ASSESSING CLIMATE CHANGE PERCEPTIONS AND ADAPTATION STRATEGIES AMONG SESAME FARMERS IN YOBE STATE, NIGERIA.

CONTRIBUTIONS OF AUTHORS: This work was carried out in collaboration among all authors. MJM formulated and executed the research project. OEO helped in data analysis and interpretation. HHB and MHK were involved in data collection and coding. All authors have read and approved the research.

ABSTRACT

The study was conducted on sesame farmers' perception of climate change on sesame production in Bade Local Government Area of Yobe State, Nigeria. A sample of 125 farmers was selected for the study. Data was collected on the socioeconomic characteristics of the farmers, perception of climate change, sources of information, adoption of adaptation strategies and constraints to sesame production. Descriptive statistics such as means, percentages and Likert scale were used to analyze the data. The results show that male farmers (80.0%) dominated sesame production. The mean age was 35.03 years and most (64.0%) of the farmers weremarried. Most (56.8%) of the respondents had unfavourable perception of climate change. The major source of information on climate change was other farmers (86.4%). Most (52.8%) of the respondents had low level of adoption of climate change adaptation strategies. The majority (53.6%) of the respondents faced high level of constraints to sesame production.It was recommended that agricultural extension services should be revived to disseminate climate change information to sesame farmers*so as to improve their control measures to climate change* with the view to enhance sesame production

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Key words: Perception, climate change, sesame, production

INTRODUCTION

Sesame, an ancient oilseed, is one of the oldest cultivated plants in the world. Sesame (*Sesamumindicum L.*), otherwise known as sesame or benniseed, member of the family pedaliaceae, is a significant plant among Nigerian farmers and it is widely grown solely or intercropped with other plants as a small-holder plant (Abu *et al*, 2011). The highest grower of sesame seeds in Africa is Nigeria but 90% of sesame seeds produced is sold outside the country. It contributed 0.57% of the total export value and 36.39% of the total agricultural exports to the Nigeria economy (Proshare, 2015). Nigeria has the highest untapped potential from sesame

export estimated to be $170 million (NEPC, 2018). This increasing demand for sesame seed gives Nigeria the privilege to increase its production to satisfy the worldwide demand for the product. The realization of the capability of sesame production to earn foreign exchange for the country has made the production of sesame a prominent enterprise in the country. In Nigeria, sesame is cultivated on over 80,000ha across most of the northern states for food and oil.Sesame is one of the cash crops grown in Yobe State. It is a very popular crop among the rural farmers. It was reported that 85% of small scale farmers in Yobe State are involved in sesame production, processing and marketing of sesame, 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)

Climate change is a critical phenomenon with strong implications for human systems, and consequently human development.The impact of climate change is visible and widespread in Africa and the world in general.According to FAO(2010), Nigeria is already experiencing the impacts of climate change, with more extreme weather events occurring, more variability in timing and intensity of rainfall and higher temperatures over the whole country. In Yobe State, analysis of climatic data over 35 years (1981- 2016) have shown anomalies in rainfall, temperature and evaporation. During this period, Yobe State and indeed the entire northern part of Nigeria suffered series of drought notably, the droughts of 1970s, 1980s and 1990s. There is an observed increasing average rainfall trends but this was accompanied by higher average temperature trends (1999–2016). This higher temperature trend will have effect on crop and pasture production (NIMET, 2017).

Yobe State is an agrarian state.Evidence of climate change have indicated that, there were delayed onset of rains, particularly in Northern part of the State, increase in the number of dry days during the raining season and increase in maximum temperature, strong winds, thunderstorms respectively (Saleh, 2014). Yobe is estimated to account for 73% of annual loss of resources from desertification among the eleven frontline States in Nigeria [(YOSERA), 2012-2015]. Therefore, communities in the State had a serious problem of crop failure, or low yield arising from climate variability particularly the delayed onset of rains and the increasing length and frequency of dry spells during the growing season. In addition the problem of flood, high temperature and incidences of pests and diseases have also aggravated the irrigation and upland famers' losses which consequently increase the incidence of poverty and malnutrition in the

State. Unless appropriate mitigation and adaptation strategies are taken, climate change will frustrate common man, particularly farmers' in their effort to achieve sustainable agricultural production and food security Sale(2016)Arifah*et al*,(2021) reported that 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 socioeconomic factors.Consequently, the primary motive to embark on this research was to investigate and fill the existing gap in knowledge on farmers' perception of climatechange and coping strategies to changing climate and their determinants in the rural farming households in Nigeria.

The specific objectives were to:

i. determine the socioeconomic characteristics of the sesame farmers in the study area;

ii. assess sesame farmers' perceptions of climate change in the study area;

iii. identify sources of information on adaptation strategies used by the farmers;

iv. ascertain the suitable adaptationstrategiesadopted by respondents; and

v. identify the constraints faced by sesame farmers in the study area.

MATERIALS AND METHODS

The study was carried out in Bade Local Government Area (LGA) in Yobe State, Nigeria. The LGAis bounded byJakuskoonthe South, Bursarionthe East, Yusufarion the North and Karasuwaon the West. Its Coordinates are 12°52′N and 10°58′E. It has an area of 772 km² and a population of 139,782 at the 2006 census (Ishaya, *et al.,* 2018).The hottest months are March and April with temperature ranges of 38-40° Celsius. In the rainy season, June-September, temperatures fall to 23-28° Celsius, with rainfall of 500mm to 1000mm. People in the area, who are mainly smallholder farmers, produce different crops such as sesame, millet, sorghum, cowpea, wheat, soybeans and rice.

The sample for this studywas taken from the population of sesame farmers in Bade LGA. The Local Government Area has ten (10) geopolitical wards namely, Sarkin hausawa, Lawan musa, Lawan Fannami, Zango, Katuzu, Sabongari, Gwio-kura, Dagona, Usur/Dawayo and Sugum/Tagali. The study employed the use of two-stage sampling procedure. In the first stage, four (4) wards were purposively selected because of high concentration of sesame farmers.

Second stage involved simple random selection of fifteen percent (15%) of sesame farmers from the lists of sesame farmers in the selected four (4) wards leading to the final selection of a total of one hundred and twenty-five (125) respondents for the study. Table1 below shows the selection procedure.

Table 1: Sample frame and sample size of sesame farmers

Wards	Sampling frame	Sample size (15%)
Katuzu	200	30
Lawan-Fannami	161	24
Usur-Dawayo	153	23
Zango	317	48
Total	831	125

Source: Department of Agriculture, Bade Local Government Area, 2023

Collection of Data

Primary data was collected from selected sesame farmers using a structured questionnaire.The data was collected on socioeconomic characteristics of the sesame farmers, sesame farmers' perception of climate change, sources of information on adaptation strategies used by sesame farmers, adaptation strategies adopted by sesame farmers, and constraints faced by sesame farmers in the study area. Descriptive statistics such as mean, frequency counts and percentageswere used to analyse the data.

Measurement of variables

Sesame farmers' perception of climate change: It was measured using a Likert Scale comprising seventeen perception items (negative and positive) in which the respondents indicated their level of agreement or disagreement with the items as follows: Strongly Agreed (5), Agreed (4), Undecided (3), Disagreed (2) and Strongly disagreed (1). Scoring was reversed for negative items.

Sources of information on adaptation strategies to climate change: It was measured by asking the respondents to indicate through ticking the sources of their information on adaptation strategies to climate change.

Adaptation strategies adopted by sesame farmers: It was measured by asking the respondents to indicate the adaptation strategies they employed to cope with climate change using a five-

point Likert type scale of Strongly Agreed (5), Agreed (4), Undecided (3), Disagreed (2) and Strongly disagreed (1).

Constraints to sesame production faced by farmers: It was measured by asking the respondents to indicate the level of constraints using a four-point rating scale of Very Severe Constraint (4), Severe Constraint (3), Mild Constraint (2), Not a Constraint (1)

Statistical tools to be used

Descriptive statistical tool and Likert scale were used to analyze the data. Descriptive tools used include mean, frequency counts and percentages to achieve objectives 1, 3 and 5.

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, thevariables were measured using a five-point Likert Scale comprising seventeen items (negative and positive) in which the respondents indicated their level of agreement or disagreement with the items as follows: Strongly Agree (5), Agree (4), Undecided (3), Disagree (2) and Strongly disagree (1). Likert Scale was employed to achieve objectives 2 and 4

Limitation of the Study

The limitation of the study was farmers' inability to clearly apprehend the meaning of climate and weather as needed. They were also not able to recall in detail their experiences of several climatic shift events from the past as at when interviewed.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Respondents

According to Cathy &Nahanga, (2017) socio-economic characteristics of farmers in any community affect their livelihood and welfare. This study therefore used some of the socioeconomic characteristics of farmers in the study to relate it with how they may act on climate change as it affected their farming activities. Table 2 presents the socio-economic characteristics of the respondents. The results show that 43.2% of the respondents were between the ages of 25-34 years, 25.6% were between the ages of 35-44 years while 10.4% were between

the ages of 45-54 years. The mean age was 35 years. The results implied that sesame farmers are young and active producers who have the physical and mental abilities to contribute to the growth of sesame production sub-sector of the economy if given all the necessary support. The finding is similar to the findingsof Madaki *et al*(2022) andOwoade*et al* (2021) who reported that the mean age of rice farmers in Bade Local Government Area was 33.5years and 38.62 years, respectively.Also, the results revealed that 80.0% of the respondents were males while 20.0% were females. Therefore, sesame production in the study area was dominated by male farmers which could be explained by tediousness associated withthe production of sesame.The finding is similar to the findings of Madaki *et al*(2022) and Owoade*et al* (2021).Owoade*et al* (2021) who reported that rice farmers in Bade Local Government Area were mainly males. Furthermore, Table 2 reveals that only 11.2% of the respondents did not acquire formal education, 48.0% had primary school education, 30.4% had secondary education and 10.4% had tertiary education. The finding is in agreement withNwalem *et al,* (2019) andRukwe*et al* (2020) who reported that the majority ofsesame farmers were literate.This implies that the sesame farmers are educated. Education enhances farmers' ability to acquire and use agricultural information. It further helps farmers to adopt new agricultural ideas and practices to boost production. In addition, the Table reveals that the majority (77.6%) of the respondents had household size ranging from 1 to 10, 20.8% had household size of 11 to 20 while 1.6% had 21 and above. The mean household size was 8. The finding is similar to the findings ofMadaki *et al*(2022) andOwoade*et al* (2021) who reported the mean household size of rice farmers in Bade Local Government were 8 and 9, respectively.This implies that the respondents had large household size which could make family labour available for sesame farming. Moreover, Table 2 reveals that most (68.8%) of the respondents had 1-10 years of experience in sesame farming and 31.2% had 11 and above years of experience. The mean year of experience in sesame farming was 9.2. Hence, respondents had sufficient years of experience which can enhance their perception of climate change in the area. Furthermore, Table 2 shows that the majority (96.8%) of the respondents had between 1 to 5 hectares of farm holding, and 3.2% had 6 and above hectares. Theaverage size of farm holding was 2.83 hectares.This implies that the respondents are mostly smallholder sesame farmers. Results in Table 4.1 further show that 37.6% had livestock farming as their other source of income, 28.8% are civil servants and 7.2% produce other crops. Sesame farmers were also

involved in other agricultural enterprises probably to reduce risks associated with farming and boost their income.

Table 2: Socio-economic characteristics of the respondents (n=125)

Variables	Frequency	Percentage (%)	Mean	Standard deviation
Age (in years)				
15-24 years	20	16.0		
25-34 years	54	43.2		
35-44 years	32	25.6		
45-54 years	13	10.4		
55 years and above	06	4.8	35.03	11.14
Sex				
Male	100	80.0		
Female	25	20.0		
Marital status				
Married	80	64.0		
Single	32	25.6		
Widowed	07	5.6		
Divorced	06	4.8		
Level of education				
Qur'anic education	14	11.2		
Primary education	60	48.0		
Secondary education	38	30.4		
Tertiary education	13	10.4		
Household size				
1-10	97	77.6		
11-20	26	20.8		
21 and above	02	1.6	7.65	3.93
Years of sesame farming experience				
1-10	86	68.8		
11 and above	39	31.2	9.20	8.57
Farm size (in hectares)				
1-5	121	96.8		
6 and above	04	3.2	2.83	1.39
Other sources of income				
Production of other crops	09	7.2		
Civil service	36	28.8		
Livestock production	47	37.6		
Qur'anic teaching	33	26.4		

Source: Field survey, 2023

Sesame Farmers' Perception of Climate Change

Results in Table 3 show that the majority (71.2%) of the sesame farmers agreed that there was an observed increase in temperature in recent years. The finding agrees with the finding by Galadima and Nandi (2016) and Jorge*et al* (2020)who reported that farmers' perceived increase in temperature as being the highest effect of climate change. Majority (71.2%) of the sesame farmers also agreed that cutting down trees causes climate change. Almost half (43.2%) of them were undecided that overgrazing of animals causes climate change and 72.8% of the sesame farmers agreed that there was usually a delay in rainfall these days.Furthermore, the majority (78.4%) of the sesame farmers disagreed that flooding is now a regular occurrence on sesame farmland, the finding is in contrast to the finding by Tologbonse*et al* (2010) that climate change increases flooding, which results in soil erosion, loss of soil fertility and low agricultural productivity. The results also showed that majority (78.4%) of the sesame farmers agreed that climate change has led to a change in planting date of sesame;86.4% of the farmers strongly disagreed that God is responsible for climate change. In addition,most (89.6%) sesame farmers strongly disagreed that there is nothing farmers can do to reduce climate change; while 62.4% of the sesame farmers agreed that burning of vegetation is one of the causes of climate change and 8.8% strongly agreed. The results further reveal that more than half (62.4%) of the sesame farmers were undecided that crop rotation is a measure to prevent climate change. The mean scores reveal the level of agreement or disagreement with the perception statements while the overallmean (3.54) was used as the threshold for agreement with the perception statements. The mean score of each statement that was above the overallmean indicates agreement with that statement. The respondents agreed with statements i, ii, iv, v, vii, viii, ix, x, xi, xii, xiii, and xvi.

By using the criterion of above and below the mean (60.34), only 43.2% of the respondents had favourable perception of climate change while most (56.8%) of the respondents had unfavourable perception of climate change. Unfavourable perception of climate change implies that their understanding, knowledge and interpretation of climate change werelow. With the majority of sesame farmers having unfavourable perception of climate change, their preparedness and response to climate change adaptation strategies may be inadequate thereby leading to low crop yields and farm level income. Therefore, providing extension education is a sine qua non to boosting farmers' perception of climate change and the need to adopt adaptation strategies.

Table 3: Sesame farmers' perception of climate change (n=125)

S/N	Statement	SA	A	U	D	SD	Mean
i.	There is an observed increase in temperature in recent years.	12.0	71.2	12.0	4.8	0.0	3.90*
ii.	Cutting down trees causes climate change.	14.4	71.2	14.4	0.0	0.0	4.00*
iii.	Overgrazing of animals causes climate change.	5.6	41.6	43.2	9.6	0.0	3.43
iv.	Rainfall distribution is heavy within few months.	15.2	41.6	36.0	7.2	0.0	3.65*
v.	There is usually a delay in rainfall these days.	10.3	72.8	13.6	3.2	0.0	3.90*
vi.	Flooding is now a regular occurrence on sesame farmland.	0.0	0.0	10.4	78.4	11.2	1.99
vii.	Burning of vegetation is one of the causes of climate change.	8.8	62.4	16.8	12.0	0.0	3.68*
viii.	Climate change has been reducing crop yields.	2.4	62.4	24.8	10.4	0.0	3.57*
ix.	Climate change has led to a change in planting date of sesame.	7.2	78.4	13.6	0.8	0.0	3.92*
x.	Climate change has caused a reduction in the yield of sesame.	8.8	75.2	15.2	0.8	0.0	3.92*
xi.	Climate change has caused a sudden end of rainfall during the growing cycle of sesame.	16.8	69.6	11.2	2.4	0.0	4.00*
xii.	God is responsible for climate change.	0.0	0.0	0.0	13.6	86.4	4.86*
xiii.	There is nothing farmers can do to reduce climate change.	0.0	0.0	0.0	10.4	89.6	4.90*
xiv.	Cutting down of trees cannot lead to climate change.	83.2	8.8	8.0	0.0	0.0	1.99
xv.	A change in rainfall pattern has not been observed during the growth cycle of sesame.	8.8	85.6	5.6	0.0	0.0	1.99
xvi.	Planting of trees can prevent climate change.	0.0	76.8	16.8	4.0	2.4	3.78*
xvii.	Crop rotation is a measure to prevent climate change.	0.0	3.2	62.4	0.0	34.4	2.69
	Overall mean	**3.54**					
	Perception	Percentage		Min.	Max.	Mean	
	Favourable(>60.34)	43.2					
	Unfavourable(<60.34)	56.8		54	65	60.34	

Source: Field survey, 2023

Mean > 3.54* indicates agreement while mean < 3.54 indicates disagreement.

Respondents' Sources of Information on Sesame Production in Relation to Climate Change.

The results in Table 4 shows that the majority (86.4%) of the sesame farmers got their information on sesame production from other farmers, (11.2%) and (6.4%) of the sesame farmers got their information from radio and television respectively. Furthermore 5.6% of the sesame farmers got their information on sesame production from Non-Governmental Organizations (NGOs) and about (17.6%) of the farmers got information from extension agents. This results implied inadequate extension service in the study area and lack of access to television and radio information. Awareness of the effects of climate change, through appropriate and reliable sources, is an important determinant of adoption of suitable adaptation strategies to cope with such changes,reduce losses and take advantage of the opportunities associated with these changes.Maddison (2007) found that farmer's awareness and perceptions of soil erosion problems positively and significantly affected their decisions to adopt suitable adaptation strategies.

Table 4: Sources of information of the respondents on sesame production (n=125)

S/N	Source of information	Frequency	Percentage (%)
i.	Extension agents	22	17.6
ii.	Other farmers	108	86.4
iii.	Radio	14	11.2
Iv.	Newspapers	14	11.2
v.	Television	08	6.4
vi.	Non-Governmental Organizations (NGO's)	07	5.6

Source: Field survey, 2023

Respondents' Adoption of Adaptation Strategies on Climate Change

The results in Table 5 on sesame farmers' level of adoption of adaptation strategiesrevealed that the overall mean of adaptation strategies used by the respondents was 3.78. Therefore, the adoption of fertilizers, manures and pesticides (4.10),early planting (4.06), planting of drought resistant varieties (3.90),different tillage system (3.86), soil water conservation practices (3.83) as adaptation strategieswas high among sesame farmers to cope with climate change and boost sesame production.The results implied that sesame farmers adopted different climate change adaptation strategies to cope with the effect of climate change.The finding is in agreement with Agbugba (2017) who reported that sesame farmers adopted improved seed varieties, early planting and used of chemicals to cope with the effect of climate change on sesame production.

By using the criterion of above and below the mean (26.47), only 47.2% of the respondents had high level of adoption of climate change adaptation strategies while more than half (52.8%) of the respondents had low level of adoption of climate change adaptation strategies. The result implies that the adoption of adaptation strategies by most respondents was low. Hence there is a need to give extension education to farmers on climate change adaptation strategies to avoid losses of sesame and boost its production.

Table 5: Respondents' adoption of adaptation strategies on climate change (n=125)

S/N	Statement	SA	A	U	D	SD	Mean
i.	Planting of early-maturing varieties of sesame.	0.0	52.0	5.6	42.4	0.0	3.09
ii.	Planting of different crops.	0.0	81.6	0.0	18.4	0.0	3.63
iii.	Planting of drought resistant varieties.	2.4	89.6	4.0	4.0	0.0	3.90*
iv.	Use of soil water conservation practices.	0.0	91.2	0.8	8.0	0.0	3.83*
v.	Using different tillage systems.	0.8	92.0	0.0	7.2	0.0	3.86*
vi.	Use of fertilizers, manure and pesticides.	10.4	89.6	0.0	0.0	0.0	4.10*
vii.	Early planting.	8.8	88.8	2.4	0.0	0.0	4.06*
	Overall mean	**3.78**					
	Adoption of adaptation strategies	Percentage	Min.	Max.	Mean		
	High(>26.47)	47.2					
	Low(<26.47)	52.8	22	30	26.47		

Source: Field survey, 2023

Mean > 3.78* indicates high adoption of adaptation strategies while mean < 3.78 indicates low adoption of adaptation strategies.

Constraints Faced by the Sesame Farmers

The constraints faced by sesame farmers are presented in Table 6. The results show that 92.0% of the sesame farmers indicated that inadequate extension services was a very severe constraint; 77.6% of the sesame farmers indicated that lack of improved seeds was a very severe constraint while 86.4% indicated low rainfall as a very severe constraint. Also, 86.4% of the farmers indicated that pest and diseases was a very severe constraints; 84.8% of the respondents indicated soil infertility as a very severe constraint while 84.0% respondents faced high cost of fertilizers as a very severe constraint. The mean scores further indicate that the high constraints

to sesame production are inadequate extension services (3.92), pests and diseases (3.86), low rainfall (3.86),soil infertility (3.85), lack of access to fertilizers (3.83), and lack of improved seeds (3.78). By using the criterion of above and below the mean (26.32), only 46.4% of the respondents faced low level of constraints to sesame production while more than half (53.6%) of the respondents faced high level of constraints to sesame production. The result implies that the majority of sesame farmers were faced with high constraints which can cause low production of sesame in the study area. Hence there is a need to address the major constraints to sesame production.

Table 6: Constraints faced by the sesame farmers on sesame production (n=125)

S/N	Constraint	4 Very Severe constraint	3 Severe Constraint	2 Low constraint	1 Not a constraint	Mean
i.	Lack of improved seeds	77.6	22.4	0.0	0.0	3.78*
ii.	Soil infertility	84.8	15.2	0.0	0.0	3.85*
iii.	Pest and diseases	86.4	13.6	0.0	0.0	3.86*
iv.	Low rainfall	86.4	13.6	0.0	0.0	3.86*
v	Lack of access to pesticide	0.00	0.00	83.2	16.8	1.83
vi.	Lack of access to fertilizers	84.0	15.2	0.8	0.0	3.83*
vii.	Lack of access to loan	0.00	0.00	40.0	60.0	1.40
viii.	Inadequate extension services	92.0	8.0	0.0	0.0	3.92*
	Overall mean	3.29				
	Constraints	Percentage	Min.	Max.	Mean	
	High(>26.32)	53.6				
	Low(<26.32)	46.4	22	30	26.32	

Source: Field survey, 2021

Mean > 3.29* indicates high constraint to sesame production while mean < 3.29 indicates low constraint sesame production

CONCLUSIONAND RECOMMENDATIONS

From the results of this study, it can be concluded that the sesame farmers' perception of climate change was unfavourable.Adoption of adaptation strategies to climate change was also low. The majority of sesame farmers faced high level of constraints to sesame production and the major ones were inadequate extension services, pests and diseases, soil infertility, low rainfall and lack of improved seeds. The majority of sesame farmers got their information from other farmers instead of the extension service mandated and equipped with scientific information and

innovations to assist farmers in combating the effects of climate change and motivate them to adopt adaptation strategies. Based on the findings of the study, it was recommended that agricultural extension services should be revived to disseminate climate change information to sesame farmers and promote improved sesame production. Constraints facing sesame production should be addressed in the study area.

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