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FARMER'S PERCEPTION OF CLIMATE CHANGE AND ITS ASSOCIATION WITH DEMOGRAPHIC CHARACTERISTICS IN MAIZE PRODUCING AREA OF NORTHERN, NIGERIA

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ABSTRACT
This study was designed to found farmers' perception on climate change and weather changeability using farmers' demographic information to analyze gender exertion with education level in maize producing areas of the northern region, and its impacts on crop yields. Purposive sampling was used to select a sample size of 400 households. Information was composed from heads of households using a questionnaire and the data obtained were analyzed using statistical analysis. The results showed that farmers perceived climate change and weather variability correctly. The result of the independent-sample t-test on-farmers' perception about climate change and farming status shows that there was a significant difference in perception of climate change between farmers and non-farmers. chi-square cross-tabulation also demonstrated that there is a significant association between farmers' level of perception of climate change and gender. Lastly, the study outcome indicates that there was no significant difference in farmers' perception based on the educational level of the farmers. These findings will be used by both institutions and government in formulating policies and funding for better maize production and agricultural practice in general.

Keywords: climate change, demographic, farmers, maize production, perception.

INTRODUCTION

The influence of climate change and climate capriciousness on smallholder rain-fed farming has been a subject of deliberation amongst policymakers and agricultural practitioners. Despite these widespread debates, not much is known about the smallholder farmers' perceptions on the impacts of climate change and its variability on their agricultural practices. More so, there is very little documented information on farmer's perceptions of agricultural practices as it relates to climate change especially in developing countries (Dhanya & Ramachandran, 2016). Further still, there has been diminutive focus on the role of demographic variables such as gender on the perception of climate change and mitigating, the impacts brought about by climate change. This article presents some of the outcomes of the studies carried on the farmer's survey on climate change, perception, mitigation and adaptation strategies in northern maize belt, Nigeria.

Studies have accentuated the perception of farmers' on climate change and variability and the relationship between farming practices and food security (Bryan et al., 2010; Nyanga et al., 2011; Osbahr et al., 2011; Rao et al., 2011; Kristjanson et al., 2012). Understanding how farmers' perceive climate change and whether conditions, there are modifications in perception between demographic characteristics could shed light on how productivity at the local level could be boosted. The perceptions could indicate how farmers manage long-term changes associated with climate change and its variability as well as their adaptive capacity. This will be helpful to researchers and the government by enabling them to tap on to existing adjustments farmers' are already making with, to sustain their productivity. Furthermore, the variations in smallholder farmers' perceptions on agricultural practices amongst different agro-ecological zones and across different timelines are yet to be properly documented in Nigeria. Knowing farmers' perceived changes in agricultural practices in smallholder systems will allow researchers, extension service officers and farmers to develop research agendas and adopt practical measures that would meet present and future farming needs in specific agro-ecological zones. This study sought to fill this gap by evaluating the smallholder farmers' perceptions of the impacts of climate change and climate variability on their agricultural practices. It also seeks to contribute to the limited literature concerning the role of demographic characteristics of households on their perceived changes in climatic conditions as well as the adaptive measures they are putting in place to cushion the effect of the variations in climate.

LITERATURE REVIEW

The agriculture subdivision is the backbone of the economies of most of the developing world, employing about 60 percent of the workforce and contributing an average of 30 % gross domestic product (GDP) in sub-Saharan Africa (World Bank 2011). Smallholder farmers' are the mainstream in this sector and form the backbone of agricultural production in Africa (Dixon et al. 2004). These smallholder farmers are estimated to be about 36 million across the continent and have average access to two hectares or less of land for their agricultural production (Jaeger, 2010). Their dominance in the sector makes a huge and

important contribution to the domestic food production, while at the same time producing export crops that earn foreign exchange for these economies (Quan, 2011). In Nigeria, the agriculture sector contributed 30 % of the country's GDP and 70 % employment in 2009 respectively (NBS, 2009). With reliable and consistent climatic conditions, the contribution of smallholder farmers could lead to economic stability of agriculture reliant on countries that include most African countries. Unfortunately, agriculture to a large extent is affected by different production factors, both natural and man-made. One of such factor is climatic capriciousness which is negatively affecting agricultural productivity leading to substitution through importation or a shift to other sectors. These effects have a direct impact on smallholder farmers' due to reliance on rain-fed agriculture for their production and have a limited means of coping with this adverse weather variability (FAO, 2012). Research on how to mitigate the impacts of climate change and variability to agricultural productivity is still very limited (Sylvester & Anam, 2012) and farmers have been found to have a problem in distinguishing between impacts arising from climate change and problems caused by local environmental degradation (Mutimba et al., 2010). This lack of farmers' awareness influences negatively their adoption of appropriate adaptive technologies. One approach to alleviating the impacts of climate change is through the adoption of appropriate agricultural practices such as soil and water management, soil fertility management; weed control, pest and disease control amongst others. These practices are mainly used by farmers to improve their agricultural production by reducing risks associated with farming. For individual farms, agricultural practices begin with tilling of the soil for seed establishments, addition of plant nutrients and employing pest control methods (FAO, 2012). For example, research has shown that proper land preparation at the initial stage determines the quality and quantity of harvest that the farmer gets at the end of the season (Kamau, 2005). However, some of the agricultural practices continue to reduce the natural protection provided by vegetation cover hence subjecting to the land to severe soil erosive losses (Khisa et al., 2002). Thus, adopting good farming practices influences the agricultural production (Branca et al., 2012).

In most circumstances anywhere climatic consequence is observed, attempts were being made to understand the real-time situation such as whichever the farmers' are perceiving climate variability and changes, what are the impacts of it and their possible responses to climate change or have they changed their cropping pattern and what are their adaptation need to promote successful adaptation in the agriculture practices, it is essential to understand how the farming community perceives climate change and the factors influencing their local adaptation measures (Bryan et al., 2009). To investigate at the local scale, searches are recommended by many researchers (Johnston & Chiotti, 2000; Ovuka & Lindqvist, 2000; Roncoli et al., 2001; Vedwan & Rhoades, 2001) to understand the farmers' perceptions about climate inconsistency and their responses and adaptation requirements. Kumar, (2009) has highlighted the need to have locally downscaled climate information for each study location, for the advancement in policy responses and examination of climate implications on dependent sectors.

Several studies reported on rural adaptation to climate change in West Africa which shown that climate is one of the major factors influencing local adaptation strategies (Nielsen & Reenberg, 2010; Mertz et al., 2011; Diallo et al., 2012; Dieye & Roy, 2012). A survey conducted in the Sahel discovered that farmers' remain aware with climate variability (Mertz et al., 2009). Climate plays a major role in a farmers' life as the cropping patterns are generally planned according to climatic conditions, soil types, irrigation water availability, crop rotation, water allocation policies, etc. (Dhanya & Ramachandran, 2016). Parikh, (2007) deduced that climate change may bring additional hardship for farming activities, often carried out by the poorest people through loss of harvests, as their sole sources of food, income and make them the most susceptible to climate change. For example, Udmale et al., (2014) reported that recurring drought is a major challenge in Maharashtra state, Central India. Despite the good perception of the severity of drought impacts by farmers, the preference given for mitigating its adverse impacts in agriculture was not good enough. Apart from that, the level of satisfaction among farmers was low as far as the government mitigation measures are concerned. The study on farmers' perception and awareness of crop insurance was conducted by Goudappa et al., (2012) who reveals that in north-eastern parts of Karnataka due to very less rainfall compared to other parts of Karnataka, the people of this region always suffer from dry spells and droughts.

METHODOLOGY

Population and Sampling

The data for this study were collected from seven states of the northern Nigeria including the Federal capital territory Abuja. The states included in the study were: Kaduna, Katsina, Kano, Niger, Nasarawa, Zamfara and Abuja. The total respondents were four hundred and seventy-three (473) in all, but only four hundred valid responses were considered for this study. The entire study region had 7-selected states that produce mostly maize. The sampling procedure in the current study is multistage, which involves the use of many sampling techniques. Initially, states were clustered and in each cluster, one local government area (LGA) was randomly selected. From each LGA, one maize-producing district was purposively sampled and finally, a systematic random sampling technique was adopted where the first household was randomly selected and subsequently, every third 3rd sample was selected.

Data Collection and Analyses

The required data in this study were based on the primary data sources. The data were obtained through a survey using a structured questionnaire. At each point of the questionnaire administration, the questionnaire was tested to ensure clearness and interpretability for the respondents. A pilot survey was conducted on the respondents, from the target groups before the conduct of the main survey. The village heads and farmers associations were briefed before the commencement of the survey. The representative of the communities was nominated for a briefing on the purposed objective of the current research, and who later explained it to them in a way they will understand better before the commencement of the survey. To understand how climate change impacts maize crop production, the survey method is an appropriate means since it allows being in touch with the grassroots producers in the study area (Mendelsohn & Kurukulasuriya, 2008; Seo & Mendelsohn, 2008; Nhemachina et al., 2010; Ajetomobi et al., 2011; Ajetomobi & Abiodun, 2010; Dlamini et al., 2012; Kuwornu et al.,

2013). The data obtained from this study were analyze with the aid of a computer statistical tool (IBM SPSS version 23) were analyses such as descriptive analyses, the chi- square, independent sample t-test and ANOVA were carried out.

RESULTS

Demographic Information of the Respondents

The results of the socio-demographic characteristics of the respondents are presented in Table 1. The distribution of respondents' gender revealed that 393 (98.2 %) of them were male, while 7 (1.8 %) were female. This indicates that the ratio of males is by far, higher than that of female Farmers. This outcome revealed the true nature of northern Nigeria where women rarely engage in farming activities, as farming is considered an exclusive profession for men. For respondents' marital status, the results revealed that those who are married were 384 (96.0 %), whereas those who are single accounted for the remaining 16 (4.0 %). The respondents' primary source of income were mostly from crop farming (327), that is 81.1 %, while those who earn mostly from business sources were 34 (8.5 %) and those who relied on salary were 23 (5.8 %). For pastoralists, they constitute 10 (2.5 %) whereas income source from remittance constitutes only 6 (1.5 %).

The distribution of the respondents based on age shows that those within the age range of 20-31 years were 173 (43.3 %), those within the range of 32 – 43 years of age were 160 (40 %), while those within 44 – 55 years age bracket were 47 (11.8 %). Lastly, those whose age range from 68 years and above constitute only 6 (1.5 %) of the total respondents.

On Farmers' level of education, those who had non-formal education were only 3 (0.8 %), those who attained only primary level of education were 150 (37.5 %), whereas those with secondary level of education were 126 (31.5 %). Those who have a diploma or college of education certificate were 94 (23.5 %), and those with a university degree were 27 (6.8 %). For respondents years of farming experience, 100 (25 %) spent between 1-5 years, while those who spent 6-10 years were 194 (48.5 %). Those who spent 10-20 years farming were 56 (14.0 %) and those who have been farming for 31 years and above were 22 (5.5 %). On the farming status of the respondents, the majority of them 371 (92.8 %) were full-time farmers, whereas 29 (7.2 %) were part-time farmers.

Table 1. Socio-demographic characteristics of the respondents

Variables		Frequency	Percentage
Gender			
	Male	393	98.2
	Female	7	1.8
Marital Status			
	Married	384	96.0
	Single	16	4.0
Primary Source of Income			
	Crop farming	327	81.8
	Pastoralism	10	2.5
	Business	34	8.5
	Salary earner	23	5.8
	Remittance	6	1.5
Age			
	20-31	173	43.3
	32-43	160	40.0
	44-55	47	11.8
	56-67	14	3.5
	68-above	6	1.5
Level of Education			
	Non-formal Education	3	.8
	Primary	150	37.5
	Secondary	126	31.5
	Poly/Collage of Education	94	23.5
	University	27	6.8
Years of Farming			
	1 - 5 Years	100	25.0
	6 - 10 Years	194	48.5
	10- 20	56	14.0
	21- 30	28	7.0
	31 Years and Above	22	5.5
Farming Status			
	Part-time	29	7.3
	Fill-time	371	92.8

Farmers Level of Perception of Climate Change

To determine the farmers' level of perception about climate changes and their impact on farmers' perception was categorized into five levels as; very low, low, average, high and very high, the result in Figure 1. Shows that, 94 (23.5 %) of the respondents have a very high level of perception of climate change. Out of the total valid responses obtained (400), those who shows a high level of perception of climate change were 76 (19 %), whereas those whose level perception of climate change was average were 114 (28.5

%). For those who exhibited low-level perception of climate change, the constituted 93 (23.25 %) out of the total responses while those who shows a very low-level perception of climate change were only 23(5.75 %). this outcome indicated that the maize farmers in northern Nigerian have some level of perception that climate change is taking place.

Because of the above finding, there is the need for a holistic approach to climate change in Nigeria to stem the tide of the unpredictable weather pattern that is currently bedeviling and worrisome since the 1970s drought. Weather elements play an important role in the realization of higher or lower crop yield in Nigeria; as such farmers' perception on climate change, and to what extents will it affect the future production of maize in the region is of utmost to policymakers and the peasant/commercial crop farmers. Roudier et al (2011), opined that in the vulnerable regions of West Africa, a better quantification and understanding of climate impacts on crop yield is needed. The full understanding of the climatic risk from the interaction of the climatic, environmental and socio-economic factors is important for designing appropriate, place-based and context-specific participatory adaptation strategies (Fasona et al., 2013), for the rain-fed subsistence farmers agricultural communities.

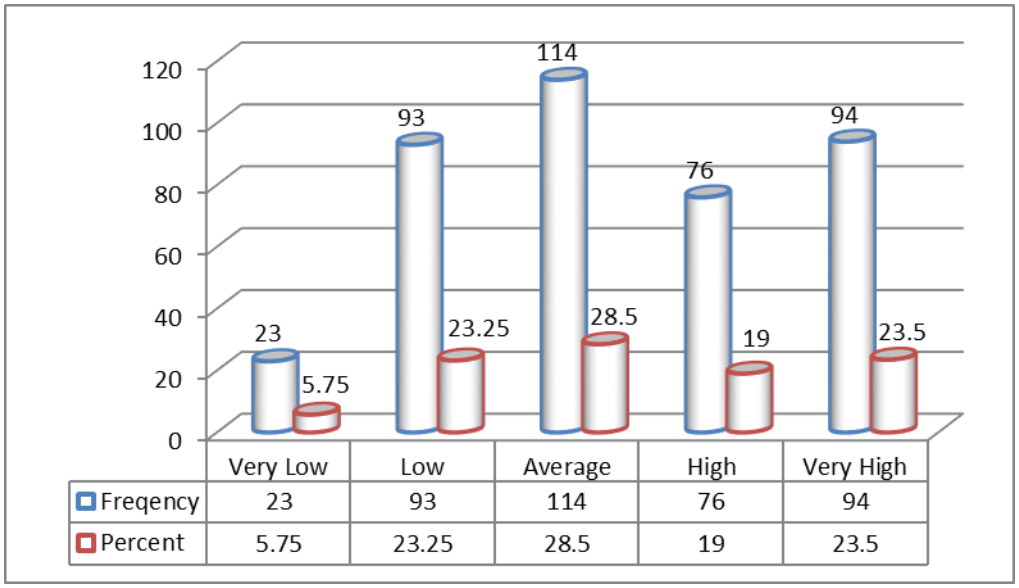

Fig. 1. Cross-tabulation of Farmers' Perception with Important Demographic Information

Association Between Perceptions with Respondents' Gender

A chi-square test of independence was employed to compare the farmers' perception of climate change with the respondents' gender. A significant association was found (X^2 (4),= 10.551, P < .05) as shown in Table 2. The result further indicated that males have higher perception than female gender. Out of the 23 respondents that show a very low level of perception, all of them were male, whereas none of the females indicated a very low level of perception. On the low level of perception, a total of 93 farmers responded, where 5 were females out of the 7 total females which represent 71.43 % of the total female respondents. The remaining 88 out of the 393 males, representing 22.4% also shows a low level of perception. However, in the category of those who show 'high' and 'very high' perception of climate change among the respondents, all of them (100%) were male with no single female respondent revealing a higher perception of climate change. Thus, based on the outcome of the present study, it can be deduced that there is a significant association between gender and perception of climate change, where males perceived that climate change is real whereas the female level of perception was low. This outcome will not be unconnected with the fact that the majority of the farmers in the study area are male, who has been in the occupation for years, thus can observe and notice any change with regards to the climatic condition of the area.

Table 2: Cross Tabulation of Respondents Level of Perception with Gender

Perception		Gender of Respondents			χ^2 (df)	p-value
		Female	Male	Total		
Very Low	Count	0	23	23		
	% within Perception	0.0%	100.0%	100.0%		
	Std. Residual	-.6	.1		10.551 (4)	**0.032***

Low	Count	5	88	93
	% within Perception	5.4%	94.6%	100.0%
	Std. Residual	2.6	-.4	
Average	Count	2	112	114
	% within Perception	1.8%	98.2%	100.0%
	Std. Residual	.0	.0	
High	Count	0	76	76
	% within Perception	0.0%	100.0%	100.0%
	Std. Residual	-1.2	.2	
Very High	Count	0	94	94
	% within Perception	0.0%	100.0%	100.0%
	Std. Residual	-1.3	.2	
Total	Count	7	393	400
	% within Perception	1.8%	98.3%	100.0%

Comparing the Differences in Perception with Education Level

A one – way ANOVA between subjects was conducted to examine whether there is a significant difference in climate change perception based on the different level of education The result shows that there was no significant difference in farmers perception of climate change (P>.05) on their level education [F (4, 395) = 1.925, p = 0.105] as presented in Table 3. This outcome shows that educational level does not play role in the perception of climate change among farmers in the study area. This can further be justified that experience in the field gives farmers more reason to understand climate variability over the years that their educational attainment.

Table 3: Differences in Perception of Climate Change on Farmers' Education Level

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	128.206	4	32.051	1.925	.105
Within Groups	6576.732	395	16.650		
Total	6704.938	399			

Comparing Farmers' Perception with Farming Status

An independent – sample t-test was conducted to compare perception between respondents' farming status; farming and not farming in the study region. There was significant difference in the scores for respondents that are farming (M = 7.55, SD = 4.13) and respondents that are not farming (M = 5.69, SD = 3.27; t (35.36) = 2.88, p = 0.019. This result suggested that respondents who were farming do understand the climate change perception than those not farming in the study region as presented in Table 4.

Table 4: An Independent sample test of perception and farming status

		Levene's Test for Equality of Variances						
	Farming status	F	Sig	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Perception	Equal variances assumed	3.134	.077	2.364	398	.019	1.858	.786
	Equal variances not assumed			2.881	35.357	.007	1.858	.645

CONCLUSION AND POLICY IMPLICATION

The respondents' perceptions of climate change were solicited through the household survey; the survey data were analyzed using cross-tabulation of variables using chi-square, student t-test and ANOVA to test the significance of some important demographic variables of the respondents. These estimates provide some significant difference between climate change perception of the respondents and the effect of some important demographic variables on climate change, it also explains how education, gender effects of respondents were distinguished those farming and not farming in understanding climate change, it indicates their association with climate change in the study region.

The outcome of this present study has some policy implications. First, the study result shows that maize farmers in the northern maize belt of Nigeria have some level of perception of climate change. This means that they developed their adaptive capacity by adopting local coping strategies. More so, the study revealed that gender plays a significant role in understanding the impact of climate change among maize farmers. It explicitly shows that men have a high level of perception of climate change than females. Also, the study revealed that educational attainment does not affect perception about climate change. This implies that regardless of the educational level of a person, long-term experience in the field as a farmer gives one the opportunity to understand climate variability over time. Lastly, the study shows that there is a significant difference in perception about climate change based on Farming status. Farmers have a high perception of the incidence of climate than those farming.

Based on the findings of this present study, it is therefore recommended that a climate change awareness campaign can be a tool that will help to create awareness to not only maize farmers but farmers in general on the need to the developed adaptive capacity that will help in cushioning the effect of climate change in the region. As crop production employs rural populations and raw-materials to urban industries in Nigeria, it is important to keep the agricultural warriors informed on climate change impact and the need to develop coping strategy based on local knowledge and resources Findings are significant to both farmers and government to prepare for future climate impact on maize yield which would serve as a guide for effective policy formulation on maize production in particular and food security in general.

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