers' perception on climate change and adaptation strategies, conducted in Kankara Local Government Area of Katsina State in order to examine how farmers perceived climate change and it impacts on crop production over time. Eighty number (80) questionnaires were administered and successfully retrieved. The data were analyzed using descriptive statistics. The results showed that majority of the respondents perceived that there is a significant increase

in rainfall pattern in the study area, and 65.5% revealed that there is increasing temperature, this perception of increasing temperature goes in line with Abaje (2016) where he find out that the global mean surface air temperature increases by 0.3°C to 0.6°c since the last 100 years, with the five average warmest years in the 21st century. The drought occurrences in the study area as responded by the community dwellers is mostly as a result of irregularity on the onset or cessation of rainfall. As results indicated about 70% of the respondents, were on the opinion that deforestation is the major cause of climate change in the study area, while other perceived causes of climate change include the release of harmful gasses, combustion of fossil fuel which all increases the concentration of greenhouse gasses in the atmosphere.Majority of the respondents hold the view that rainfall is no longer supporting crops when compared to some previous years, about77% of the respondents have that view. While, 89% owned the view that flood has negative impacts in destructing farmland and crops. Then, 88% opined that drought has some effects on crop production in the study area. However, most of the respondents 67% believed that Fluctuation in the cultivation period also contribute toward poor achievement on food security in the region.

Conclusion

Climate change is a reality which is expected to have significant impacts on Nigerian economy as a whole not only Kankara, whatever affects food security its directly affect the people economy and their general wellbeing. The frequency of extreme flooding, deforestation and droughts were the contributing factors in changing rainfall patterns. The study found that the farmers in the study area perceived some elements of climate change. Being severely dependent on natural water sources for agriculture. Hence, suitable adaptation measures to climate change used by local farmers include the use of fertilizers to increase crop yields., herbicides, mixed cropping, cultivating different varieties of crops as adaptation strategies, use of irrigation farming by adopting water maximization by practicing Irrigation known as *Fadama* farming, Praying for God intervention, etc. The results indicated that farmers need to adjust their management practices to ensure that, they make efficient use of the available rainfall and water resources for crop production and other needs. Barriers to adaptation strategies in the study area were identified as lack of credit facilities and information concerning climate change forecasting rationing of inputs and lack of improve seed as important constraints. Addressing these issues may significantly help the farmers to tailor their management practice to overcome the problems in the study area and achieve maximally on food security.

Recommendations

1. The State Agricultural Development Programs should strengthen ways in mitigating climate change,prior information should be given as part of extension package for dissemination knowledge among the farmers in the study area. This could increase farmers' level of awareness and knowledge of climate change issues and preferences for climate change adaptation and mitigation strategies in the study area.
2. Non-governmental organization (NGOs) should strengthen the capacity of rural dwellers through awareness campaign programs on climate change. This can be done

through radio and television programs, provision of newsletters booklets etc to rural farmers.

3. Major stake holders, financial institutions, government and non-governmental organization in the area should provide credit facilities to farmers in the study area.

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