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An Assessment of Farmers' Awareness and Percetion of Climate Change on the Yield of Grains in Sokoto State, Nigeria

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Abstract
This study examined farmers' awareness and perception of climate change on grain yield in Sokoto State, Nigeria. Systematic multi-stage sampling technique was used to select 6 LGAs in the state. Seven hundred and eighty-three (783) grain farmers were purposively selected using Krejcie and Morgan (1970)'s sample size determination. Yamane (2010) method was used to determine the number of respondents from each of the settlements. Structured questionnaire and FGD scheduled were used to obtain the required information from the selected farmers. Seven hundred and sixty-two (97.3%) questionnaire were successfully returned. Both descriptive (frequencies, percentages, mean) and inferential statistics (Likert-type rating techniques) were used for data analysis and presentation. Findings from the study show that 97% of the farmers are aware of climate change. 34% of the farmers got their source of information on climate change from personal observation and from interaction with friends and researchers. The results further show that 72% of the farmers perceived that climate change is an act of God; 95% perceived that rainfall onset dates are now coming late; 75% perceived that cessation dates are now earlier than before and 90% perceived that temperature is rising. The result further revealed that the farmers perceived agricultural drought, increase in crop infestation by pest and diseases, flooding of farmlands, increase in poverty and decrease in grain yield as effects of climate change on grain yield. The study recommended that the government agencies and NGOs should assist in raising awareness about climate change to the farmers; there should be adequate provision of weather forecast records and climate related data; grain farmers should be encouraged to participate in agricultural extension services which will educate them on the effects of climate change and adaptation strategies.

Key words: Adaptation Strategies, Assessment, Climate Change, Grain Farmers and Grain Yield

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I. Introduction

Climate change is perceived as the most serious danger facing human society in the 21st century (Dojovic and Doole, 2014). Recent scientific findings by individuals (e.g.Emeghra, 2015; Ikpe, 2014 and Odjugo 2010), and institutions such as the Inter-Governmental Panel on Climate Change (IPCC, 2007), the United Nations Development Programme and the World Bank, (2010) have demonstrated that climate change is a reality and a primary environmental threat to sustainable development in the 21st century. IPCC (2007) defined climate change as a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, which persists for an extended period typically decades or longer. The most crucial thing about the concept of climate change is not only the time periods involved but also the degree of variability that the change is subjected to, as well as the duration and impact of such variability on man and the ecosystem (Ayoade, 2003). According to Odjugo (2010a), climate change is caused by two basic factors: natural processes (bio-geographical) and human activities (anthropogenic).

According to the United Nations Framework Convention on Climate Change (UNFCCC, 2006), perception is generally understood to mean an attitude or understanding based on what is observed or thought. It is the process by which we receive information or stimuli from our environment and transform it into psychological awareness. Doss and Morris (2001) opined that the perspectives of the local farmers, the way they think and behave in relation to climate, as well as their values and aspirations have a significant role to play in addressing climate change. The farmers live close to the natural resources, and have immense knowledge of their micro-environment, observe the activities around them and are first to identify any changes and adapt to them (Anthony, 2006). Farmers' perceptions are therefore very important in the study of climate change because

they form critical components of the socio-political context within which policy makers operate (Leisorewitz, 2006).This research is therefore aimed at assessing the farmers' perception and awareness of climate change on the yield of grains in Sokoto State.

Study Area

Sokoto State is located in the north-west Sudano-Sahelian Savannah ecological belt of Nigeria between Latitudes 11° 3' and 13° 50' N of the Equator and Longitudes 4° 14' and 6° 40' E of the Greenwich Meridian (Abubakar, 2006). Its headquarters is at Sokoto. It has an area of 25,973 Km^2. It is bounded by Niger Republic to the north, Zamfara State to the east and south and Kebbi State to the west. Presently, the State has twenty-three (23) Local Government Areas (LGAs) (see Figure 1).

Sokoto State is located in the semi-arid region of Nigeria, where desertification is intensifying and rainfall is unreliable for crop production (Odjugo and Ikhuoria, 2003). The annual rainfall is between 500mm in the north and 800mm in the south. Ojo (1991) reported that rainfall in Sokoto State as in other parts of the Sudan-Sahelian savannah ecological belt is very erratic and characterized by late onset and early cessation which could have adverse effect on effective crop cultivation if no viable adaptation strategies are put in place. Odjugo (2010) observed that this erratic rainfall pattern which lasts for only four months (June – September) and the climatic characteristics of Sokoto State favour the cultivation of grain crops. The average temperature during the dry season is about 40.6ºC.

The topography of Sokoto is dominated by the famous Hausa plain of northern Nigeria. The state is drained by the Rima River. The study area combines both sandy and alluvial type of soils. According to the 2006 population census, Sokoto State has a population of 3,702,676 (NPC, 2006). It has a population density of 169.1Km^2. Sokoto State is mainly populated by Hausa, Fulani and the Zabamarwa people.

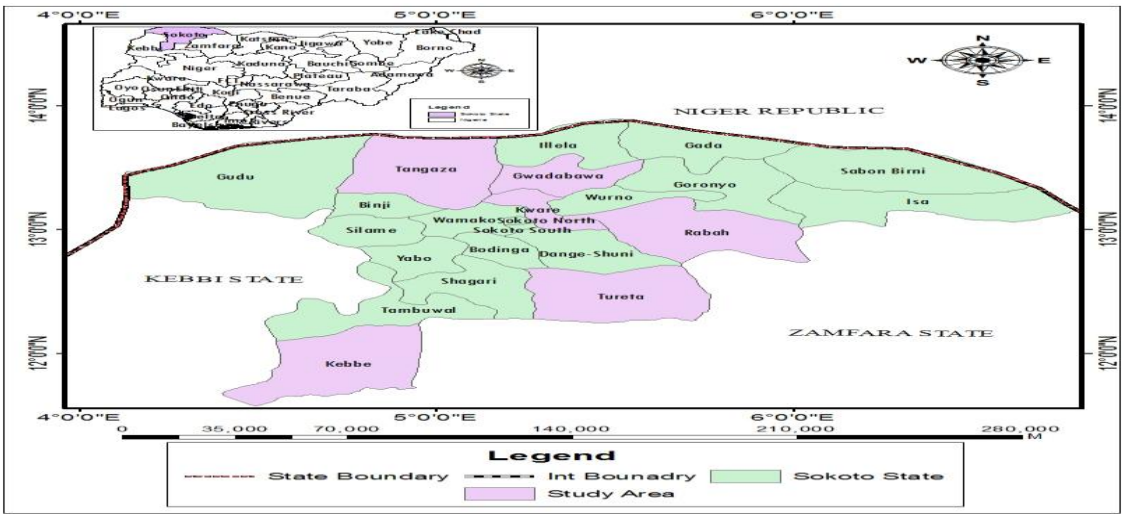

Figure 1: Map of Sokoto State showing the Study Area
Source: Sokoto State Administrative Map, 2019

II. Methodology

A multi-stage sampling technique was used for the study. In the first stage, the Local Government Areas (LGAs) in the State were clustered into the three senatorial zones of Sokoto East, North and South.

In the second stage, systematic sampling technique was used to select the LGAs from the three senatorial zones of the State. For proper representation, the LGAs in each senatorial zone were arranged in alphabetical order and every third LGA were selected as a sampled LGA. Thus, the selected LGAs were Gwadabawa, Rabah, Kware, Tangaza, Kebbe and Tureta.

Sample size was based on Krejcie and Morgan's (1970) sample size determination. It stated that where a population range is between 500,000 and 10,000,000 the sample size is 783 at 95% confidence level and 3.5% margin of error. 3.5% margin of error was chosen in order to minimize the margin of error as smaller sample sizes will yield larger margins of error. Therefore, since the 2018 projected total population of the study area falls within this range (1,179,980), the sample size of 783 was adequate and used for this research.

In the third stage, systematic sampling technique was used to select wards from the six selected LGAs. For proper representation of the six (6) selected LGAs, the wards in each of the LGAs were arranged in alphabetical order and every third ward was picked from each LGA. A total of nineteen (19) wards were selected from the six sampled LGAs (three wards each from Gwadabawa, Rabah, Tangaza, Kebbe, Tureta and four wards from Kware LGAs).

The fourth stage involved the use of purposive sampling technique to determine the actual settlements from which respondents were drawn. Settlements already identified during the reconnaissance survey to have the highest number of grain farmers were chosen; one from each ward to make a total of nineteen (19) settlements.

In the fifth stage, purposive sampling technique was used to select the respondents from the sampled settlements. Grain farmers above thirty (30) years of age and who must have lived in the study area for at least twenty (20) years were identified through the "Sarkin Noma" (Head of the Farmers) and the village Heads. The reason for this decision was that those within the age bracket had the information needed about climate change in the area. Questionnaire was administered proportionately among the selected settlements. Out of the 783 questionnaire administered, 762 were successfully returned.

III. Results and Discussion

Sex Distribution of the Grain Farmers -

Table 1 show the socio-economic characteristics of the sampled farmers. The result show that majority (95%) of the grain farmers were male, while 5% were females. This result agrees with the findings of Umar, Isah, Bello and Abubakar (2015) which reported that males dominate the agricultural workforce in Sokoto State with 99.1%. According to Umar *et. al* (2015), the high proportion of males to females in Sokoto State may be because religion and custom play crucial roles in the livelihoods of the people of the state. For instance, males who are mostly the household heads have more access to land and participate more in outdoor activities than females. The results further agree with the observation of Adedoyin, Mbada, Awofolu and Oyebami (2015) who reported that women are restricted from actively participating in farming and other outdoor activities as a result of the socio-religious belief in northern Nigeria.

Table 1: Frequency Distribution of the Farmers by their Socio-economic Characteristics

Variables		
Gender of the Grain Farmers	**Frequency**	**Percentage**
Male	724	95
Female	38	5
Total	**762**	**100**
Age (Years) of the Farmers		
30 – 40	198	26
41 – 50	213	28
51 – 60	205	27
61 – 70	137	18
71 &Above	8	1
Total	**762**	**100**
Religion of the Grain Farmers		
Islam	739	97
Christianity	19	2.5
Traditional religion	4	0.5
Total	**762**	**100**
Marital Status of the Grain Farmers		
Married	686	90
Divorced	15	2
Single	42	5.5
Widowed	19	2.5
Total	**762**	**100**
Level of Education of the Grain Farmers		
Primary	122	16
Secondary	175	23
Tertiary	152	20
Koranic	251	33
No formal education	61	8
Total	**762**	**100**
Years of Farming Experience		
20 – 25	312	41
26 – 30	198	26
31 – 40	92	12
41 – 45	76	10
46 – 50	69	9
50 & above	15	2
Total	**762**	**100**

Source: Field Work 2019

Age Distribution of the Grain Farmers -

Table 1 show the age distribution of the grain farmers in the study area. The results of the age of the farmers shows that 26% fell within 30 – 40 years; 28% fell within 41 – 50 year; 27% fell within 51 - 60 years; 18% fell within 61 – 70 years and 1% fell within 70 years and above. Majority (74%) of the grain farmers fell within the age of 41 and above. The average age of the farmers was 49 years. Gbege and Akubuilo (2013) acknowledged that the age of a farmer may positively or negatively influence the decision to adopt new technologies as older farmers have more experience in farming and consequently have a higher probability of adopting modern technology than younger farmers.

Distribution of the Grain Farmers by Religious Belief -

The result of the religious belief of the grain farmers are presented in Table 1. The table shows that 97% of the farmers are Muslims; 2.5% are Christians, while 0.5% belongs to the African traditional religion. The religious belief/faith of the respondents plays a major role on their perception of climate change, especially on what causes climate change. According to Constable (2016), the influence of religion, especially the Christian principles was evident in her study in the assertion that climate change is an act of God, a punishment for man's disobedience and a sign to end of the world. Tucker and Grim (2001) stated that religion provides explanations as to how the world was created, why, what humans' role is within it and even when natural disasters occur.

Marital Status of the Grain Farmers -

The results of the marital status of the grain farmers are presented in Table 1. The result shows that 90% of the sampled grain farmers were married. About 2% were divorced, while 5.5% were single and 2.5% were widowed. This result agrees with the study of Umar, Isah, Bello and Abubakar (2015) which stated that majority of the farmers (98.6%) in Sokoto State were married. This indicated that majority of the farmers have family responsibilities to cater for which affects their knowledge of climate change issues and farming activities.

Level of Education of the Grain Farmers -

Table 1 show the level of education of the grain farmers. The Table shows that 41% of the respondents never attended a formal school, that is, they had no formal education, while about 59% of the farmers had formal education. Out of the 59% of the farmers that had formal education, about 16% of them only attended primary school; 23% attended secondary school while about 20% attended higher institution at various levels; 33% had Koranic education and 8% had no formal education at all. This implies that majority of the respondents (43%) only attempted secondary school or its equivalent. These results agree with the findings of Nwaru and Onuoha (2010) that found out that a greater percentage of smallholder crop farmers in Imo State, Nigeria, only attempted secondary school or its equivalent.

Respondents' Experience in Grain Production -

The result of the farmers' years of farming experience in grain production in the study area is presented in Table 1. The result shows that 41% of the farmers have been farming in the study area for between 20 to 25 years; 26% have been farming in the area between 26 and 30 years; 12% between 31 and 40 years; 10% between 41 and 45 years; 9% between 46 and 50 years and 2% have been farming in the study area for more than 59 years. In all, the results revealed that about 59% of the farmers have been farming in the area for at least 25 years. The result on the farmers' years of farming in the study area helped to elicit climate change information from the farmers in the study area. Nhemachena and Hassan (2008) observed that the farming experience of a farmer matters more than merely the age of the farmer when it comes to perception and awareness of climate change. They argued that more farming experience increases the knowledge of the farmer on climate change issues. According to Mudzonga (2012), farmers with more years of farming experience in Zimbabwe have more information about changes in climatic conditions.

Farmers' Awareness of Climate Change

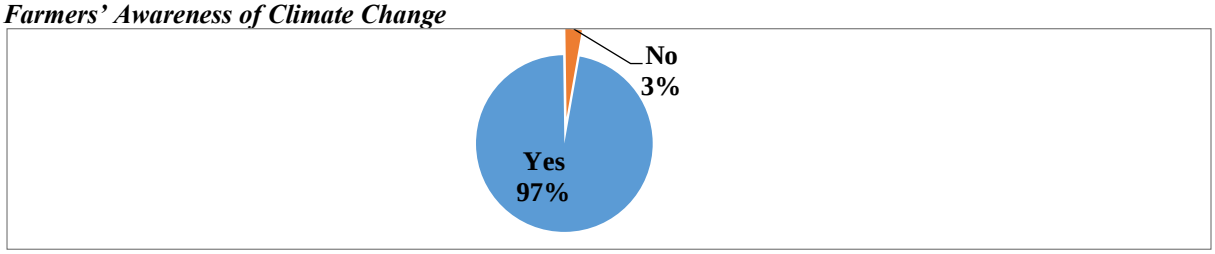

Figure 2: Grain Farmers Awareness of Climate Change

Source: Field Work 2019

Figure 2 shows that 97% of the grain farmers were aware of climate change, while 3% were not aware of climate change. This result agrees with the findings of Agboola and Emmanuel (2016) which indicated that 97% of undergraduates in Southwest Nigeria are aware of climate change.

Farmers' Years of Awareness of Climate Change

Table 2: Grain Farmers Years of Awareness of Climate Change

Awareness (Years)	Respondents	Percentage
Less than 5 years	157	21
6 – 10	234	31
11 – 15	184	24
16 – 20	177	23
Above 21 years	10	1
Total	**762**	**100**

Source: Field work 2019

The result shows that 21% of the farmers had been aware of climate change for less than 5 years; 31% for about 6 to 10 years; 24% for about 11 to 15 years; 23% had been aware of climate change for about 16 to 20 years, while about 1% had been aware of climate change for at least 21 years. According to Maddison (2006) the years of awareness of climate change have positive effect on the adaptation strategies used by the farmers, that is, the higher the number of years of awareness the more experienced the farmer in coping with the change in climate. He further stated that farmers' awareness of changes in weather parameters/attributes is important for adaptation decision making.

Sources of Information about Climate Change

The result on the sources of information about climate change is presented in Figure 3. The result shows that 34% got information about climate change through personal observation of the environment; 34% through interacting with friends, extension workers and researchers; 2% from the printed materials; 9% from electronic media; 2% from schools and 19% from all of the above mentioned sources.

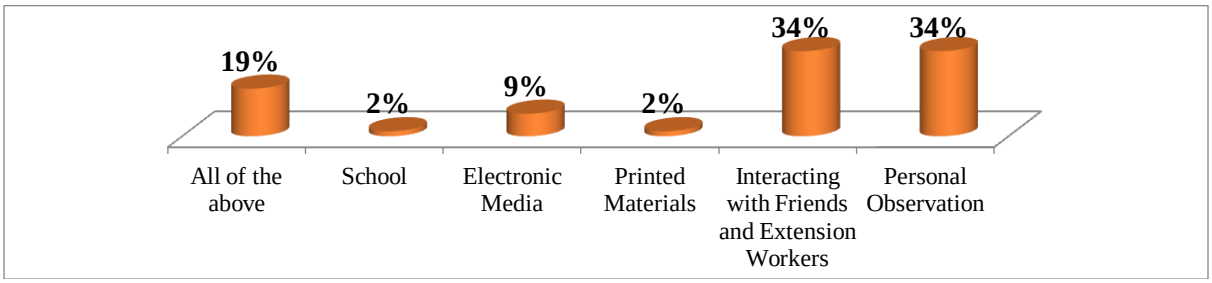

Fig. 3: Grain Farmers Sources of Information on Climate Change

Source: Field work 2019

On the sources of information about climate change in the study area, majority (34%) of the farmers chose interacting with friends, extension workers and researchers. That the majority stated that they got information on climate change from interacting with friends, extension workers and researchers agrees with the study of Umar (2015) which reported that 96% of farmers in Katsina State identified other farmers and extension workers as important source of information on climate change which implies that information on climate change is majorly disseminated informally in his study area. The results disagree with the findings of Ejeh (2015) which stated that the farmers in Kano State received information on climate change majorly from Radio and Television as agreed by 73.1% of his respondents.

Farmers Perception of the Causes of Climate Change

Table 3 presents the farmers' perception of what causes climate change. The result shows that 72% of the farmers strongly agreed that climate change is an act of God; 20% agreed; 0.5% were undecided; 4.5% strongly disagreed and 3% disagreed that climate change is an act of God. That 72% of the grain farmers in Sokoto State attributed the cause of climate change to an act of God agrees with the study of Constable (2016) which stated that 90% of the respondents in Jamaica believed that climate change is an act of God.

On whether climate change is natural and caused by nature, 48% strongly agreed; 44% agreed; 0.5% were undecided; 5.5% strongly disagreed and 2% disagreed that climate change is natural and caused by nature. On whether human activities such as deforestation, bush burning, overgrazing are responsible for the cause of climate change, 32% strongly agreed; 48% agreed; 5% were undecided; 9% strongly disagreed and 6%

disagreed that human activities are responsible for climate change. Twenty-nine percent of the farmers strongly agreed that climate change is caused by the use of modern technological developments such as gas flaring and industrialization which leads to pollution of the environment; 35% agreed; 8.5% were undecided; 11.5% strongly disagreed and 16% disagreed.

Table 3: Farmers Perception of the Causes of Climate Change

	Variables	SA	A	U	SD	D
A	Climate change is an act of God	550 (72%)	154 (20%)	4 (0.5%)	34 (4.5%)	20 (3%)
B	It is natural and caused by nature	368 (48%)	339 (44%)	4 (0.5%)	39 (5.5%)	12 (2%)
C	Human activities such as deforestation, bush burning, overgrazing etc. are responsible for climate change	245 (32%)	367 (48%)	38 (5%)	68 (9%)	44 (6%)
C	Modern technological developments (e.g. gas flaring) leads to pollution of the environment causes climate change	219 (29%)	269 (35%)	65 (8.5%)	87 (11.5%)	122 (16%)

Source: Field work 2019
Where: SA – Strongly Agreed; **A –** Agreed; **U –** Undecided; **SD –** Strongly Disagreed; **D –** Disagreed.

Farmers' Perception of Onset, Cessation, Number of Rainy Days and Effectiveness of Rainfall for Grain Yield in Sokoto State

The farmers' perception of onset dates, cessation dates, number of rainy days and the effectiveness of rainfall for grain yield in the study area are presented in Table 4. The result of the study shows that 58% of the grain farmers affirmed that rainfall onset is now coming late compared to the past ten years; 37% agreed; 2% were undecided; 2% strongly disagreed and 1% disagree that rainfall onset is now coming late compared to the past ten years.

Table 4: Farmers' Perception of Onset, Cessation, Number of Rainy Days and Effectiveness of Rainfall for Grain Yield in Sokoto State

	Weather and Climate Change Indices	SA	A	U	SD	D
A	Rainfall onset is now coming late compared to the past ten years	441 (58%)	282 (37%)	16 (2%)	16 (2%)	7 (1%)
B	Rainfall cessation is now earlier than before	335 (44%)	221 (29%)	15 (2%)	160 (21%)	23 (3%)
C	Number of rainy days/months/year is increasing	92 (12%)	205 (27%)	31 (4%)	252 (33%)	182 (24%)
D	The yearly rains are not supporting crop production as before	229 (30%)	381 (50%)	30 (4%)	92 (12%)	30 (4%)
E	Rainfall amount compared to the past ten years and more is decreasing every year	335 (44%)	297 (39%)	15 (2%)	84 (11%)	31 (4%)

Source: Field Work 2019

On whether rainfall cessation is now earlier than before, 44% strongly agreed that rainfall cessation is now earlier than before; 29% agreed; 2% were undecided, 21% strongly disagreed and 3% disagreed that rainfall cessation is now earlier. The fact that majority of the farmers characterized the climate of the study area as late onset and early cessation agrees with the study of Odjugo (2010b) which stated that the semi-arid region of Northwest Nigeria is experiencing late onset and early cessation of rains which affects crop production. The results further concur with the study of Sawa, Adebayo and Bwala (2014) which reported that crop farmers in Kano State perceived late onset and early cessation of rainfall. The result further agrees with Umar, Isah, Bello and Abubakar (2015) which reported that 68% of crop farmers perceived early cessation of rainfall in Sokoto.

The farmers' perception that the number of rainy days is increasing is presented in Table 4. The result show that 12% strongly agreed that the number of rainy days is increasing in the study area; 27% strongly agreed; 4% were undecided, while 33% strongly disagreed and 24% disagreed that the number of rainy days is increasing in the study area. In all 57% of the respondents disagreed that the number of rainy days is increasing in the state. The perception that the number of rainy days is decreasing in Sokoto State agrees with the study of

Odjugo (2010b) who observed that rainfall amount and duration is decreasing as rainfall amount was reduced by 178mm within the 70 years reviewed (1940 – 2010) in the Northwest States of Sokoto and Zamfara.

The grain farmers were asked whether the yearly rains are not supporting crop production as before, 30% of the farmers strongly agreed that the yearly rains no longer support effective crop production as before; 50% agreed; 4% were undecided; 12% strongly disagreed and 4% disagreed that the yearly rains no longer support crop production as before. In all, 80% of the farmers agreed that the yearly rains no longer support crop production as before. This result agrees with the study of Odjugo (2010b) which observed that the rainfall amount in the northwest zone of Nigeria is decreasing with an increasing temperature which has eventually shortened the growing season of crops. He further stated that this decreasing amount of rainfall in the zone has forced the farmers to shift from the cultivation of sorghum as their best crop to millet which has a short growing season of 2 – 3 months.

Table 5 show the farmers' perception of the temperature related issues in the study area.

Table 5: Farmers' Perception of the Temperature and Temperature Related Issues

	Weather and Climate Change Indices	SA	A	U	SD	D
A	The temperature around this village is rising	366 (48%)	320 (42%)	15 (2%)	30 (4%)	31 (4%)
B	The weather is becoming drier	343 (45%)	328 (43%)	15 (2%)	53 (7%)	23 (3%)
C	The changing climate has led to crop infestation and disease by pest	272 (36%)	364 (48%)	15 (2%)	67 (9%)	44 (6%)
D	The changing climate is affecting human and animal health	313 (41%)	297 (39%)	7 (1%)	99 (13%)	46 (6%)
E	There have been increased incidences of floods during the rainy season	122 (16%)	244 (32%)	15 (2%)	213 (28%)	168 (22%)
F	Continuous poor yield condition as a result of high temperature and low rainfall in the past ten years	427 (56%)	213 (28%)	8 (1%)	53 (7%)	61 (8%)

Source: Field Work 2018

On whether temperature is increasing in the study area, 48% strongly agreed; 42% agreed; 2% were undecided; 4% strongly disagreed and 4% disagreed that there is an increase in temperature in the study area. 45% strongly agreed that the weather is becoming drier; 43% agreed, 2% were undecided; 7% strongly disagreed and 3% disagreed that the weather is becoming drier in the area (Table 5). The fact that majority of the farmers have perceived higher temperature for at least 10 years agreed with the findings of Ejeh (2014) who in his study "Assessment of farmers' perception and adaptation strategies to climate change in Kano State, noted that majority of the farmers at Kano perceived that there is an increase in the mean temperature for the past two decades. The result further agrees with the study of Otitoju (2013) which reported that crop farmers in south-west Nigeria perceived that there was higher temperature, decreased rainfall and delayed/erratic rainfall in south west Nigeria.

Table 5 further shows that 36% of the farmers strongly agreed that the changing climate has led to crop infestation and diseases by pest; 48% agreed; 2% were undecided; 9% strongly disagreed and 6% disagreed that the changing climate has led to crop infestation and diseases by pest. The fact that majority of the farmers (84%) observed that the changing climate has led to crop infestation and diseases by pest concurs with the reports by Oladipo (2010) which stated that the direct effects of climate change on agriculture in Nigeria include the effects of pests and diseases on crop production.

Table 5 further shows that 41% of the farmers strongly agreed that the changing climate is affecting human and animal health; 39% strongly agreed, 1% were undecided, 13% strongly disagreed, while 6% disagreed that the changing climate is affecting human and animal health. This result agrees with the findings of Oladipo (2010) titled "Towards enhancing the adaptive capacity of Nigeria" which reported that climate change is affecting human health in Nigeria without discriminating between the educated and the illiterate, the rich and the poor, the old and the young.

On the increased incidences of floods after rainfall, Table 5 shows that 16% strongly agreed that there have been cases of flood after rain; 32% agreed, 2% were undecided, 28% strongly disagreed and 22% disagreed that there has been an increased incidences of floods after rain in recent times. This result confirms the findings of Ejeh (2014) which reported increased incidences of flood episodes in Kano State especially in recent years.

Concerning the continuous poor yield condition as a result of high temperature and low rainfall, Table 5 show that 56% strongly agreed that there has been a continuous poor yield as a result of high temperature and low rainfall; 28% agreed; 1% were undecided; 7% strongly disagreed and 8% disagreed that climate change is negatively affecting crop yield in the study area. The perception that the study area was experiencing continuous poor yield was in line with the findings of Maccarthy and Vlek (2012) in Ghana, who predicted that the percentage change in grain yield will be higher under climate change weather condition and that climate change poses a potential risk more to low input small holder farmers who provide a significant proportion of crop produce, hence, a potential threat to food security in the study area. The findings also agree with the findings of Njoku (2006) who reported that climate change was found to have a negative effect on annual crop yields.

Farmers' Perceived Effects of Climate Change on Grain Yield

Table 6 presents the farmers' perceived effects of climate change on grain yield in the study area. Table 6 shows that 47% strongly agreed that agricultural drought and insufficient water for irrigation and domestic uses are part of the effects of climate change in the study area; 46% agreed; 0.5% was undecided; 5% strongly disagreed, while 1.5% disagreed that agricultural drought and insufficient water for irrigation and domestic uses are part of the effects of climate change in the study area. This result aligns with the findings of Abdullahi, Muhammad, Adeogun and Mohammed (2014) who reported that climate change has led to the annual reduction in the total available water of about 1.7 billion cubic meter and monthly water of about 17.11 billion cubic meters in the Sokoto Rima river basin. According to Odjugo (2010a), many rivers in Nigeria have been reported to have dried up or are becoming more seasonally navigable while Lake Chad shrunk in area from 22,902 Km^2 in 1963 to a mere 1304 Km^2 in 2000. This shows that what was left of Lake Chad in the year 2000 was just 5.7% of its 1963 size. Moreover, the Sudan and Sahel region of Nigeria has suffered decrease in rainfall in the range of 3-4% per decade since the beginning of the nineteenth century.

Table 6: Farmers' Perceived Effects of Climate Change on Grain Yield in the Study Area

	Variables	SA	A	U	SD	D
A	Agricultural drought and insufficient water for irrigation & domestic uses in recent years	358 (47%)	351 (46%)	4 (0.5%)	38 (5%)	11 (1.5%)
B	Increase in crop infestation by pests and crop diseases	389 (51%)	323 (42%)	12 (2%)	30 (4%)	8 (1%)
C	Flooding of farmlands and residential areas	122 (16%)	267 (35%)	15 (2%)	221 (29%)	137 (18%)
D	Increase in poverty, migration and clashes with cattle herdsmen and villagers	335 (44%)	320 (42%)	-	84 (11%)	23 (3%)
E	Decrease in grain yield	358 (47%)	290 (38)	-	69 (9%)	45 (6%)

Source: Field work 2018

On whether increase in crop infestation by pests and crop diseases is one of the perceived effects of climate change on grain yield, 51% strongly agreed that there is an increase in pests and crop diseases which destroys plants; 42% agreed; 2% were undecided; 4% strongly disagreed and 1% disagreed that increase in crop infestation by pests and diseases is an effect of climate change on grain yield (Table 6). This result agrees with the study of Adeshina and Odekunle (2011) which reported that climate change is affecting crop yield through crop infestation by pests and crop diseases. The result showed a consensus with the findings of Daniel (2018) which stated that climate change has led to the increase in pests and diseases in crops and livestock, as well as in soil loss in Benin, Edo State.

According to Farauta, Egbule, Idrisa and Agu (2011) apart from the effects on cropping pattern, climate change brings with it proliferation of pests and diseases; these can hinder storage when the need arises because of temperature increase. With climate change, crop diseases tend to spread to area where they were previously unable to thrive. A good example is the spread of tsetse fly and disease causing organisms to the drier regions of northern Nigeria from the southern part as a result of the movements of Cattle herders with their cattle. This confirms the study of Audu, Audu, Bindol and Gana (2013) which reported that the incidence of pests and diseases in Nigeria is very common and it is becoming worrisome because the environment is becoming warmer, dryer and more conducive for them.

Table 6 shows that 16% perceived that flooding of farmlands and residential areas is an effect of climate change, 35% agreed; 2% were undecided; 29% strongly disagreed and 18% disagreed that flooding of farmlands and residential areas is an effect of climate change in the study area. Vincent and Afokoghene (2014) in their study: "Natural hazard and crop yield in south-south Nigeria" reported that the farmlands of Oleh community (South-south of Nigeria) have been subjected to seasonal flood events during and after every rain throughout the period of 2011 and 2012. The study further revealed that most of the food crops cultivated by the

inhabitants of Odah, Iwhreotah and Erorin quarters are affected by flooding. The results of the analyzed data showed satisfactory impact of flooding on crop yield in the area. The result further confirms the findings of Audu, Audu, Bindol and Gana (2013) which stated that heavy rainfall has led to the submergence of crops, farmlands, livestock and loss of lives thereby causing crop failure, poor yield, and shortage of food as well as poverty.

Furthermore, as shown in Table 6, 44% of the grain farmers in Sokoto State strongly agreed that climate change has led to increase in poverty, migration and clashes with cattle herdsmen and villagers; 42% agreed; 11% strongly disagreed and 3% disagreed that climate change has led to increase in poverty, migration and clashes with cattle herdsmen. That majority (86%) stated that climate change has led to increase in poverty, migration and clashes with herdsmen and villagers agrees with the report of Hadassah (2016) which stated that the migration of herdsmen as a result of climate change often results in increasing spate of communal clashes between herdsmen and farmers and such clashes have resulted in the death of about 1,229 people between 2014 – 2016 in six northern States. The result further confirmed the projection of the FAO (2016) which stated that hundreds of millions of people might need to flee their homes as a result of climatic and environmental pressure between now and 2050. Odjugo (2010a) noted that climate change has prompted frequent migration and clashes with cattle herdsmen and villagers in northern Nigeria. This has prompted massive emigration and resettlement of people to areas less threatened by desertification. Such emigration often results in increasing spate of communal clashes among herdsmen and farmers and such clashes resulted in the death of 186 people in six northern states of Nigeria between 1998 and 2006.

Decrease in Grain Yield

That decrease in yield is an effect of climate change on grain yield in the study area, Table 4 shows that 47% of the farmers strongly agreed; 38% agreed; 9% strongly disagreed and 6% disagreed. In all, 85% agreed that decrease in yield is an effect of climate change on grain yield in the state. This result agrees with the projection of FAO (2016) which stated that food security will be compromised by projected yield declines across the crop especially in Sub Saharan Africa and Asia where most of today's food insecure live. The result that 85% agrees that decrease in yield tons/ha is an effect of climate change in the study area agrees with the summarized result of the FGD where the grain farmers stated that there has been continuous poor yield as a result of agricultural drought, pest infestation and invasion on farmlands by cattle herdsmen. Obayelu, Adepoju and Idowu (2014) further reported that climate change poses a great threat to human security through erratic rainfall patterns and decreasing crop yields, contributing to increased hunger.

IV. Conclusion

This study has assessed grain farmer's awareness and perception of climate change on grain yield in Sokoto State. The study revealed that 97% of the farmers are aware of climate change in the study area; 72% perceived that climate change is an act of God; 95% perceived that the onset dates of rainfall is coming late; 73% perceived that rainfall cessation now comes early; 57% stated that the number of rain days is reducing; 50% perceived that the yearly rains are no longer supporting crop production as before. The farmer's perception of the effects of climate change on grain yield are agricultural drought, increase in crop infestation by pest and diseases, flooding of farmlands, increase in poverty and decrease in grain yield.

V. Recommendation

Based on the findings, the study recommended that government agencies and NGOs should assist in raising awareness about climate change to the farmers; there should be adequate provision of weather forecast records and climate related data; grain farmers should be encouraged to participate in agricultural extension services which will educate them on the effects of climate change and adaptation strategies.

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