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Crop Farmers' Perception of and Adaptation to Climate Change in Orlu Agricultural Zone of Imo State, Nigeria

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Abstract

Food insecurity is a big challenge which Nigeria is currently battling with. This is compounded by the negative effects of climate change on agricultural production, and by extension, rural development. This work was therefore designed to ascertain crop farmers' perception of, and adaptation to climate change in Orlu agricultural zone of Imo State. The objectives of the study were to: assess farmers' level of awareness of elements of climate change, ascertain the extent farmers perceived climate change in the zone, find out the various effects of climate change in the area as perceived by the farmers, and ascertain the adjustment strategies adopted by the farmers. Data were collected from one hundred and twenty (120) crop farmers randomly selected from the zone, using interview schedule. Percentage, means, frequency distribution as well as multiple regression model were used to analyze the data. Most of the farmers (98.33%) experienced climate change in the area and that changes in rainfall pattern were most prominent. Farmers perceived reduced crop yield, drought and increased flooding, among others, as the greatest adverse effects of climate change. Some of the strategies adopted to combat the adverse effects included; adjustment in planting period, use of improved crop varieties, adoption of improved farming methods, among others. Age, farming experience, educational level and membership of social organizations were significant factors that influenced farmers' perception of climate change in the area. Some of the recommendations include; extension agents should advice farmers to adopt early planting and harvesting before adverse climate conditions get to their peak, government and non-governmental organizations should assist farmers with irrigation facilities so that they will not be solely dependent on rain fed agriculture, among others.

Introduction

Climate change refers to all changes in climate that has been persistent over time, be it as a result of human activities or natural variations. Ozor (2009) defines climate change as any significant change in climate over time, whether due to natural variability or as a result of human activity and is widely recognized as the most serious environmental threat facing our planet today. Such significant change, according to Wiggins and Wiggins (2006), may include any or all of the following, among others: unpredictable rainfall; rising temperatures and drought; increased likelihood of hazards such as floods, landslides and severe cycloids which may result in hurricanes and typhoons.

Agricultural production depends on weather and climate. Climate change can therefore, adversely affect agriculture in many ways. It brings about change in weather pattern that can cause serious repercussions by upsetting seasonal cycles, harming the ecosystem and water supply, causing food shortages, landslide, drought and incidence of pests and diseases. Early estimates suggest 4 – 24% losses in production in the developed countries, and 14 – 16% losses in developing countries (IPCC, 1996). Climate change is a global challenge and issue of great concern in almost all continents of the world today. It has been anticipated that climate change will affect agriculture in many ways, both direct and indirect. Part of the direct effect will induce low income to farmers, unemployment and lack of interest in agriculture by the youth (Battish, et al., 2007).

Eboh (2009) notes that countries in sub-Saharan Africa, including Nigeria, are likely to suffer the most because of their greater reliance on climate-sensitive renewable natural resources sectors like agriculture. Also other authors have equally noted that Nigeria, like all the countries of sub-Saharan Africa, is highly vulnerable to the impacts of climate change (NEST, 2004, IPCC, 2004 and Apata, et al, 2004). Incidentally, climate change may result in the loss of biodiversity, may increase extinction rates for vulnerable species and may cause a decline in the viability of important ecosystems (McCarthy, et al, 2001)

Crop farmers need to and should respond to climate variabilities if food security will not be seriously threatened. Over the years, farmers have been responding to climate change through adaptation, which is the process by which ecological, social or economic systems adjust in response to actual or expected climatic stimuli and their effects or impacts (Smith, et al., 2001). Therefore, adaptation to climate change refers to activities that reduce the negative impacts of climate change and/or takes advantage of new opportunities that may be presented. NEST (2004) suggested a number of adaptation measures to reduce the effects of climate change on crops. These include:

- Diversification to new plant species and varieties that would have higher resistance to anticipated temperature increase and reduced rainfall;

- Improving local agricultural crop varieties that are well acclimatized and drought and pest resistant;
- Introduction of new irrigation schemes to dry land management to improve water use, particularly in the Sudan-Sahel zone;
- Encouraging farmers to use meteorological forecasts; etc.

Increasing climate variability is having profound impact on agriculture and adapting to climate change is a priority for smallholder farmers (Hailu, 2011). The result of research carried out by Eheazu (2011) in south east Nigeria, shows that many of the respondents, especially those living in the rural areas of Igbo land, are yet to understand the phenomena and attendant implications of global warming and climate change. He noted that such people are therefore neither reasonably aware of their individual and collective contributions to the incidence of the phenomena nor are they equipped mentally, practically and psychologically to properly respond to observable changes and impending hazards and disasters. Hence, this research was designed to investigate crop farmers' perception of and adaptation to climate change in Orlu Agricultural Zone of Imo State, Nigeria.

The specific objectives of the study include to:

1. assess the farmers' level of awareness of elements of climate change;
2. ascertain the extent farmers perceived climate change in the zone;
3. find out the various effects of climate change in the area as perceived by the farmers; and
4. ascertain the adjustment strategies adopted by the farmers.

Hypothesis

It was hypothesized that there is no significant relationship between the socio-economic characteristics off the farmers and their perception of climate change in the area.

Methodology

The study was carried out in Orlu Agricultural zone of Imo State. The zone has twelve (12) Local Government Areas (LGAs) and crop production is common among farmers in the area.

A multi-stage random sampling technique was used to select one hundred and twenty (120) crop farmers for the study. In the first stage, four (4) LGAs were randomly selected. In the second stage, three (3) communities were also randomly selected from each of the four LGAs. In the final stage, ten (10) crop farmers were equally randomly selected from each of the communities, giving a total of 120 farmers. The ADP extension staff in the zone helped in the selection process and also assisted in data collection.

Data were collected using structured and validated questionnaire and interview schedule. The literate crop farmers were given the questionnaire to fill while the interview schedule was used to collect information from the illiterate ones. Information was sought from the farmers on; their socio-economic characteristics, awareness of climate change, source(s) of information, extent of knowledge or awareness of climate change, perceived impacts of climate change and adaptation strategies.

Data were analysed using frequency distribution, percentages and mean. The hypothesis was tested using Ordinary Least Square multiple regression model.

Results and Discussion

Socio-economic characteristics of the respondents

Data in table 1 reveal that greater proportion (33.33%) of the respondents fall within the age range of 41 – 50 years while 31.67% are above 50 years of age. This is similar to the finding of Imbur, et al (2008) who reported that majority of the citrus farmers in Benue State fall within the age range of 40 – 49 years and 50 – 59 years respectively. The mean age of the farmers is 44.2 years, implying that they are in their middle ages and therefore active enough to adopt measures or technologies geared towards combating the challenges of climate change. Majority (56.67%) of the respondents are females. This is not surprising since generally, women in the state engage in farming more than the men. Also, majority (66.67%) of the respondents are married. Results also show that greater proportion (35%) of the respondents had secondary school education while 33.33% had primary school education. This implies that majority of the respondents are farley literate and therefore are likely to readily adopt climate change adaptation and mitigation measures. Imbur, et al (2008) noted that the literacy level of the farmers is a very important variable as it influences the ability to properly comprehend new techniques and methods required to bring positive changes in knowledge, attitudes, skills and aspirations of the farmers.

TABLE 1
Distribution of respondents by personal characteristics

Characteristics	Frequency	Percentage	Mean
Age (Years)			
21 – 30	12	10.00	
31 – 40	30	25.00	
41 – 50	40	33.33	44.2 years
51 and above	38	31.67	
Sex			
Male	52	43.33	
Female	68	56.67	
Marital status			
Married	80	66.67	
Single	6	6.67	
Widow	32	26.67	
Educational status			
No formal education	38	31.67	
Primary school education	40	33.33	
Secondary school education	42	35.00	
Tertiary education	-	-	
Farming experience			
1 – 5 years	16	13.33	
6 – 10 years	36	30.00	
11 – 15 years	26	21.67	12.76 years
16 – 20 years	22	18.33	
Above 20 years	20	16.67	
Household size			
1 – 4	34	28.33	
5 – 8	72	60.00	5.8
9 and above	14	11.67	
Organization membership			
Member	116	96.67	
Non-member	4	3.33	

The results further indicate that greater proportion (30%) of the farmers have 6 – 10 years farming experience while 21.67% have farming experience of 11 – 15 years. The mean farming experience is about 13 years, implying that many of the farmers have been into farming long enough to observe climate changes and their impact. Majority (60%) of the respondents have household size of 5 – 8 persons while the mean household size is about 6 persons. This implies a moderate household size. Also, majority (96.67%) of the farmers belong to one form of social organization or the other. The implication is that the farmers may obtain

information about climate change from these organizations. Another implication is that it will be easy to reach these farmers in groups for purposes of information dissemination about climate change.

Farmers' awareness and perception of climate change

Table 2 reveals that all (100%) of the farmers are aware of change in climate and that majority (98.33%) observed the change through personal experience. Also a large proportion (48.33%) of the farmers get information on climate change through their various social organizations. Only few of the farmers get information from mass media (31.67%) and Extension service (20.00%). The implication is that there is poor information dissemination on climate change through the mass media and Extension service to the farmers. This is buttressed by the fact that none of the farmers seems to be aware of what causes climate change. Unfortunately therefore, the farmers may be unconsciously contributing to global warming and climate change through indiscriminate burning of bushes and felling of trees without replacement.

Results also show that majority (75%) of the farmers are aware of changes in rainfall pattern, while many are aware of changes in sunlight (71.67%), temperature (58.33%) and wind (40%). Greater proportion (45%) of the farmers perceive climate change "to a large extent" and "to a little extent" respectively, while only very few perceived it "to a very large extent" (6.67%) and "to a very little extent" (3.33%).

TABLE 2
Distribution of respondents according to awareness of climate change; sources of awareness, causes of change, elements that change, and level of perception of change

Variables	Frequency	Percentage
Awareness of climate change		
Yes	120	100.00
No	0	0.00
Sources of awareness/information*		
Mass media	38	31.67
Social organization	58	48.33
Personal observation	118	98.33
Extension service	24	20.00
Awareness of causes of climate change		
Yes	0	0.00
No	120	100.00
Awareness of elements that changed*		
Rainfall pattern	90	75.00
Relative humidity	4	3.33
Sunlight	86	71.67
Temperature	70	58.33
Wind	48	40.00
Level of perception of change		
To a very large extent	8	6.67
To a large extent	54	45.00
To a little extent	54	45.00
To a very little extent	4	3.33

**Multiple responses*

Adverse effects of climate change and adaptation measures

Table 3 shows that majority (87.50%) of the respondents perceive increased rainfall intensity as one of the effects of climate change. Others include: increased flooding (85%), excessive heat (73.33%), poor crop performance (65.33%), increased soil erosion (66.67%), windstorm (64.17) and pest and disease attack (51.67%). The result is in line with the assertion of Wiggins and Wiggins (2006) that climate change may result in significant environmental threats like; rising temperature and drought, increased likelihoods of hazards such as floods, landslides and severe cycloids. Majority (66.67%) of the farmers adopt diversification of farming activities as an adaptive strategy. Other strategies include adjustment in planting date (60.83%), engagement in non-farm activities (53.3%), among others.

TABLE 3
Distribution of respondents by their perception of adverse effects of climate change and adaptation strategies

Variables	Frequency	Percentage
Perceived adverse effects*		
Increased rainfall intensity	105	87.50
Increased flooding	102	85.00
Excessive heat	88	73.33
Increased soil erosion	80	66.67
Increased wind storm	77	64.17
Increased disease outbreak/pest attack	62	51.67
Poor crop performance	82	68.33
Adaptation strategies*		
Use of irrigation	20	16.67
Adjustment in date of planting	73	60.83
Use of improved crop varieties	44	36.67
Reduced investment in the farm	32	26.66
Diversification of farming activities	80	66.67
Engagement in non-farm activities	64	53.33
Increased use of farm input (e.g. fertilizer and organic manure)	48	40.00

**Multiple responses*

Hypothesis testing

The hypothesis was that there is no significant relationship between the socio-economic characteristics of the crop farmers and their perception of climate change. The regression result is as shown in table 4. Four functional forms of the model were tried in order to determine the most fit. The double-log functional form was chosen as the lead equation, based on the fact that it had the highest

coefficient of multiple determinations (R^2), the highest F-value and the highest number of significant variables.

TABLE 4
Ordinary least square multiple regression result of crop farmers perception of climate change and their socio-economic characteristics

Explanatory variables	Linear function	Semi-log function	Double-log function	Exponential function
Constant	306.4291	237.1826	173.0927	105.2601
R^2	0.4613	0.3968	0.7817	0.5108
No. of Observations	120	120	120	120
Degree of freedom	52	52	52	52
F – Value	6.5901	4.7238	26.5884	7.7629
X_1 (Sex)	-4.7815	-1.5928	-0.0917	-0.0098
	(-1.3872)	(-1.2982)	(-1.0713)	(-1.1807)
X_2 (Age)	6.3999	1.1169	0.0373	0.0055
	(1.1239)	(2.7255)**	(3.6559)**	(1.1702)
X_3 (Marital status)	5.4718	1.18213	0.0453	0.0069
	(1.1332)	(1.0656)	(4.2336)**	(1.2545)
X_4 (Ed. Level)	8.6912	1.2281	0.0227	0.0076
	(3.1224)**	(2.9942)**	(2.7349)**	(2.7143)**
X_5 (Farming exp.)	11.2998	0.9718	0.0659	0.0083
	(1.0752)	(1.0896)	(2.7119)**	(3.1923)**
X_6 (H/H size)	8.2714	2.7414	0.0782	0.0075
	(3.4682)**	(1.09637)	(3.6037)**	(1.1719)
X_7 (Org. mem.)	7.4163	0.8413	0.0836	0.0092
	(3.5925)**	(1.0653)	(2.6372)**	(3.1724)**

- *Significant at 5% (0.05)*

*** Significant at 1% (0.01)*

Figures in parenthesis are T-ratios or values

Results show that the ages of the farmers, their marital status, educational status, farming experience, household size and membership of social organizations are significant variables and have direct relationship with crop farmers perception of climate change. Age, educational level, farming experience and membership of social organization are positive and significant. This implies that as one advances in age, the more he becomes aware and appreciates climate change. Also, the more educated the farmer is, the more he becomes aware of climate change and identifies it. Similarly, as one farms for a reasonable period of time, the more he gathers experience on climate change. Marital status and household size being positive and significant may imply information sharing in the family between or among family members on climate change. Sex of the farmers has no significant impact on their appreciation of climate change. Generally, however, the results imply that the socio-economic characteristics of the farmers influence their perception of climate change.

Conclusion and Recommendations

Results of the research showed that the farmers are aware of climate change but however, do not seem to know the cause(s). Their knowledge of climate change is mainly based on personal experience over time and information from social organizations. Elements of climate which they perceived to have changed significantly include rainfall pattern, sunlight and temperature. They seem to have perceived climate change to a fairly large extent. Perceived adverse effects include increased rainfall intensity, flooding, erosion, excessive heat and poor crop performance. Major adaptation strategies include; change in planting date, diversification of farming activities and engagement in non-farmer activities. Age of the farmers, their educational level, farming experience and membership of social organizations are significant variables that influenced the farmers' perception of climate change.

Based on the major findings, the following recommendations were made:

- Intensive capacity building workshops on climate change issues should be mounted by the Agricultural Development Programme (ADP) for Extension Agents so that they will be better equipped to enlighten the farmers.
- Government and non – governmental organizations should mount aggressive campaign through the mass media to enlighten the citizens on climate change issues, especially the causes and consequences

The above measures, and more, are necessary if we must ensure food security and meet the needed Millennium Development Goals (MDGs).

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