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ASSESSMENT OF SESAME FARMERS' PERCEPTION AND ADAPTATION STRATEGY TO CLIMATE CHANGE IN MACHINA LOCAL GOVERNMENT AREA, OF YOBE STATE, NIGERIA

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ABSTRACT: *The study was conducted to assess sesame farmers' perception and adaptive measures to climate change in Machina Local Government area of Yobe State, Nigeria. The data was collected from randomly sampled 63 sesame farmers in the study area. Descriptive statistics and Likert scale tools were used to analyze the collected data. The results' findings show that sesame production is dominated by married male farmers (92.1%) that have an average age of 42 years, farm size average of 1.14 hectares, and an average farming experience of 15 years in the study area. The farmers were also found to have a household size average of 11 members; as well majority of them were found to have formal education ranging from Primary (31%), secondary (28%) and tertiary education (20%). The study findings further revealed farmers in the study area strongly agreed to perceive climate change majorly through an observed change in pattern of temperature (61.9%), and change in the pattern of temperature (46%). Meanwhile, climate change adaptive strategies used by farmers were majorly increased soil water conservation (3.17), use of chemicals, fertilizers, manure and pesticides (2.65) and using different tillage systems (2.52). The sesame farmers faced challenges of inadequate capital (69.8%), pest and disease attack (55.6%) as well as high cost of production inputs (54%). It can therefore be recommended that inputs subsidies and training on early warning systems of climate change shall be given to the farmers so as to improve their control measures to climate change.*

KEYWORDS: Perception, Climate change, Adaptive Measures, Sesame Farmers.

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INTRODUCTION

Globally, climate change is recognized as a critical phenomenon with strong implications for socio-ecological, biophysical, human systems, and consequently human development. In Africa and many parts of the world, the impact of climate change is visible and widespread. Indeed, Nigeria is already experiencing the impacts of climate change, with more extreme weather events occurring, more variability in timing and intensity of rainfall as well as higher temperatures over the whole country (Food and Agricultural Organisation, 2010). In Yobe state, analysis of climatic data over 35 years (1981- 2016) have shown anomalies in rainfall, temperature and evaporation within Yobe state represented by Potiskum in the south (Sudan savanna) and Nguru (Sahel) in the north. During these periods, Yobe state and indeed the entire northeastern part of Nigeria suffered a series of droughts notably, the droughts of the 1970s, 1980s and 1990s. There is an observed increasing average rainfall trend but this was accompanied by higher average temperature trends (1999–2016) for Potiskum. This higher temperature trend had an effect on crop and pasture production (Nigerian Meteorological Station, 2017).

Many small farmers in rural areas who already live in harsh environments may become very vulnerable to climate change impacts because of their geographic exposure to extreme events, low incomes, dependence on agriculture, and few options to pursue other livelihoods (Interamerican Association for Environmental Defense (AIDA), 2011). Due to environmental threats resulting in declining crop yields, some farmers in Nigeria are abandoning farming for non-farming activities (Apata, Ogunyinka, Sanusi & Ogunwande, 2010). Sesame is one of the cash crops grown in Yobe State. It is a very popular crop among the rural farmers. It's reported that 85% of small scale farmers in Yobe State are into sesame production, processing and marketing of sesame within the area which shows the usefulness of the crop to improve the standard of living of all the actors involved in producing, marketing and processing of sesame crop (Sharon, 2016). Notwithstanding the great local and international market value and for its seed oil, the production system is usually characterized by the utilization of traditional methods. Despite all attempts to increase sesame production in Yobe State, the rural farmer still produces only at a subsistence level, using a traditional system of farming and low yielding varieties. Extension services have not been very effective because improved technologies of sesame production are available in research Institutes, but have not successfully reached sesame farmers (Sharon, 2016).

The overdependence of agriculture on rainfall and temperature makes overwhelming reliance of the economy on agriculture a serious problem which is by no means immune to climate change and sesame production in the state is generally rain fed. This calls for the essentiality of agricultural adaptation to climate change. According to Intergovernmental Panel on Climate Change. IPCC, (2007), unless effective adaptation strategies are carried out timely, some African countries could lose up to 50% of yield from rain-fed agriculture by the year 2025 and access to food will be severely confronted in many African countries. Thus, Nigeria cannot be an exception given its overdependence on a climate driven economy. Earlier studies on climate change in different parts of Nigeria cannot be implied for other specific areas. It is because adaptation strategies vary contextually and spatially within communities and even among individuals so that identified adaptation measures do not necessarily translate from one area to another area (Temesgen, 2009; Belaineh, Yenealem, Fekadu & Jema, 2013). The capacity to adapt to climate change is unequal across and within societies. Adaptation responses are also underpinned by common enabling factors. These include effective institutions and governance,

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innovation and investments in environmentally sound technologies and infrastructure, sustainable livelihoods, and behavioral lifestyle choices (IPCC, 2014).

Unless appropriate mitigation and adaptation measures are taken, climate change will frustrate common man, particularly farmers' in their efforts to achieve sustainable agricultural production and food security (Saleh, 2016). However, developing such strategies will require information from the target respondents in the study area since; the ability to adapt and cope with climate change depends on their knowledge, skills, experiences and other socio economic factors (harja et al., 2011). It is against this background that this study assessed sesame farmers' climate change perception and adaptation strategy to the effect of climate change. Consequently, thereby contributing to the existing gap of knowledge on farmers' perception and adaptation strategies to changing climate and their determinants in the rural farming communities in Nigeria.

METHODOLOGY

Study area

Yobe State is located between latitudes 10° 25 '55'' North to 11° 34' 25'' East and longitudes 11° 19 '50'' East to 13° 25' 13'' North of the equator. It has a total area of 45,502 km2 and a projected population of 3,408,062 as at 2018 using an annual growth rate of 3.2% [NPC, 2006], with a population density of 74.9/km2. It is made up of three [3] agricultural zones which include Zone I, Zone II and Zone III consisting of 17 Local Governments Areas (Sharon, 2016). The State shares borders with Borno State to the South and East, Bauchi and Jigawa States to the West and Gombe State to the South. It also shares an international boundary with the Diffa Region and Zinder Region in the Republic of Niger to the North (Yobe State Socio-Economic Reform Agenda (YOSERA) III, 2012-15).

The State lies largely in the dry Savanna belt. Weather conditions are hot and dry for the greater part of the year, with exception in the southern part of the State which has a milder climatic condition. The hottest months are March, April and May with temperatures varying from 30°C – 42°C. The period of the rainy season in the state differs here and there, but generally lasts for about 120 days in the north and more than 140 days in the south. The annual rainfall ranges from 400 mm – 500 mm in the North and 600 mm – 1000 m in the southern part of the state and the rainy season is normally from June to September in the north and May to October in the south. This is suitable for the growth and development of sesame requiring little water (Yobe State Statistical Year Book (YSSYB), 2017).

Sampling Procedure and Sample Size

The study employed the use of a multi-stage sampling procedure. In the first stage, Machina local government area was purposely selected from the 17 local government areas that are involved in sesame farming in the State. Second stage involves the selection of 4 wards from the 10 district wards in Machina local government area for the purposes of the studies due to the high concentration of Sesame farmers in the study area. Third stage involves a random selection of 63 farmers that are involved in sesame production in the study area. The sample size was determined using Rao soft sample size calculator at 90% confidence level.

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Table 1: Sample Frame and Sample Size of Sesame Farmers

Wards	Sampling Frame	Sample size
Machina kwari	370	26
Dole	200	14
Lamisu	161	12
Falmaram	153	11
Total	884	63

Source: *Department of Agriculture, Machina Local Government Area, (2021)*

Procedure for Data Collection

Structured questionnaire was designed and used for primary data collection in this study. The primary data collected majorly include demographic, socioeconomic, institutional, perception and awareness of climate change of sesame farmers.

Analytical Tools

Descriptive statistics and Likert Scale were used for analyzing the primary data collected. Descriptive statistics such as frequency, percentages, mean, minimum and maximum were used in expediting socioeconomic characteristics of farmers and constraints to climate mitigating measures; while the Likert scale was used to depict the perception of farmers on climate change

The Likert Scale

Likert scale is a type of psychometric response scale in which respondents specify their level of agreement to a statement typically points of scale. In this study, a five-point Likert scale was designed to depict the perception as: (1) strongly agree; (2) Agree; (3) neither agree nor disagree or undecided; (4) strongly Disagree; and (5) Disagree. While that of frequency of adaptation as a result of change which was given as (5) strongly agree; (4) Agree; (3) neither agree nor disagree or undecided; (2) strongly Disagree; and (1) Disagree.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Farmer

Socio-economic characteristic is the social standing or class of an individual or group. Examinations of socioeconomic status often reveal inequities in access to resources, plus issues related to privilege, power and control. Socio-economic characteristics of farmers in any community affect their livelihood and welfare (Cathy & Nahanga, 2017). This study therefore implored some of the socioeconomic characteristics of farmers in the study area so as to relate it with how they may act on climate change as it affected their farm production activities. The age of the respondents as presented in Table 2 reveals farmers to have an average age of 42 years and their majority (over 60%) are within the age range of 19-46 years. This implies that the respondents are middle aged and so still physically active to participate in farm production activities. Regarding their farming experience, most of them (over 50%) have 1-20 years of

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farming experience, and an average of 15 years farming experience; similarly the farmers have farm size average of 1.14 hectares with their majority (over 90%) having a farm size of less than 5 hectares. This implies that sesame farmers have been into farm production activities for a long period and they operate at a small-scale level in the study area; hence their long period experience will give better understanding of climate change. With respect to their household size, they have 11 household members on average and the majority of their household heads are Males (92%) and Married (81%). These results agree with the findings of Umar et al. (2011) who reported high married male dominance in sesame production in the study area. In addition to that, their majority had formal education ranging from Primary (31%), secondary (28%) and tertiary education (20%) while the remaining few (19%) had an informal education in the form of religious and adult education. This generally implies that sesame production is male dominated who are responsible and have some level of education to be able to make rational decisions regarding their production activities and they may have ideas to act on climate change affecting their farming activities in the study area.

Table 2: Socio-economic Characteristics of the Farmers

Variable	Frequency	Percentage	Minimum	Maximum	Mean
Age of the farmer					
19-24	1	1.6	19	75	42
25-35	24	38.1			
36-46	19	30.2			
47-57	12	19.0			
58-68	3	4.8			
69-79	4	6.3			
Farming experience (in years)					
1-10	30	47.7	1	50	15
11-20	19	30.2			
21-30	7	11.1			
31-40	5	7.9			
41-50	2	3.18			
Household Size					
1-5	12	19.1	1	30	11
6-10	17	27.0			
11-15	15	23.9			
16-20	10	15.9			
20-25	9	14.3			
Farm size					
0.2-1.1	27	42.93	0.2	5.9	1.14
1.2-2.3	22	34.97			
2.4-3.5	10	15.9			
3.6-4.7	3	4.77			
4.8-5.9	1	1.59			
Gender					
Male	58	92.1			
Female	5	7.9			

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Marital Status					
Married	51	81.0			
Single	11	17.5			
Widow	1	1.5			
Education level					
Primary education	20	31.7			
Secondary education	18	28.6			
Tertiary education	13	20.6			
Others (informal)	12	19.01			
Total	**63**	**100.00**			

Source: *Field Survey, 2021*

Perception of Sesame Farmers on the Trend of Climate Change

Results in Table 3 show that majority of the sesame farmers strongly agree that there is an observed change in pattern of temperature (61.9%), almost half of the sesame farmers strongly agree to it when the change in the pattern of temperature was very high (46.0%), and half of the sesame farmers agreed to what climate change when there is regular change in the rate of temperature (50.0%). This agrees with the study of Tologbonse et al., (2010) on farmers' perception of climate change where they found that farmers' perceived increase in temperature as being the highest effect of climate change similarly the finding of the study is tandem with the findings of Galadima and Nandi (2016) that increased temperature favors the breeding of pest and diseases while temperature increases evapotranspiration and causes wilting of crops.

Table 3: Perception of Sesame Farmers on the Trend of Climate Change

Variables	SA Freq (%)	A Freq (%)	N Freq (%)	D Freq (%)	SD Freq (%)	Mean
There is an observed change in pattern of temperature	39(61.9)	20(31.7)	3(4.8)	1(1.6)	-	1.46
The change in the pattern of temperature was very high	29(46.0)	24(38.1)	7(11.1)	3(4.8)	-	1.74
There is regular change in the rate of temperature	16(25.4)	31(49.29)	14(22.26)	2(3.18)	-	2.0
The intensity of heat observed was too hot	22(34.9)	16(25.4)	16(25.4)	7(11.1)	2(3.2)	2.22
The rate of rainfall pattern was heavy	15(23.8)	19(30.2)	19(30.2)	10(15.9)	-	2.38
There is change in wind pattern	13(20.6)	18(28.6)	22(34.9)	7(11.1)	3(4.8)	2.50
The pattern change in wind was heavy	11(17.5)	18(28.6)	17(27.0)	13(20.6)	4(6.3)	2.69
The intensity of solar radiation	19(30.2)	11(17.5)	17(27.0)	9(14.3)	7(11.1)	2.58
There is increase in percentage rate of humidity	6(9.5)	24(38.1)	18(28.6)	11(17.5)	4(6.3)	2.73
There is change in pattern of crop production	12(19.0)	23(36.5)	12(19.0)	9(14.3)	7(11.1)	2.61

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There is increase in farm yield produced	11(17.5)	23(36.5)	13(20.6)	11(17.5)	5(7.9)	2.61
There is higher yield this year than last year's production	15(23.85)	11(17.49)	11(17.49)	13(20.67)	13(20.67)	2.93

Source: *Field Survey, 2021*

Sesame Farmers Adaptive Measures on the Trends of Climate Change

The results in table 4 shows sesame farmers' adaptive measures to climate change. Results show that increased soil water conservation (3.17), use of chemicals, fertilizers, manure and pesticides (2.65) as well as using different tillage systems (2.52) as the most important mitigating measures adapted. Meanwhile, early harvesting (2.04) and use of prayer and socio-cultural adaptations (2.01) were the least practiced. Whereas, early planting, improved crop variety, crop diversification, mixed cropping, and early harvesting were also important measures agreed to be used by sesame farmers as suitable adaptive measures to cope with the impacts of climate change. This study agrees with the study of Jacqueline et al. (2017) that sesame farmers have adapted to such changes through the use of improved seed varieties, use of chemicals and mixed cropping.

Table 4: Sesame Farmers Adaptive Measures to Climate Change

Variables	**SA F (%)**	**A F (%)**	**U F (%)**	**D F (%)**	**F (%)**	**Mean**	**Rank**
Increased soil water conservation	7(11.1)	11(17.5)	19(30.2)	16(25.4)	10(15.9)	3.17	1st
Use of chemicals, fertilizers, manure and pesticides	19(30.2)	13(20.6)	11(17.5)	11(17.5)	9(14.3)	2.65	2nd
Using different tillage system	13(20.6)	21(33.3)	18(28.6)	5(7.9)	6(9.5)	2.52	3rd
Early planting	21(33.3)	17(15.9)	12(19.0)	10(15.9)	3(4.8)	2.31	4th
Improved crop variety	17(27.0)	21(33.3)	19(30.2)	3(4.8)	3(4.8)	2.26	5th
Crop diversification	17(27.0)	27(42.9)	10(15.9)	7(11.1)	2(3.2)	2.20	6th
Mixed cropping	24(38.1)	15(23.8)	16(25.4)	4(6.3)	4(6.3)	2.19	7th
Early harvesting	24(38.1)	19(30.2)	15(23.8)	3(4.8)	2(3.2)	2.04	8th
Use of prayer and socio-cultural adaptations	25(39.7)	21(33.3)	11(17.5)	3(4.8)	3(4.8)	2.01	9th

Source: *Field Survey, 2021*

Constraints Faced by the Sesame Farmers

The constraint faced by farmers due to climate change in the area is presented in Table 5. The distribution shows that about 69.8% of the respondents faced inadequate capital, while about 46.0% viewed shortage of rainfall as their major constraint. Also, about 55.6% of the respondents viewed pest and disease attack as the major hindrance, about 54.0% of the respondents revealed high cost of farm inputs such as fertilizer, pesticide and herbicides, etc. The assessment further showed about 42.9% of the farmers' battle with high cost of farm labor.

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44.4% viewed poor information about climate change as a constraint faced due to climate change. This finding agrees with Mendelson and Williams (2004) who stated that lack of money hinders small scale farmers from getting the necessary resources and technologies due to the fact that adaptation strategies are very costly which make farmers vulnerable to the negative effects of climate change. This is in agreement with a study carried out by Apata, Samuel and Adela (2009) which reported that the most adverse effects of climate change are felt mainly by developing countries, especially those in Africa due to their low capital income that will increase their level of coping capacities.

Table 5: Constraints Faced by the Sesame Farmers

VARIABLES	Constraint Freq (%)	Not constraint Freq (%)	Rank
Inadequate Capital	44(69.8)	36(57.1)	1st
Pest and disease attack	35(55.6)	35(55.6)	2nd
High cost of farm inputs such as fertilizer, herbicides, etc.	34(54.0)	34(54.0)	3rd
Shortage of rainfall	29(46.0)	29(46.0)	4th
Poor information about climate change	28(44.4)	28(44.4)	5th
High cost of farm labor	27(42.9)	19(30.2)	6th

Source: *Field Survey, 2021*

CONCLUSION AND RECOMMENDATION

The study revealed that farmers in the study area perceived climate change through observed changes in their crop yield, humidity, wind pattern, heat intensity and changes in rainfall pattern. Meanwhile climate change adaptive strategies they used to ameliorate its effect on their production activities were; use of soil-water conservation practices, use of agro-chemicals, different tillage method, early planting and use of improved varieties. However the sesame farmers faced challenges of inadequate capital, pest and disease attack as well as high cost of production inputs as constraints hindering their output potential. It can therefore be recommended that inputs subsidies and training on early warning systems of climate change shall be given to the farmers so as to improve their awareness on climate change.

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