Perception of farmers on variation of climate change and its effects on crop production in Niger State, Nigeria

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ABSTRACT
Learning from the perception of farmers, by investigating first what the local people know about climate change and its effects on production can improve understanding of local conditions and provide context for activities designed to help the communities. It is against this back drop, the study was conducted to assess perception of farmers on variation of climate change and its effects on crop production in Niger State, Nigeria. One hundred and twenty five (125) crop farmers were interviewed to elicit relevant information in line with the objectives of the study. Descriptive statistics and inferential statistical tools were used for data analysis. Findings revealed that majority (74%) of the respondents are aware of climate change and majority (74.4%, 70.4%, 66.4%, 61.1% and 60.8%) of the respondents indicated that effect of climate change has negatively resulted to late rainfall, affected soil nutrient, increase incidences of drought, decreased crop yield and less rainfall. The result from the study also revealed that all (100%) the respondents have adapted mixed cropping system of farming as coping strategy to increase yield, reduce risk of crop failure and increase food availability at home, the study further revealed that majority of farmers have positive perception towards effects of climate change on crop production. Inferential statistic analysis shows that there is a significant relationship between respondents' socio – economic characteristics and perception of farmers on effects of climate change on crop production; it is recommended that effective capacity building should be put in place to strengthen the most vulnerable group in agricultural production with the required knowledge and information necessary for climate change mitigation and adaptation; and Farmers should also have regular information on current issues related to climate change and agriculture.

Key words: Climate, Farmers, crop production, Perception, adaptation strategies.

INTRODUCTION

Climate change effects on agriculture are being witnessed all over the world and models generally predict that rising temperatures, increased climate variability and extreme weather events could significantly affect food production in the coming decades (ICAR, 2010). Available evidence shows that climate change is global, likewise its effects; but the most adverse effects will be felt mainly by developing countries, especially those in Africa, due to their low level of coping capabilities (Nwafor 2007; Jagtap 2007). Farmers in Africa become vulnerable to crop failure due

to effects of global warming which causes shift of rainfall patterns and events of droughts which lead to poor and unpredictable yields (UNFCCC, 2007). FAO (2007) reported that up to 11% of arable land could be highly affected by climate change in the developing world. There will be a reduction of cereal production in 65 countries and retardation of about 16% of agricultural GDP. A decrease of up to 30% in world food production due to effects of climate change on agriculture is generally predicted (IPCC, 2007).

Nigeria is currently experiencing increase incidence of disease, declining agricultural productivity, increasing number of heat waves, reliable or erratic weather patterns, flooding, declining rainfall in already desert prone areas in the north, causing increasing desertification (Ikeme, 2009). Similarly, the savannah areas of northern Nigeria were projected to experience less rainfall, with temperature increases, reduces soil moisture availability; changes in climate are severely affecting agricultural production in many Africa countries (United Nation Environmental Programme (UNEP), 2007). Increased temperature and accompanying decrease in water availability reduce length of growing seasons and yield potential and hence the area suitable for agriculture, further adversely affecting food security over the continent (Thornton et al., 2006).

It is estimated that by the year 2100, Nigeria and other West African countries are likely to have agricultural losses of up to 4% of GDP due to climate change (Mendelsohn and Dalfelt, 2000). Part of the country that experienced soil erosion and operate rain-fed agriculture could have decline in agricultural yield of up to 50% between 2000-2020 due to increasing effects of climate change (Agoumi, 2003; IPCC, 2007). In response to higher temperature and as adaptation strategies, farmers have resorted to using heat tolerant crop varieties (drought resistant), crop varieties with high water use efficiently, early maturing crop varieties and increased crop livestock farming (mixed farming) (Benhim, 2006).

Due to the continuous climate change, a lot of alterations have occurred in the weather, such as irregularities in the commencement of rainfall, less rainfall, more sunshine, increased temperature, with decreased water availability, thereby reducing the length of growing seasons and yield potentials of crop as well as suitable areas for agriculture. Climate change resulted to variation of climate and other elements of weather thereby hindering and delaying farming activities which poses a lot of threats to agriculture, the only sector of the economy that bears the burdens of food production and the source of livelihood for the rural populace. According to Mark *et al*., (2008), some of the elements of direct effects of climate change on agricultural system include: (a) seasonal changes in rainfall and temperature, which could have effects on agro-climatic conditions, thereby altering growing seasons, planting and harvesting calendars, water availability, pest, weed and disease populations; (b) alteration in evapotranspiration, photosynthesis and biomass production; and (c) alteration in land suitability for agricultural production.

Climate change will affect all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. It will have an effects on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows (Howard, 2011). This research work attempts to contribute to existing research efforts on climate

change and seeks to know the level of awareness and perception of rural farmers in the study area towards effects of climate change on crop production and the strategies for adaptation because there is strong need to strengthen the resilience of rural people to help them cope with this additional threat to agricultural production. Learning from the perception of farmers, by investigating first what the local people know about climate change and its effects on production can improve understanding of local conditions and provide context for activities designed to help the communities. Considering the above, in order to assess perception of farmers on variation of climate change and its effects on crop production in Niger State, the research objectives for the study include: determining the level of awareness of farmers on climate change, identifying the climatic variation observed by the farmers, determining farmers' perception towards effects of climate on crop production and identifying the coping strategies adapted by farmers on the effects of climate change on crop production in the study area.

Methodology

The study area is Niger State, Nigeria. The state is located in the Southern Guinea Savannah ecological region of Nigeria and falls within latitude $8^{o} - 10^{o}$ and longitude $3^{o} - 8^{o}$ East of the equator with an average temperature of $37^{o}C$. The state has two distinct seasons in a year (rainy and dry seasons), the rainfall usually commence in May and last up to November with annual range of 1100mm in the North to 1600mm in the South with the peak in August, farming is the primary occupation of 85% of its population (Niger State Agricultural Development Project, 2002); and it has a population of 3,950,249 people (N.P.C., 2006).

For this study multi- stage random sampling technique was used, the first stage involves random selection of 5 local government areas from the state; the second stage involves the selection of 25 respondents from each of the selected local government area. Interview schedule was used to elicit information from the respondents to achieve the study objectives while descriptive statistics (frequency, percentages, means and standard deviation) and 4 point likert scale with values of strongly agree = 4; agree = 3; disagree = 2; and strongly disagree = 1 were used to determine the perception of respondents towards effects of climate change on crop production. A mean score of ≥ 2.5 depicts a favourable statement with regard to the perception of farmers towards effects of climate change on crop production while a mean score $<$ 2.5 implies unfavourable perception. Lastly, correlation matrix was used to test the relationship of the perception of the farmers with their socio – economic characteristics.

Results and discussion

Age is an important factor among the socio – economic characteristics of every activity in agricultural production. It determines the effectiveness and competence of labour availability for production. As revealed in Table 1, more than one third (37.6%) of the respondents are in their active age of 31 – 40 years, hence they have the ability to supply the required labour needed in the production process. On the educational level of the respondents which directly influence the farmers' ability to adequately keep record and make observation on the influence of effects of climate change on

crop production pattern, the table shows that only 36% and 12.8% of the respondents have secondary and tertiary education respectively, while 12.0% of the respondents did not have any formal education. This is to say farmers with good educational background are most likely to have better ability to keep records and make observation on effects of climate change on their farms than the illiterates. The Table also depicts that 31.2 % and 37.6% of the respondents have years of farming experience of between11 – 20 and 21 – 30 years respectively, hence, majority of them have good years of farming experience and this may influence their level of performance and observation on variation on climatic elements and its effects on crop production.

Table 1: Socio – economic Characteristics of Respondents in the Study Area (N =125)

Age (years)	Frequency	Percentage
Below 31	33	26.40
31-40	47	37.60
>41	45	36.00
Total	125	100
Educational level		
No formal education	15	12.00
Ault education	20	16.00
Primary education	29	23.20
Secondary education	45	36.00
Tertiary education	16	12.60
Total	125	100
Years of Farming Experience		
Below 10	28	22.40
11-20	39	31.20
21-30	47	37.60
Above 30	11	8.80
Total	125	100

Source: Field survey, 2013.

From the result presented in Table 2 above it can be inferred that majority (74.40%) of the respondents were aware of climate change in the study area. this implies that the majority of the crop farmers in the study area have noticed variation in climatic elements and are likely to observe how it will affect crop production. Data presented in Table 2 also indicated that majority (74.40%) of respondents observed that climate change has lead to late rainfall, 70.40% of the respondents observed that climate change has negatively affected soil nutrient, and 66.40% observed that climate change has resulted to incidence of drought and increase in sunshine hours respectively. Similarly, majority (61.10%) of the respondents told that effects of climate change has

decreased crop yield, 60.8% of the respondents perceived that effects of climate change has resulted to less rainfall. Whereas (59.2%) of the respondents reported incidence of increased temperature as a result of climate change, this finding is similar to the report of Mark et al., (2008). Effects of climate changes results to seasonal changes in rainfall and temperature, which could have effects on agro-climatic conditions, thereby altering growing seasons, planting and harvesting calendars, water availability, pest, weed and disease populations and alteration in land suitability for agricultural production.

Table 2: Distribution of respondents' level of awareness of climate change and observe variation of climatic elements (n=125)

Level of Awareness	**Frequency**	**Percentage**
No	32	25.60
Yes	93	74.40
Total	**125**	**100**
Observed Variation in Climatic Elements	**Frequency***	**Percentage**
Late rainfall	93	74.40
Less rainfall	76	60.80
Increased rainfall	50	40.00
Increased temperature	74	59.20
Incidence of drought	83	66.40
Fluctuation in rainfall pattern	34	27.20
Increased in crop yield	53	42.40
Decreased in crop yield	77	61.10
Increase in sunshine hours	83	66.4
Decreases in soil nutrient	88	70.40

*Multiple responses recorded

Source: Field Survey, 2013.

Over centuries, farmers have traditionally adapted to climatic changes by building on their in-depth knowledge of the environment in which they live. Farmers' own perception and local traditional knowledge help them in evolving measures and technique to deal with situations arising due to climatic vagaries. These measures and techniques are locale specific, require no external help and are inherently scientific. Documentation of such practices and techniques, farmer to farmer dissemination and sharing of such innovative approaches at large platforms have helped in influencing research agenda of academic institutions and setting the priorities (Singh *et al.*, 2012). A number of questions were asked to assess the strategies adapted by the crop farmers to cope with the effects of climate change. The respondents reported a diversity of coping strategies that included both modern and traditional methods.

From the results presented on Table 3, it can be inferred that all (100%) the respondents have adapted mixed cropping system of farming to increase yield, reduce risk of crop failure and increase food availability at home. In response to effects of

climate change, farmers have resorted to using crop varieties that are drought resistant, high water use efficiency and early maturity (Benhim, 2006). Majority (76%) of the respondents indicated increase use of fertilizer and change of farm sites respectively. In addition, majority (69.6%) of the respondents change their planting dates and increase in the use of irrigation to supplement rain fall and also to reduce the risk of crop failure as a result of drought incidence or other climatic hazards. The Table also revealed that more than half (64%) of the respondents reported use of different varieties of crop for planting that are less draught resistant, early maturing, pest resistant and well adapted for water logging area. From the Table 64.80% of the respondents' adapted application of mulching on their farm land respectively as coping strategies to reduce the effects of climate change on crop production, mulching is applied to reduce erosion and runoff on their farmlands. About two third (58.4%) of the respondents switch to other sources of income as their coping strategy on effects of climate change to diversify their sources of income and guard against any unpredicted negative consequences of climate change; while 56% of them also indicated planting of trees around their farms as coping strategy to which serve as wind break to check wind erosion and lodging of crops on their farmlands, however, only about one third (33.60%) of the respondents adapted the use of zero tillage on their farms to improve the organic matter status of their fields.

Table 3: Distribution of respondents according to adaptation strategies used to mitigate the effects of climate change in the study area (n=125)

Adaptation strategies	Frequency*	Percentage
Change of planting dates	87	69.60
Planting of trees	70	56.00
Use of different varieties of crops	80	64.00
Increased use of fertilizer on farmland	95	76.00
Application of mulching on the soil	81	64.80
Increase in the use of irrigation	87	69.60
Use of zero tillage farm operation	42	33.60
Adoption of mixed cropping system	125	100
Switch to other sources of income	73	58.40
Change of farm site	95	76.00

*Multiple responses

Source: Field Survey, 2013.

Table 4 shows the distribution of the mean scores and standard deviation of the farmers' perception towards effects of climate change on crop production in the study area. The data shows that the farmers expressed positive perception towards seven out of nine statements bordering on effects of climate on crop production. Specifically, the following positive statements elicited favourable perception from the farmers: Climatic changes have resulted to less rainfall (mean= 3.26), climate change have resulted to high temperature (mean = 2.69), climate change has led to late harvest of crops (mean = 2.97), climate change have caused reduction in crop yield (2.97), climate change causes increase in drought period (2.94), Climate change has led to

late harvest of crops (2.97), climate change have led to depletion of soil nutrient (2.98). This finding shows that majority of farmers have favourable perception towards effects of climate change on crop production.

Table 4: Perception of farmers on the effects of climate change on crop Production

S/N	ITEMS	MEAN	REMARKS
1	Climate change has caused reduction in crop production	2.79	Favourable
2	Climate change is causing increase in incident of pest	2.40	Unfavourable
3	Climate change cause increase in drought period	2.94	Favourable
4	Climate change has increased incidence of crop failure	2.59	Favourable
5	Climatic changes has resulted to less rainfall	3.26	Favourable
6	Climate change has led to Fluctuation in rainfall pattern	2.29	Unfavourable
7	Climate change has resulted to high temperature	2.69	Favourable
8	Climate change has led to late harvest of crops	2.97	Favourable
9	Climate change has led to depletion of soil nutrient	2.98	Favourable

Source: Field Survey, 2013.

Conclusion and Recommendations

The study revealed that majority of the respondents are aware of climate change and hence, most likely to make observation on how its effects likely affect crop production pattern. From the result, it can also be inferred that climate change has a negative effects on availability of rainfall, affected soil nutrient, resulted to incidence of drought, increase sunshine hours, decreased crop yield, less rainfall and increased temperature. The result from the study also revealed that all the respondents have adapted mixed cropping system of farming as coping strategy to increase yield, reduce risk of crop failure and increase food availability at home. The study further revealed that majority of farmers has shown favourable perception towards effects of climate change on crop production. Hence, majority of farmers in the study area are aware of effects of climate change on crop production. Effective capacity building should be put in place to strengthen the most vulnerable group in agricultural production with the required knowledge and information necessary for climate change mitigation and adaptation. Farmers should also have regular information on current issues related to climate change and agriculture. The roles and capacity of extension system should also be strengthened in order to accommodate the new dimension brought about by effects of climate change on agriculture.

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