



Perception of Farmers on Climate Change and Adaptation Strategies Employed to Enhance Rice Production in Taraba State, Nigeria

Abraham Olawuyi Emmanuel Egunsola^{1,*}, Zubairu Eggi Chiroma², I. M. Sabo³, Amos Hasuruna¹

¹Department of Vocational Education, School of Technology and Science Education; Modibbo Adama University, Yola

²Postgraduate Student, Department of Vocational Education, School of Technology and Science Education; Modibbo Adama University, Yola

³Faculty of Technology Education, Abubakar Tafawa Balewa University, Bauchi

*Corresponding Author

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Abstract— This study examined perception of farmers on climate change and adaptation strategies used to enhance rice production in Taraba State. Specifically, the study sought to determine the awareness level of rice farmers about climate change, perception of rice farmers regarding climate change and adaptation strategies used by the farmers in rice production in Taraba State. The study was guided by three research questions and three null hypotheses. The study employed survey research design. The population of the study was 608 rice farmers; using multi stage random sampling technique a sample size of 315 was selected and used for the study. Instrument used for data collection was a researchers' designed structured questionnaire. The instrument was face validated by 3 experts, a field trial of the instrument was done using 20 rice farmers in Mayo Belwa Local Government Area, Adamawa state; using Cronbach Alpha technique, a reliability coefficient of 0.82 was obtained. The researchers administered 315 questionnaire instruments but 300 were retrieved (95% return rate). The data generated were analyzed using mean and standard deviation to answer research questions while z-test was used to test the three null hypotheses at 0.05 levels of significance. Findings showed that the perception of farmers about climate change is positive, their level of awareness is high and multifarious adaptation strategies were used by rice farmers in Taraba State to combat the menace of climate change. The study concluded that the meteorological agency should keep on creating awareness for farmers. The study recommended among others, an up-to-date and continuous flow of information about climate change from government agencies to local farmers and vice versa for better use of current adaptive strategies to enhance rice production in Taraba State. Also, Farmers need supports regarding climate change which would help them to apply different mitigating measures against climate change for enhanced rice production in Taraba State.

Keywords— Perception, Climate Change, Adaptation Strategies, Enhanced Rice Production

I. INTRODUCTION

Agriculture is the major occupation of people in Taraba State, and this has been going on for years. Though, majority of the farmers are subsistence farmers and are making profits over the years. Bako (2013)

reported that over 70% of Taraba population are into farming of different kinds both crops and animals, although majority of them are subsistent farmers but few that are into commercial farming are making maximum yields. The land is fertile and can easily be cultivated,

hence crops especially cereals, legumes, root and tuber yield maximally (Iwena, 2008 & Bako, 2013). But few years ago farmers have been facing different types of challenges ranging from high temperature, drought, fluctuating rainfall, floods, incidence of pest and diseases etc. (Mohammed, *et al* 2013). The challenges are severe and its effects to farmers are injurious and cannot be handled easily by the farmers.

Climate change is perhaps the greatest challenge facing our planet today. According to Adebayo and Oruonye (2003) some of these challenges manifest themselves in the form of drought, flooding, and low agricultural productivity, alteration of surface and ground water and devastation of eco-system among others. It has been observed by Intergovernmental Panel on Climate Change (IPCC) (2007) that Africa is one of the most vulnerable regions to the effect of global climate change due to her low human adaptability to anticipated increases in extreme events like drought, flood etc resulting from widespread poverty, illiteracy, heavy reliance on rain-fed agriculture, lack of economical and technological resources, insufficient safety nets and slow educational progress (Bako, 2013).

Climate change is a marked change in the long-term average of region weather. According to Bello (2013), the climate system is an open system and is in a steady state over a given period of time. If this steadily state is disturbed as a result of changes in one or more component making up the system or there are changes in the amount of solar radiation powering system, the climate will move over to a new state of equilibrium to produce a new climatic state. Bello further defined climate change as the long-term persistence of either positive or negative anomalies of a given or combination of climate events above or below the norm that characterizes climate change. Climate change is the statistics of weather over a long period of time.

Looking at the Nigerian situation where about $\frac{2}{3}$ of the population depend on rain-fed agriculture and fishing activities for their food and livelihood, the problems become worsened as a result of the high population pressures of 140 million people surviving on the physical environment through various activities within an area of 923,000 square kilometers (Nigerian Environmental Study Team) (NEST) (2004); (IPCC, 2007).

Several studies have shown that temperature is rising and rainfall frequency and intensity is fluctuating (Mendelsohn, *et al* 2000). The world temperature rise has been given as 0.91°C, available meteorological data in the country shows evidence of increasing air temperature since

about 1920s (NEST, 2003). Mohammed, *et al* (2003) observed that in Adamawa State of Nigeria climatic change data (temperature and rainfall) analysis over the past 25 years (1980 – 2005) showed that temperature has increased by 0.3°C and rainfall fluctuated over the years (Adebayo, 2010; Audu, 2013).

In Taraba State, evidence of climate change include delayed onset date of rains, increase in number of dry days during the rainy season and increase in maximum temperature (Mohammed 2013, Audu 2013). This leads to warmer seasons, increased frequency and intensity of weather extreme events such as drought, decline in rainfall amount by about 15 – 20% increased incidence of dry spell (Adebayo 2012; Mohammed 2013). The problems of flood, high temperature, incidences of pests and diseases have also aggravated the farmers' losses which consequently increases the incidence of poverty and malnutrition in the state (Ifejika, Kiteme & Opondo, 2009; Adebayo, 2012). Perception and adaptation to climate change are two basic solutions to avoid the ill effects of climate change but with distinctly different responses. Farmers' attitudes towards these two general responses to climate change must be understood.

Adaptation to climate change involves changes in agricultural management practices in response to changes in climate conditions (International Meteorological Institute, 2014). To adapt to the climate change, farmers are required first to notice that climate has altered and then identify potential useful adaptation measures and implement them. To enhance policy towards tackling the challenges that climate poses to farmers, it is important to have knowledge of farmers' perception on climate change, potential adaptation strategies and factors affecting adaptation to climate change (Adebayo, 2012; Mohammed 2013).

Climate change adaptation refers to spontaneous or organized process through which human beings and societies adjust to change in climate thereby making changes in the systems of operation of land use or natural resources use and other forms of social and economic organization (Issa, *et al* 2015). Adapting to climate entails the right measures to reduce the negative effects of climate change (or exploit the positives uses) by making the appropriate adjustment and change (Gutu, Bezebih & Mengistu, 2012).

Many farmers in Nigeria are facing problem of extreme weather events such as floods, drought, pests and diseases, weeds insurgence, climate change as its affect health, ocean as well as global warming effects and causes biodiversity, carbon cycle, which are responsible for low farmers' productivity (Issa, *et al*, 2015). These challenges

called for adaptation to climate change or variability in order to maintain optimal level of production (International Food Policy Research Institute, 2009).

Climate change adaptation is a policy response to climate change that seeks to reduce the vulnerability of social and biological systems to climate change effects. Adaptation means anticipating the adverse effect of climate change and taking appropriate actions to prevent or minimize the damage it can cause, or taking advantage of opportunities that may arise. Adaptation has the potentials to reduce adverse impacts of climate change and to enhance beneficial impacts (Apata, Samuel & Adeola, 2009). Adaptation to climate change in agriculture production is the adjustment of farming activities or methods to suit the changes in climatic conditions in order to lessen the potential change that are caused. It involves changes in agricultural management practices in response to changes in climatic conditions.

Climate change challenge is a major issue affecting both male and female farmers over the world and these has reduced yield and increased disease and pest manifestation (Mohammed, 2013). Climate change causes low productivity in agriculture, the low productivity is aggravated due to poor implementation of agricultural policies and strategies. This poor implementation of policies has also caused many farmers not to be competent in climate change adaptation. To solve this problem and attain food security, International Food Policy Research Institute (2009) observed that farmers are making efforts to adapt to climate change in various ways such as planting tolerant varieties, altering planting schedules, planting early maturing varieties and crop diversification. This effort may be futile if the agricultural extension services system do not assist farmers to initiate more and effective strategies to cope with the changing climate. Most agricultural research on climate change has tended to focus on assessing the sensitivity of various attributes of crop systems without evaluating the role of the agents of change and crop adaptation strategies to changes in climate. Thus, this call for more attention in order to improve in adaptive strategy to the fast climate changing impacts on agriculture.

Taraba state government over the years has embarked on awareness campaign on the effects of climate change on farming activities through Ministry of Agriculture and Rural Development, and Media Houses; Radio, Television etc. And also encourages farmers to embark on plantation of trees and avoidance of harmful farming practices such as bush burning, indiscriminate felling of trees and extreme use of chemicals (Mohammed, 2013). Taraba state is an agrarian state with over 75 percent of its inhabitants depends on agriculture as their

main source of livelihood. This makes them most prone to the effects of climate change and variability. Although climate change has begun to create havoc in the study area, there is paucity of research work that examines the pattern of climatic change and local awareness and knowledge of this problem. This knowledge gaps may greatly reduce the failures in measures to develop effective monitoring, adaptation and mitigation measures to climate change in the study area.

It has been observed that climate change and agriculture are both interrelated processes, as they take place on global scale (Parry, *et al* 2007), hence, increasing temperature of the earth (global warming) which is projected to have significant impacts on conditions affecting agriculture, including precipitation and glacing run-off (McCarthy, 2001). Recently food crises in countries such as Nigeria are reminders of the continuity in vulnerability of the region to the vicissitudes of climatic conditions (Apatu, 2009).

Over the years temperature is rising, flood is becoming frequent, drought is increasing and crop yield is decreasing (Nyanganji, 2012). Most farmers are not aware of the climate change, they rather attribute their losses to handy work of enemies who transformed into witches and wizards and attack their farms (Nyanganji, 2012). Some of the farmers also do not believe their harmful farming practices like bush burning, indiscriminate tree cuttings, and extreme use of chemicals are the causes of climate change. Majority of the farmers do not adhere to the strategies suggested by experts as adaptive measures to climate change (Apata, 2010, Bako, 2013). It was against this background that, this study examined the level of Farmers' awareness and their adaptation strategies to climate change and its implication to enhanced rice production in Taraba State.

II. PURPOSE OF THE STUDY

The main purpose of this study was to examine the perception of Farmers on climate change and adaptation strategies employed to enhance rice production in Taraba State.

Specifically, the study sought to determine:

1. awareness level of Rice Farmers about climate change in Taraba State.
2. perception of Rice Farmers regarding climate change in Taraba State.
3. adaptation strategies being used by the Farmers in Rice production in Taraba State.

Research Questions

- a) What is the awareness level of rice farmers about climate change in Taraba State?
- b) What is the perception of the rice farmers regarding climate change in Taraba State?
- c) What are the adaptation strategies being used by farmers in rice production in Taraba State?

Hypotheses

- I. There is no significant difference in the mean responses of Male and Female Farmers on their awareness level about climate change in Taraba State.
- II. There is no significant difference in the mean response of Male and Female Farmers on their perception regarding climate change in Taraba State.
- III. There is no significant difference in the mean responses of Male and Female Farmers on the adaptation strategies being used by the Farmers to mitigate climate change in Taraba State.

This study was based on Diffusion of Innovation (DOI) Theory, propounded by E. M. Rogers in 1962. The theory is one of the oldest social science theories. It originated in communication to explain how, overtime an idea or product gain momentum and diffuses (or spreads) through a specific population or social system. The end result of this diffusion is that people as part of a social system, adopt a new idea, behavior, or product. Adoption means that a person does something differently than what they had previously (i.e. purchased or used a new product, acquire and perform a new behavior etc). The key to adoption is that the person must perceive the idea, behavior or product as new or innovative. It is through this that diffusion is possible.

Adoption of a new idea, behavior, or product (i.e. “innovation”) does not happen simultaneously in a social system rather it is a process whereby some people are more apt to adopt the innovation than others. Researchers have found that people who adopt an innovation early have different characteristics compared to people who adopt innovation later. When promoting an innovation to a target population, it is important to understand the characteristics of the target population that will help or hinder adoption of the innovation.

According to Diffusion of Innovation Theory, there are five established adopter categories, but majority of the general population tends to fall in the middle categories. These categories include:

1. Innovators: These are people who want to be the first to try the innovation. They are venturesome and interested in new ideas. These people are very willing to take risk and are often the first to develop new ideas. They need very little appeal to convince them adopt an innovation if anything.
2. Early Adopters: These individuals have the highest degree of opinions leadership among the adopter categories. They have a higher social status, financial liquidity, advanced education and are more socially forward than late adopters. They are more discrete in adoption choice than innovators. They use judicious choice of adoption to help them maintain a central communication position.
3. Early Majority: They adopt a innovation after a varying degree of time that is significantly longer than the innovators and early adopters. They have above average social status, contact with early adopters and seldom hold position of opinion leadership in a system.
4. Late Majority: They adopt an innovation after the average participants. These individuals approach an innovation with a high degree of skepticism and after the majority of society have adopted the innovation. Late majority are typically skeptical about an innovation, have below average social status, little financial liquidity, in contact with others in late majority and they have little opinions leadership.
5. The Laggards: They are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change agent. Laggards typically tend to be focused on “traditions” lowest social status, lowest financial liquidity, oldest among adopters, and in contact with only family and closed friends.

This theory was adopted because it is talking about adoption of information and innovation of a new system. Hence, it is relevant to the study because the study is focused on the awareness, perception and *adaptation* to climate change.

III. METHODOLOGY

This study employed survey research design. The design is considered appropriate for this study because the study was carried out directly at the farmers' area; the questionnaires were distributed to them directly at their place of residence. The area of the study is Taraba State of Nigeria. Taraba state is located at the North East zone of Nigeria. It lies between Latitude 6° and 8° 00'0 00" North of the Equator and between Longitude 9° and 12° 30'0 00" East of the Greenwich Meridian. The state has a population of about 2.5 Million people (National Population Census (NPC), 2006). The state shares boundary with Bauchi and Gombe States in the North, Adamawa State in the east and the Cameroon Republic in the South. The major tribes of the people in the state includes Mumuye, Wurkum, Jukun, Hausa Fulani, Jenjo, Kuteb, Mambila, Kaka, Kona, and Ndola/Ichen among others. Their occupations include: crops farming, pastoral farming, commercial activities and public service.

About 75% of the populations are farmers while the other percent are into businesses and Civil Services. Interestingly, both male and female are into these farming enterprises. The state has a land area of 60,291 KM² (NPC, 2006). Taraba state has sixteen local government areas (LGAs) subdivided into three senatorial districts (Taraba North, Central and South). The researcher carried out the study in Taraba State because majority of the farmers cultivate rice and the land is fertile, virtually, all the farmers in the study area cultivate rice.

The population of this study was 608 Rice Farmers. 315 rice farmers were randomly selected from the farming communities in the study area. Majority of the people of Taraba State are farmers but mainly at subsistence level. The multi-stage sampling techniques were adopted for this study. The first stage involved the delimitation of the state in to zones. The second stage involves the selection of local government areas. The last stage involves the selection of farmers from the chosen settlements in the Local Government Areas (LGAs).

Three local governments each Senatorial district were purposively selected and these include: Zing, Karim-Lamido and Ardo-Kola LGAs (Taraba North); Bali, Gassol and Gashaka LGAs in (Taraba Central); and Wukari, Ibbi and Takum LGAs (Southern Taraba). A total of nine LGAs were sampled out of the sixteen LGAs of the state. In each LGA 35 questionnaires were administered to rice farmers; giving a total of 315 questionnaires that was administered. The instrument used for the collection was a five-point scale researchers' deigned structured

questionnaire (instrument) having options categorized as: Very High Extent (VHE) = 5points, High Extent (HE) = 4 points, Medium Extent (ME) = 3 points, Low Extent (LE) = 2 points, and Very Low Extent (VLE) = 1 points respectively; administered to the sampled rice farmers in the study area. The instrument was titled "Climate Change Awareness and Adaptation Questionnaire" (CCAAQ). It has three parts: Part 1 which has 15 items (number 1 – 15), focused on the perception of the rice farmers on the effects of climate change on rice production; Part 2 which has number 18 items (number 16 – 33) focused on the awareness level of rice farmers about climate change; and Part 3 which has 19 items (number 34 – 52), focused on the adaptation strategies employed by rice farmers to mitigate climate change.

The instrument was validated by three (3) experts, two from the Department of Vocational Education and one from the Department of Crop Protection Faculty of Agriculture Modibbo Adama University of Technology Yola. The observations and suggestions made by the experts were integrated into the modified copy of the instrument. To establish the reliability of the instrument, field trial was carried out on 20 rice farmers (10 males and 10 females) in Mayo-Belwa of Adamawa State. The data generated were analyzed using Cronbach Alpha Technique which yielded a reliability index of 0.82. This is considered a highly reliable index for using the instrument to collect data for the study.

The researchers distributed 315 copies of the instrument to 185 male and 130 female rice farmers from the selected farming communities in the study area. After the retrieval of the questionnaire from the respondents, 15 copies (5 male and 10 female instruments) were missed out; 300 completed instruments were retrieved and returned from 120 female and 180 male rice farmers. These were used in analyzing data to generate results from the study. Means, standard deviation and z-test were used to analyze the data. Means and standard deviation were used to answer the research questions while z-test was used to the three null hypotheses at 0.05 levels of significance. Any mean value < 2.00 is Very Low Extent, 2.00 to 2.49 is Low Extent, 3.00 to 3.49 is Medium Extent, 3.5 to 4.49 is High Extent; and ≥ 4.5 is Very High Extent.

IV. RESULTS

Research Question 1: What is the awareness level of rice farmers about climate change in Taraba state?

Table 1: Awareness level of rice farmers about climate change in Taraba State

n = 300

S/n	Items/Statements	Mean	SD	Decision
1	Rice production is affected	3.80	1.07	HE
2	Affect date of plantation of the crop	3.62	1.11	HE
3	Temperature has increased	3.80	0.92	HE
4	Delayed crop maturity	3.90	0.88	HE
5	Affecting number of irrigations	3.85	0.97	HE
6	Rainfall has decreased	3.78	0.86	HE
7	Flood has become frequent	3.92	0.85	HE
8	Infestation of new weeds in the crop	3.86	0.93	HE
9	Affecting the control measures of insect pest	3.88	0.95	HE
10	More infestation with diseases	3.88	0.91	HE
11	Increase in crop pest population	3.81	1.06	HE
12	Crop quality affected	4.00	0.79	HE
13	Affect the net income from the crop	3.86	0.95	HE
14	Soil Nutrients decreased	3.83	1.01	HE
15	Sun intensity has increased	3.87	0.94	HE
16	Indiscriminate trees cutting	3.92	0.87	HE
17	Precipitation decreases	3.87	0.94	HE
18	Transpiration decreases	3.82	1.03	HE
	Grand Mean	3.85	0.9	HE

Table 1 shows that the awareness level of rice farmers about climate change in Taraba state is high and positive with grand mean of 3.85 and the means were close with SD 0.9

Research Question 2:

What is the perception of rice farmers regarding climate change in Taraba state?

Table 2: Perception of rice farmers regarding climate change in Taraba state

n = 300

S/n	Items/Statements	Mean	SD	Decision
1	How often have you heard of climate change	3.62	0.98	HE
2	Delay raining season setting	3.86	0.93	HE
3	There is increase in temperature over the years	3.79	0.89	HE
4	Indiscriminate felling of trees causes climate change	3.84	0.99	HE
5	More usage of chemicals also causes climate change	3.86	0.95	HE
6	There is general reduction of crop yield	3.84	0.98	HE
7	There is general reduction of water level	3.89	0.89	HE
8	Flooding is becoming frequent	3.93	0.87	HE
9	There is general reduction in the quality of Agricultural produce	3.96	0.82	HE
10	Farmers attribute climate change as work of enemies	3.86	0.95	HE

11	Farmers see bush burning as major causes of climate change	3.86	0.93	HE
12	Farmers often attribute increase flood to climate change	3.78	1.11	HE
13	Farmers hear about climate change through Radio	3.84	0.97	HE
14	Extension agents are the major sources of Information about climate change	3.94	0.81	HE
15	Improper usage of natural resources causes climate change	3.85	0.97	HE
Grand Mean		3.85	0.93	HE

Table 2 shows that the level of perception of rice farmers regarding climate change in Taraba state is high and positive with a grand mean of 3.85 and the means were close with SD of 0.9.

Research Question 3:

What are the adaptation strategies being used farmers in rice production in Taraba state?

Table 3: Adaptation strategies being used by the farmers in rice production in Taraba state

n = 300

S/n	Items/Statement	Mean	SD	Decision
1	Use of resource conservation technologies	3.87	0.94	HE
2	Adopting the strategies of Nigeria metrological agencies	3.84	1.00	HE
3	Adopting irrigation methods	3.92	0.89	HE
4	By adopting soil moisture conservation methods	3.80	0.07	HE
5	Site specific nutrient management techniques	3.86	0.98	HE
6	By using short duration crop varieties	3.83	1.01	HE
7	By practicing integrated farming system	3.82	1.04	HE
8	By changing planting dates	3.84	1.00	HE
9	By changing the cropping pattern	3.82	1.03	HE
10	Land management practices	3.86	0.95	HE
11	By using insect pest management strategies	3.85	0.98	HE
12	Availing weather forecast service	3.89	0.89	HE
13	By stopping burning of crop residue	3.87	0.94	HE
14	By reducing tillage practices	3.92	0.88	HE
15	By reducing usage of chemical fertilizers	3.80	1.09	HE
16	By practicing crop diversification	3.86	0.96	HE
17	By controlling environmental pollution	3.84	0.99	HE
18	By trees plantation (afforestation)	3.62	0.90	HE
19	By educating farmers through Extension Agents	3.86	0.93	HE
Grand Mean		3.84	0.92	HE

Table 3 shows that all respondents concur with all the mitigating strategies listed in the study as the adaptation strategies being used by the farmers in rice production in Taraba state with mean of 3.84 and SD of 0.9 revealed the closeness of their agreement to one another.

Testing Hypothesis

H0₁: There is no significant difference in the mean responses of male and female rice farmers on their awareness level about climate change in Taraba state

Table 4: Z-test of male and female rice farmers on their awareness level about climate change in Taraba State

	Variables	N	Mean	SD	SE	DF	t	Sig	Decision
PERCEPTION	MALES	180	56.16	7.12					
	FEMALES	120	57.71	7.96	1.26	298	1.76	0.08	Not Sig.

Table 4 revealed that there is no significant difference in the mean responses of male and female rice farmers on their awareness level about climate change in Taraba state with $t = 1.76$ (df 298); $P = 0.08$ since the computed p-value

(0.08) is greater than 0.05 level of significance, the null hypothesis is upheld.

H0₂: There is no significant difference in the mean response of Male and Female rice Farmers on their perception regarding climate change in Taraba State

Table 5: Z-test of male and female rice farmers on the awareness level to climate change in Taraba state

	Variables	N	Mean	SD	SE	DF	t	Sig	Decision
AWARENES S LEVEL	MALES	180	73.99	8.46					
	FEMALES	120	75.70	7.98	1.36	298	1.76	0.08	Not Sig.

Table 5 revealed that there is no significant difference in the mean responses of male and female rice farmers on their perception regarding climate change in Taraba state with $t = 1.76$ (df 298); $P = 0.08$ since the computed p-value (0.08) is greater than 0.05 level of significance, the null hypothesis is upheld.

H0₃: There is no significant difference in mean responses of Male and Female rice Farmers on the adaptation strategies being used by them to mitigate climate change in Taraba State

Table 6: Z-test of male and female rice farmers on the adaptation strategies being used by the farmers to mitigate climate change in Taraba state

	Variables	N	Mean	SD	SE	DF	t	Sig	Decision
ADAPTATI ON STRATEGIE S	MALES	180	73.43	7.45					
	FEMALES	120	75.75	7.88	1.28	298	0.75	0.45	Not Sig.

Table 6 revealed that there is no significant difference in the mean responses of Male and Female rice Farmers on the adaptation strategies being used by them to mitigate climate change in Taraba State with $t = 0.75$ (df 298); $P = 0.45$. Since the computed p-value (0.45) is greater than 0.05 level of significant, the null hypothesis is upheld.

strategies being used by the farmers in rice production in Taraba state

- There was no significant difference in the mean responses of male and female rice farmers on their awareness level about climate change in Taraba state
- There was no significant difference in the mean responses of male and female rice farmers on their perception regarding climate change in Taraba state
- There was no significant difference in the mean responses of Male and Female rice Farmers on the adaptation strategies being used by them to mitigate climate change in Taraba State

V. FINDINGS OF THE STUDY

- The awareness level of rice farmers about climate change in Taraba state is high
- The perception of rice farmers regarding climate change in Taraba state is high and positive
- The respondents concur with all the mitigating strategies listed in the study as the adaptation

VI. DISCUSSION OF FINDINGS

The finding that awareness level of rice farmers about climate change in Taraba state is high and positive; and the corresponding hypothesis that there was no significant difference in the mean responses of male and female farmers on their awareness level about climate change in Taraba state indicates that the respondents have the similar opinions. This finding is corroborated by Ishaya and Abase (2008) who reported that majority of farmers perceived climate change as a critical environmental issue that needs immediate attention. The farmers also affirmed that climate change had led to various forms of drought, thereby reducing the quality and quantity of crops produced which were very significant factors that increase cost of food crops.

In addition, IPCC (2007) reported in the 4th Assessment Report that many farmers perceived climate change as mere phenomenon that comes from time to time whose effects are very damaging in crop cultivation, animals rearing, fishing and other agricultural activities. Nyangaji and Aminy (2011) reported that farmers perceived an increase in the duration of the cold season were more than the one they knew. Furthermore, most farmers perceived no change in the duration of the hot season. Some of the negative effects perceived by farmers include: poor crop production, droughts, poor livestock production due to flooding, prolonged dry spells and increased food insecurity. Other negative effects include increased pests and diseases, destruction of physical infrastructure, difficulty in planning because of increased variability of the weather and reduced access to inputs due to low income from poor crop production.

Another finding that perception of rice farmers regarding climate change in Taraba state is high and positive; the hypothesis showed there was no significant difference in the mean responses of male and female farmers on their perception regarding climate change in Taraba state. This implies that the rice farmers in Taraba state are convergent in their opinions on climate change. In conformity to this finding, Kisauzi (2012) found out that majority of male and female farmers were aware of climate change and their perception largely resonates with scientific meteorological data. Both male and female farmers had observed the length of seasons had changed, temperatures had increased, rainfall had decreased, floods, droughts and strong winds had become more frequent and severe. Ringler and Kohlin, (2008) also reported that farmers understand that turbulent weather is attributed to a climate shift, culminating in extreme weather events, heat waves and drought. However, Benedicta (2012) reported that there was no significant difference in perceptions regarding changes on all climate parameters between men

and women with the exception of perceived frequency and severity of droughts.

According to Nyangaji (2012) majority of the educated and non-educated farmers are aware of the climate change, its effect on crops, humans and animals as well as strategies of adapting to climate. On the contrary note some of the illiterate farmers interviewed in the rural farming communities don't have knowledge of climate change rather attribute their low crop yield, pests and diseases of crops, flooding to the handy work of enemies who transformed into witches and wizards to destroy farm produce and livestock (Issa, et al 2015).

The finding that respondents concur with all the mitigating strategies listed in the study as the adaptation strategies being used by the farmers in rice production in Taraba state and the hypothesis that there was no significant difference in the mean responses of Male and Female Farmers on the adaptation strategies being used by the Farmers to mitigate climate change in Taraba State. This finding is in tandem with Oruonye and Adebayo (2015) who found out that the common adaptation measures applied by the local farmers include altering of planting season, use of different tillage system, use of tolerant seed varieties, planting early matured varieties and crop diversification.

According to World Bank (2010), Nzeadibe and Egbule, (2011) and Nest (2004) suggested several adaptation technologies and strategies which include: Planting of early maturing crops varieties, planting pest/diseases resistance varieties, planting drought resistant varieties, crop diversification, irrigation, agro-forestry practices, mixed farming/cropping, provision of water through boreholes/tube wells, forestation, composting use of organic manure, construction of dams, embankment, labor migration, shifting cultivation, rain water harvesting, raising high yielding varieties, job diversification, seeking government assistance, reduction in stocking rate or livestock density, restoration of degraded areas (soils habits) awareness creation and sensitization.

In support of this findings, Bartels and Furman (2016) indicated that common adaptation methods in agriculture include use of new crop varieties and livestock species that are better suited to drier conditions, irrigations, crop diversification, mixed cropping and livestock farming systems; and changing planting dates, using different crop varieties, changing planting and harvesting dates, increasing use of water and soil conservation techniques and diversifying from farm to non-farm activities to cope up with climate change.

Oruonye and Adebayo (2015) analyzed the choice of adaptation measures employed by the local farmers and

the constraints to such measures and found that most of the farmers living in rural communities have been affected negatively by recent changes in climate through low rainfall, flooding, drought, high temperature and other factors. The findings show that most of the farmers' opinions, observation and adaptation measures to climate change agrees with expert's report. The study findings show that the common adaptation measures applied by the local farmers include altering of planting season, use of different tillage system, use of tolerant seed varieties, planting early maturing varieties and crop diversification. Regrettably, Irrelevantly, Apata (2010), reported that majority of the farmers do not adhere to the strategies suggested by experts as adaptive measures to mitigate the menace of climate change.

VII. CONCLUSION

Climate change and agriculture are both interrelated processes. Climate change has significant impacts on conditions affecting agriculture which is vulnerable to the vicissitudes of climatic conditions. The awareness and perception of farmers about climate change becomes very paramount for enhanced productivity by farmers including rice farmers. However, most farmers are not aware of climate change and many farmers do not adhere to the strategies suggested by experts as adaptive measures to militate against climate change. Therefore, meteorological agency should keep on creating awareness to farmers as well as stating the effects of climate change on rice production and other crops. Farmers need more education on their perception regarding climate change which would help them to apply different methods in rice production. There should be more enlightenment to all farmers by the extension agents on the adaptation strategies to militate against climate change.

RECOMMENDATIONS

On the basis of the findings and conclusions, the following recommendations were made:

1. More awareness should be created among rice farmers on climate change. Farmers should have more access to up-to-date and continuous information on climate change from the agencies concerned with providing it through jingles in mass media and local farm exhibitions.
2. Farmers should apply the adaptation strategies suggested by experts wisely such as planting early maturity crops, diseases resistance varieties, forestation and farm yard manure application to boost their outputs *et cetera*.
3. There is need to improve extension services to increase farmers' accessibility to information on adaptive research findings on early maturing, insect/pest tolerant, and high yielding varieties among others through increase extension services in the study area.
4. Government should provide required assistance to farmers for training them on new innovations of adaptation technologies for effective rice production in Taraba state.

REFERENCES

- [1] Adebayo A. A. (2012): Evidence of Climate Change in Taraba State. A Preliminary Report. A paper presented at the faculty of science seminar series, held at the lecture hall on 13th September, 2012. Taraba State University, Jalingo, Nigeria.
- [2] Adebayo, A. A, (2010), Climate: Resource and *Resilience* to Agriculture. 8th Inaugural Lecture of Federal University of Technology, Yola, Adamawa State, Nigeria.
- [3] Adebayo A. A. & Oruonye E. D., 2013: An Assessment of Climate Change in Taraba State, Nigeria. *Nigerian Journal of Tropical geography*, 4 (2): 602 – 612.
- [4] Apata, T. G. (2010). [Effects of global climate change on Nigerian agriculture: An empirical analysis](#). *CBN Journal of Applied Statistics* 2: 29-31.
- [5] Apata, T. G, Samuel, K. D. & Adeola, A. O. (2013). Analysis of Climate Change Perception and Adaptation among Arable Food farmers' in South Western Nigeria. Paper presented at the international Association of agricultural Economist' Conference, Beijing, China, August 16-22, 15pp.
- [6] Apatu R. A. (2009). Analysis of Climate Change perception and adaptation among Arable Food Crop Farmers in South Western Nigeria. Contributed paper prepared for presentation at the International Association of Agricultural Economist 2009 Conference, Beijing, China.
- [7] Audu, E. B. 2013: Gas Flaring: A Catalyst to global warming in Nigeria. *International Journal of Science and Technology*, 3 (1): 6 – 10.
- [8] Bako, M. M; 2013. Climate Change vulnerability assessment in part of northern Nigeria. *Nigerian Journal of Tropical Geography*, 4 (2): 449 – 470.
- [9] Bartels, W., & Furman, C. (2016). The tri-state climate learning community: A long-term engagement process for building agricultural adaptive capacity in the SE USA. Southeast Climate Consortium Annual Report.
- [10] Bello, M. (2013) Knowledge, perception and Adaptation strategies to climate change among farmers of central state of Nigeria. *Agricultural Resource*, 2(3), 107-117.
- [11] Benedicta *et al* (2017) An Assessment of the level of farmers' Awareness and Adaptation to Climate Change in Africa. *International Journal of Science and Technology* 3 (1): 6 – 10.

- [12] Gutu, T., Bezebih, E. & Mengistu, S. (2012). Econometric analysis of local level perception, adaptation and coping strategies to climate change induced shocks in North Shewa, Ethiopia. *International Research Journal of Agricultural science and Soil science*, 2(8), 347-363.
- [13] Ifejika, S. C., Kiteme, B. & Opondo, M. (2009). Adapting public Agricultural Extension services to climate change: *Insights from Kenya Life Science Journal*, 10(3), 42-51.
- [14] International Food Policy Research Institute (2009). Climate Change: Impact on agriculture and costs of adaptation. <http://www.ifpri.org/publication>. Assessed: 10th June, 2019.
- [15] International Meteorological Institute (2014). Climate information for adaptation and development needs wmo1025.
- [16] IPCC (2007). Climate Change: Impacts, Vulnerability and adaptation. Contribution of working group III to the third assessment report on the intergovernmental panel on Climate Change. Cambridge University Press, Cambridge.
- [17] Ishaya, S. & I. B Abaje (2008). Indigenous people's perception on Climate Change and Adaptation Strategies in Jemaa LGA of Kaduna State. *Journal of Geography and Regional Planning* 1 (18): 138 – 143.
- [18] Issa, F. O. Tologbonse, B. E. Olaleye, R. Tologbonse, O. M. & Kagbu J. H. (2015). Farmers' Perception of Climate Change and Coping Strategies across Gender in Two Agro-Ecological Zones of Nigeria. *Journal of Agricultural Extension*, 19(1), 35-48.
- [19] Iwena, O.A. (2008). *Essential Agricultural Science for Senior Secondary School*. Ogun: Tonad Publishers Limited
- [20] Kisauzi (2012). An Assessment of the level of awareness of the effect of Climate Change among farmers in the South-East Forest Zones of Nigeria. *International Journal of Agriculture*, 5 (4): 61 – 66.
- [21] Kiteme, B. P (2009). Agricultural Extension services and Adaptation to climate change in Kenya, Draft report German Development in stature, Born Germany, PP 12-18.
- [22] McCarthy J: O.F Canzian I, N. A. Leary, D. J. Dokken & C. White, 2001. Climate Change 2001. Impacts adaptation, and vulnerability, contribution of working group II to the 3rd Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge.
- [23] Mendelssohn R; A. Dinar & D. Arne 2000. Climate Impact on African Agriculture. *Climate Change*, (45): 583 – 600.
- [24] Mohammed D; P. V. Kwaghe, U. Bukar and J. Umar, 2013. Economic of Adaptation to Climate Change among crop farmers in Adamawa state, Nigeria. *IDSJ Journal of Agriculture and Veterinary Science*, 5 (4): 61 – 66.
- [25] National Population Commission (NPC) (2006). *National Census Abuja*: Government Press
- [26] Nigerian Environmental Study/action Team (NEST), (2003), *Climate change in Nigeria: A communication guide for reporters and educators*, NEST, Ibadan.
- [27] Nyanganji (2012) An Assessment of the Level of Awareness of the Effect of Climate Change and Adaptation Strategies among Students of Tertiary Institutions in Jalingo Metropolis, Taraba State Nigeria. *Journal of Geography and Regional Planning*, 4 (9): 514 – 519.
- [28] Nyanganji; M & Aminy I. A. (2002) Climate Change: A Threat to Natural Resources in Tropical Africa. *Journal of Agriculture*, 6 (5), 421 – 252.
- [29] Nzeadibe, T.C. & Egbule, CL (2011). Climate change awareness and Adaptation in the Nigeria Delta Region of Nigeria.
- [30] Oruonye E. D. & Adebayo A. A. (2015) Assessment of Flood Risk Perception and Response in Jalingo Metropolis, Taraba State, Nigeria. Proceedings of the Annual Conference of the Nigerian Association of Hydrological Sciences held at Federal University of Agriculture Abeokuta (FUNAAB), pp 4 – 12.
- [31] Parry M. L., O. F. Canziani J. P. Palutikof, D. L. P. J. Van & C. E, Hanson, 2007. Climate Change 2007. Impact, adaptation and Vulnerability: Contribution of working group (II) to the fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, U. K. New York, USA: Cambridge University Press.
- [32] Ringler, C., & Kohlin, G., (2008). [The impact of climate change and adaptation on food production in low-income countries: Evidence from the Nile Basin, Ethiopia. International Food Policy Research Institute, IFPRI](#)
- [33] World Meteorological Institute (2007). [Climate information for adaptation and development needs. WMO1025](#)