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Farmers' Perception on Climate Change and Constraints on Rice Production in Kwara State

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Abstract

Climate change is a devastating phenomenon that affects food production. Thus, this study examined farmers' perceived effect of climate change on rice production in Kwara State, Nigeria: To determine farmers' perception and perceived effect of climate change, and identify the constraints faced by the respondents. The study used multistage sampling technique which involves four stages to elicit primary data through interview schedule. Both descriptive and inferential statistics were used to analyze data. The respondents experienced changes in rainfall pattern ($\overline{x}$=4.57), increased amount of rainfall ($\overline{x}$=3.73), higher incidence of flood ($\overline{x}$=3.60) and unstable temperature ($\overline{x}$=3.40). Respondents perceived effect of climate change on the germinating ($\overline{x}$=2.81), seedling ($\overline{x}$=2.72), vegetative ($\overline{x}$=3.02), flowering ($\overline{x}$=3.18) and grain-filling ($\overline{x}$=2.67) stages of rice production, and about 71% had over 20kg loss of rice as a result of climate change. Major constraints faced were high cost of inputs (35.8 %), inadequate finance (30.8 %), and land (17.5 %). Therefore, it was recommended that government policies should ensure that farmers have access to timely, affordable and adequate credit to increase their ability and flexibility to change production strategies in response to climate change, farming communities in the area should be assisted by both the government and non-governmental organizations in the provision of agricultural inputs. Similarly, adequate and timely information should be made available to farmers in order to keep them alert about the constant changes in climate.

Keywords: Climate Change, Farmers Perception and constraints; Rice Production

Introduction

Agricultural production is dependent on various factors such as genetic characteristics of crops, livestock, soils, and climate, among others (Danbaba, 2007). However, climate is regarded as the most important factor in crop production due to the sensitivity of diverse agricultural elements like; soil and water resources, crop, livestock and poultry productivity among others (Antle, 2010). Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It is a phenomenon that results from the emissions of greenhouse gases from combustion of fuels, deforestation, urbanization and industrialization which brought about variations in solar energy, temperature and precipitation (Upreti, 1999). It may be a change in average weather conditions or the distribution of events around that average.

Climate change may be limited to a specific region or may occur across the whole earth. Due to the fundamental role being played by agriculture in the welfare of humans, the Federal Ministry of Agriculture and Rural Development (FMARD, 2000) has expressed a deep concern regarding the potential effect of climate change on agricultural activities in Nigeria. It is considered as posing the greatest challenge to agriculture and food security in Nigeria due to the region's vulnerability to climate change with perceived low coping capacity (Shah, Fisher and Velthuizen, 2008). Some of the adverse effects f climate change in sub-Sahara Africa in which Nigeria belongs include increased environmental damages, destruction of household assets, increased infestation of crops by pests and diseases, increased rural-urban migration, increased bio-diversity losses, increased health risks and the spread of infectious diseases (Reilly, 1999; Abaje and Giwa, 2007).

Achieving sustainable food production in order to feed her citizenry is a major objective of any country that wants to boast of true independence, but its attainment has continued to be a mirage to most developing countries including Nigeria because of rapid changes of climatic variables. Hence the impact of climate change on agricultural production may add significantly to the challenges of ensuring food security and sustainable production (Peter, 2003).Research has shown that rice can be used to offset the major adverse effects of climate change because of its potentials and unique properties as a food crop for urban poor and rural rice farmers (Manneh, kiepe, Sie, Ndjiop, Drame, Troare, Rodenburg, and Futakuch, 2007).

To analyze the effects of climate change on Nigerian farmers, there is need to examine the level of farmers' perception of climate change, adaptation measures adopted and the constraints faced by rice farmers in the area. It is generally known that climate change is a devastating environmental threat facing mankind globally. It affects agriculture in many ways, including its direct impact on food production. Climate change, which is attributable to the natural climate cycle and human activities, has adversely affected agricultural productivity in Africa (Jagtap, 2007). Available evidence shows that climate change is a global phenomenon, likewise its impacts; but the most adverse effects will be felt mainly by developing countries, especially those in Africa, due to their low level of coping capabilities of which Nigeria is one (Nwafor, 2007). Due to the warming up of the planet, there exists a shift in rainfall patterns which in turn leads to the prevalence of extreme events such as droughts, floods, and forest fires. This results in poor and unpredictable yields, thereby making farmers more vulnerable, particularly in Africa (United Nations Framework Convention on Climate Change (UNFCCC, 2007).

It is projected that crop yield in Africa may fall by 20% by the year 2050 or even up to 50% due to climate change because African agriculture is predominantly rain-fed and hence basically dependent on the vagaries of weather. As the people of Africa struggle to overcome poverty and improve economic growth, this phenomenon threatens to intensify vulnerabilities, erode hard-won gains and seriously weaken prospects for development (Jones and Thornton, 2002). Farmers constitute the bulk of the poor in Africa and are always faced with prospects of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases. Hence, the need for combined efforts toward confronting this menace cannot be over-emphasized.

Increase in rice production, which is an important cereal and food crop in Nigeria is very crucial in meeting food demands and reducing poverty. However, the major problems associated with rice production in the country generally, and Kwara State in particular include drought, flooding, salt stress, loss of productivity of soils and extreme temperatures, all of which are expected to worsen with climate change. According to National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN, 2011), over fifteen communities and farm plantations (especially, rice farmlands) in Shonga district, Edu Local Government Area (LGA) of Kwara State were submerged by flood. This resulted in a colossal loss, worth millions of naira. Drastic changes in rainfall patterns and rise in temperatures will introduce unfavourable growing conditions into the cropping calendars thereby modifying growing seasons which could subsequently reduce rice productivity (Manneh *et al.*, 2007). The aim of this study is to examine the perceived effects of climate change on rice production in Kwara State of Nigeria. The objectives are to: determine rice farmers' perception of climate change in the study area; ascertain rice farmers' perceived effect of climate change on rice production in the study area; identify the constraints faced by the respondents in the study area.

The negative effects of climate change in Nigeria can be seen through extreme temperatures, frequent flooding, droughts and increased salinity of water supply used for irrigating rice farmlands (Mendelson and Dinar, 2003). Most of the worldwide extrapolated results focus its empirical work on highly industrialized and developed nations rather than the developing countries that are at a greater risk with high vulnerability in the face of changing climate of which Nigeria is one (Mendelson, Dinar and Dalfelt, 2000). This study is expected to add to the existing knowledge using Kwara State as a case study. Much of climate

change agricultural research has tended to focus on assessing the sensitivity of various attributes of crop systems (e.g. crop/livestock yields, pest, diseases, weeds, etc) – the biophysical aspects of food production, with little or no attention to the socioeconomic aspects.

The study suggested ways of improving adaptation measures at the farm level and provided useful first-hand information for increased agricultural productivity without a corresponding increment in the available farmland. The knowledge acquired will be necessary to support decision-makers who need it most for policy making on climate change and planning in the formulation of preventive measures that could ameliorate the adverse effects of weather conditions on agricultural productivity. It will also ensure that the rural poor and the vulnerable people that are agriculture-dependent are appropriately targeted by the three tiers of government (Federal, State and Local) in research and development activities. Furthermore, this study will help other researchers that are interested in bridging the knowledge gap on the effects of climate change on crop production generally, and rice production in particular.

Methodology

Study Area

The study was conducted in Kwara State of Nigeria. The State is located within latitudes 7^0 45'N to $9^0$30' N and longitudes $2^0$30' E to 6^0 25'E. It occupies a total land mass of 36,825 square kilometres, and shares boundary with Niger State in the North, Kogi State in the East, Oyo, Osun and Ekiti States in the South, and an international boundary with the Republic of Benin in the West. It is located in the southern guinea savannah of Nigeria (Jimoh, 2003). The state has a total population of 2,591,555 (National Population Commission, 2006). The main source of the economy is agriculture. More than 90 percent of the rural communities which forms the bulk of the State's total population is engaged in farming. Gold, clay, limestone, kaolin, marble and granite rocks are some of the mineral resources that are obtainable in the State (Jimoh, 2003). The climatic condition of Kwara State is characterized by both wet and dry seasons that lasted for about six months each. Raining season usually starts towards April ending till October with an annual rainfall of between 1000 and 1500mm, while the dry season occurs between November and early April. There are hot days during the dry season with the average temperature from November to January ranging between 33^0C to 34^0C, while from February to April; it falls within the range of 34.6^0C to 37^0C.

The state has sixteen Local Government Areas (LGAs) which are divided into four agricultural zones by the Kwara State Agricultural Development Project (KWADP; 2004) for effective administrative convenience. The zones are Zone A (Baruteen and Kaima LGAs), Zone B (Edu and Patigi LGAs), Zone C (Asa, Ilorin East, Ilorin South, Ilorin West and Moro LGAs) and Zone D (Ekiti, Ifelodun, Irepodun, Offa, Oyun, Isin and Oke-Ero LGAs).

Sampling Techniques and Sample Size

A multistage sampling technique was adopted in the study area. The first stage involved a purposive sampling of Zone B due to their preponderance of rice production in accordance with the information obtained from KWADP, while the second stage comprised of a random sampling of two districts from the three districts in each of the two LGAs. The random selection of two (2) communities from each selected district was the third stage making a total number of eight (8) communities from the zone. The fourth stage involved the proportionate selection of rice farmers (50%) randomly from each rice farming community to give a total number of one hundred and twenty (134) respondents.

Methods of Data Collection

Data was collected through the use of well-structured interview schedule to elicit necessary information from the respondents. The interview schedule had 2 sections. Section A focused on both the farmers' perception and their perceived effect of climate change on rice production. A five point likert scale was adopted to determine the respondents' perception of climate change, while a four point likert scale was used to determine their perceived effect of climate change on rice production, while section (B) was used to gather information on the constraints faced by the respondents.

Methods of Data Analysis

Both descriptive and inferential statistics were used to analyze the data. Descriptive statistics such as frequency counts, mean, percentages and ranking were used to achieve objectives 3, while a five point likert scale was used to achieve objectives 1 of the study. The parameters for the likert scale were coded as 5 (Strongly agree/Very effective), 4 (Agree/Effective), 3 (Undecided), 2 (Disagree/Least effective) and 1 (Strongly Disagree/Not effective). A mean cut-off value of 3.0 was used as the decision point. Similarly, a four point likert scale was used to achieve objective 2. It was coded as 1 (Adversely affected), 2 (Moderately affected), 3 (Slightly affected) and 4 (Not affected). A mean cut-off value of 2.5 was used as the decision point.

Results and Discussion

Table 1 revealed respondents perceived that rainfall pattern has changed ($\overline{x}$=4.57) and there is an increased amount of rainfall ($\overline{x}$=3.73). This implies that rice production can be adversely affected as it could lead to flooding which can submerge the crop causing destruction of rice fields. On the other hand, it could also affect the availability of water, thereby causing drought which can decrease rice yield. WARDA (2005) reported that Africa is vulnerable to flooding and this challenge is progressively becoming more severe with climatic changes.

The result also revealed a perceived higher incidence of flood ($\overline{x}$=3.60) and unstable temperature ($\overline{x}$=3.40) in the area. This shows that the respondents have witnessed flooding and temperature fluctuations as a result of climate change Flood destroys crops and causes low output, leading to poor yield, hunger and poverty. Rice is sensitive to temperature fluctuations, especially during its flowering stage which is one of the developmental stages. It is highly sensitive to extreme temperatures and this leads to spikelet sterility during the period of intense cold or hot weather condition (Osiname, 2003).

The result further revealed that the respondents perceived increased sunshine intensity ($\overline{x}$=3.38), unusual timing of onset and cessation of rain/harmattan ($\overline{x}$=3.33), late appearance of harmattan ($\overline{x}$=3.17), prolonged drought ($\overline{x}$=3.15) and wide fluctuation in the duration of harmattan ($\overline{x}$=3.14). Drought, which can specifically destroy rice production, is common in Africa because of the presence of about 50% dry land. Among the diverse types of rice production systems, both rainfed upland and lowland systems of rice production which make up the bulk of rice production in Nigeria are more susceptible to drought (Osiname, 2002). Irrigated system of rice production with a poor water management can also be distressed by drought as rice is specifically vulnerable to drought. Rice yield can be affected by both the timing and severity of drought. Early season drought delays germination, seedling and early vegetative stages of rice while late season drought hinders the later developmental phases such as flowering and grain filling (Ekemhonye, 2013).

Table 1: Distribution according to the perception of climate change

Perception statement on climate change	Weighted sum	Mean Score($\overline{x}$=)	Decision
Rainfall pattern has changed in the area	548	4.57	Agreed
Rainfall amount is on increase	447	3.73	Agreed
Temperature is not stable in the area	408	3.40	Agreed
There is a prolong drought in the area	378	3.15	Agreed
There is higher incidence of flood	432	3.60	Agreed
Late appearance of harmattan	380	3.17	Agreed
Duration of harmattan has changed	377	3.14	Agreed
Period of dry season has increased	336	2.80	Disagreed
Sunshine intensity has increased	406	3.38	Agreed
Incessant and elongated non-stop rainfall	351	2.93	Disagreed
Dusty and cloudy atmosphere	354	2.95	Disagreed
Unusual timing of rains/harmattan	399	3.33	Agreed

Source: Field Survey 2015; *Cut-off mean = ($\overline{x}$=3.00)

Farmers' Perceived Impact of Environmental Alteration on Rice Creation

The result in Table 2 revealed that respondents perceived that environmental alteration had effect on the germinating stage ($\overline{x}$= 2.81) and seedling stage ($\overline{x}$= 2.72) of rice production. Also, the effect of climate change was perceived by the respondents on the vegetative stage ($\overline{x}$= 3.02), flowering stage ($\overline{x}$= 3.18) and grain-filling stage ($\overline{x}$= 2.67) of rice production. However, the respondents did not perceive any impact of environmental alteration on both the harvesting ($\overline{x}$= 2.31) and processing ($\overline{x}$= 2.04) stages of rice production. This implies that the consequence of environmental alteration is detrimental to rice production while on the field resulting in decrease in rice yield which will translate to low income, poor standard of living, starvation, poverty, high price of rice for consumers and lack of food security for the nation. Majority (71%) of the respondents had experienced more than 20Kg loss in rice output due to environmental change. This decrease in productivity is in agreement with the findings of Alam, Siwar, Molla, Torima and Talib (2010); Nwalieji and Uzuegbunam (2012).

Table 2: Perceived effect of climate change on rice production

Variable	**Mean ($\overline{x}$)**	**Decision**
Germinating stage	2.81	Seen impact
Seedling stage	2.72	Seen impact
Vegetative stage	3.02	Seen impact
Flowering stage	3.18	Seen impact
Grain-filling stage	2.67	Seen impact
Harvesting stage	2.31	Unseen impact
Processing stage	2.04	Unseen impact
Rice loss due to climate change (Kg)	**Frequency**	**Percentage**
1-20	35	29.17
21-40	60	50.00
41-60	17	14.16
61-80	5	4.17
81-100	3	2.50
Total	**120**	**100**

Constraints faced by the respondents

The result in Table 3 revealed that high cost of inputs (fertilizer, agrochemicals and seed) ranked first (36%) as a challenge to rice production as indicted by the respondents. Like other countries in Sub-Sahara Africa, low fertilizer use is a serious constraint to agricultural productivity in Nigeria (Africa Fertilizer Summit, 2006). This results into unavailability of sufficient inorganic manure which could result to poor rice yield by rice farmers. Kukoyi (2005) observed that from the early 2000s, there has been no domestic production of fertilizer. As a result of this, farmers depend on imported fertilizers which are cost-intensive. This among others made the price of inputs unbearable to rice farmers.

Inadequate finance ranked second (31%) in the cultivation of rice in the area. Finance is considered a major factor of production as it is used in the purchase of some inputs such as seeds, fertilizer, and hired labour. This finding conforms with Yurkushi (2015) who reported that inadequate finance stemmed from the absence of collateral to obtain required credit from financial institutions. Land inadequacy ranked third (18%) as indicated by the respondents. This can be connected with the tenure system practiced in the area which causes land to be fragmented among family members from generation to generation. Consequently, it has been reported that communal ownership of land in Nigeria is linked with such problems as limited tenure security, limitations on farmers' mobility, and the inevitable breaking up of holdings among future generations

(Onyebinama, 2004). Other constraints faced by the respondents include high cost of labour, poor transportation system, inadequate irrigation and inadequate information. This implies that these factors are also responsible for the low production of rice recorded that translated into food insecurity and poor standard of living.

Table 3: Distribution of respondents according to constraints faced

Constraints	Frequency	Percentage	Ranking
High input cost	43	35.83	1st
Inadequate finance	37	30.83	2nd
Land inadequacy	21	17.50	3rd
High Labour cost	6	5.00	4th
Poor transportation system	5	4.18	5th
Inadequate irrigation	4	3.33	6th
Inadequate information	4	3.33	7th
Total	120	100	

Source: Field Survey 2015

This research was conducted to examine the perceived effects of climate change on rice production in Kwara State of Nigeria. A multistage sampling technique was adopted for the study. Primary data were collected through the use of structured interview schedule to elicit necessary information from the respondents. Both descriptive and inferential statistics as well as likert-scale rating were used to analyze the data.

Respondents' perceived changes in climatic factors such as change in rainfall pattern ($\overline{x}$=4.57), increased rainfall amount ($\overline{x}$=3.73), higher incidence of flood ($\overline{x}$=3.60), unstable temperature ($\overline{x}$=3.40), and increased sunshine intensity ($\overline{x}$=3.38). Unusual timing of onset and cessation of rains/harmattan, late appearance of harmattan, prolonged drought, and change in harmattan duration were also noticed by the respondents. The respondents' perceived effect of climate change on the germination ($\overline{x}$=2.81), seedling ($\overline{x}$=2.72), vegetative ($\overline{x}$=3.02), flowering ($\overline{x}$=2.67) and grain-filling ($\overline{x}$=2.04) stages of rice production, and about 71% of them had experienced more than 20Kg loss of rice due to climate change.

The major constraints faced by the respondents were high cost of inputs (35.8%), inadequate finance (30.8%) and land (17.5%). Others are high labour cost (5.0%), poor transportation system (4.2%), inadequate irrigation (3.33%) and inadequate information (3.33%).

Conclusion

The study revealed that change in climate results change in rainfall pattern which causes increase in the amount of rainfall and can cause drought in some places. These changes can bring about flooding in some places and low yield where there is drought. It was also found that change in climate affects all the stages of rice production, that is from seed germination seedling stage, flowering stage to grain-filling stage. The highly ranked constraints faced by the respondents in adopting adaptation strategies were high cost of inputs (fertilizer, agrochemicals and seed), inadequate finance, and land.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Extension agencies should be more active in creating necessary awareness about the phenomenon of climatic variables like rainfall, sunshine, flooding and temperatures in order to facilitate the adoption of effective adaptation strategies.
2. Farmers should be trained on how to adapt to changes in climate in order to reduce loses that may likely occur to flooding or drought.

3. Government provide subsidised inputs to farmers in order to boost production.

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