Adaptation Strategies and Utilization to Climate Change and Variability by Farming Households
in Agricultural Zone 1
Niger State, Nigeria

[1]Ibrahim, M., Mohammed, Y., Abdullahi A., [2]Shaba, E and [3]Yisa, K. M.

[1]Department of Agricultural Extension and Rural Development,
Federal University of Technology, Minna, Niger State, Nigeria
gausubrahama@yahoo.com 0806 5725 897
[2]Cereal Research Institute Badeggi PMB 8, Bida Niger State
[3]Federal Soil Conservation PMB 2035 Kuru, Plateau State. Nigeria

ABSTRACT

The research entitled '' adaptation strategies to climate change and variability by farming households in agricultural zone 1, Niger State, Nigeria" The objectives of the study includes, describe the socio-economic characteristics of farming households, examine the level of knowledge of farming households on climate change and variability, ascertain adaptation strategies to climate change and variability adopted by farming households and their perception of its effectiveness and examine the constraints associated with farming households on the adoption of climate change and variability adaptation strategies in the study area. Multistage sampling procedure was used to select a total of 188 respondents for the study. The data were collected through primary source using questionnaire and interview schedule and analyzed using descriptive statistics, Likert type rating. The result revealed that majority 88.3% were male with mean age of 35 years only 35.6% of the respondents were married. Mean house hold of 5 persons. Majority 76.6% had one form of education or the other. Majority 90.4% engaged in farming with farming experience of 18 years and farm size of 1-5ha. The findings revealed Incident of heavy rainfall that causes damages to crop and livestock production having mean score of ($\bar{X}= 2.71$) and decrease in average temperature amount over the years having the lowest mean score of ($\bar{X}=1.60$). The finding revealed the hierarchy in adoption of adaptation strategies to climate change and variability with planting early maturing varieties and planting of high yielding varieties were 100% adopted. These variables were closely followed by use of agro-chemicals and use of manure (organic or inorganic) with 98.9%.The result revealed that planting of early maturing varieties of crop with mean score of ($\bar{X}=4.49$), and high yielding varieties with mean score of ($\bar{X}=4.25$), were more effective among the adaptation strategies adopted by the respondent. In conclusion, adaptation strategies to climate change and variability that were found to be effective was identified and when adapted would reduce effect and impact of climate change and variability on farming household. It was recommended weather information that is more reliable should be adequately relate to farmers using right channel, High yielding and early maturing varieties should be made available to farmers at subsidized rate and timely by the releasing institutions and organization,

Key words: Climate, Adaptation, Variability and Strategies

Introduction

According to the World Meteorological Organization (WMO, 2016), climate is the "average weather," in other word is the measurement of the mean and variability of temperature, precipitation or wind over a period of time, ranging from months to thousands or millions of years". Weather "is the atmospheric condition over a short period of time" (WMO, 2016). IPCC (2007) reported that "climate change is any change in climate over long period of time, whether due to natural variability or as a result of human activity. Increasing productivities in agriculture depends largely on a number of factors including weather and climatic conditions. Climate is defined as an average atmospheric weather condition of a place over a long period of time ranging from months to many years usually about 30 years. These important climatic elements include temperature, rainfall, humidity and wind (World Metrological Organization (WMO), 2016). The negative impacts of climate change and variability on agricultural sector are obvious. Nigeria has over the years experienced strong weather variability characterized by irregularities of the seasons and distribution of precipitation, change in duration of annual rainfall from one point to another that fall within the same locality. Also increase in drought period during raining season, sometimes heavy rainfall experience in some ecological zones, hot climate, soil degradation, high winds, unexpected flooding experienced by farmers in their localities which some time washed away their crops and animals and proliferation of pest and diseases. Thus, the importance of adaptation strategies for over 70% of the Nigerian farmers who depend largely on agriculture as a means of livelihood becomes an absolute priority, (Fadina, 2018). It affects agriculture in diverse ways including its impact on food production. Many farming activities depend largely on rain fed and hence fundamentally dependent on vagaries of weather. As farmers strive to overcome poverty and advance in economic growth, this trend of climate change and variability threatens hard to deepen vulnerabilities, clean off hard work gains and seriously undermine prospects for

development. However, despite several effort by the extension service delivery geared towards encouraging farmers to adopt the adaptation strategies to curb the effects of climate change and variability on their farming operations, many of the farmers adamant. Therefore, there is need for concerted efforts toward solving these problems posed by climate change and variability to reduce its impacts on the small holder farming households and the nation at large. It is against this backdrop of the problems and challenges posed by climate change and variability that this study seeks to provide answers to.

Aim and Objectives of the Study

The aim of this study was to examine the adaptation strategies to climate change and variability by farming households in Niger State. While the specific objectives of the study were:

i. describe the socio-economic characteristic of farming households in the study area;

ii. examine the level of knowledge of farming households on climate change and variability;

iii. ascertain adaptation strategies to climate change and variability adopted by farming households and their perception of its effectiveness in the study area and;

iv. examine the constraints associated with farming households on the adoption of climate change and variability adaptation strategies.

This study will assist the government and other stakeholders in decision making and to inform farmers and communities in order to minimize the negative effects of climate change. The information to be generated will assist policy makers in reviewing existing policies and to formulate effective strategies that will minimize the effect of climate change and variability to the environment and humans. The study will make farmers to be aware and understand the concept of climate change and variability. It will also provide suitable adaptation

recommendations to policy makers as well as helping farmers on adaptation strategies and mechanisms in handling climate change and variability thereby enhancing agricultural productivity. This study will further help to identify the weaknesses of current adaptation strategies of farmers that need to be corrected to bring about the desired results. The result of this research work. This study will serve as frame of reference for other researchers that want to conduct studies in similar area. Also it will inform farmers about planning guides for climatic risks.

Methodology

Study Area

This study was conducted in agricultural zone I of Niger State. The State lies between Latitude 80 to 11^0 30 North and Longitude 3^0 to 7^0 40' East. The dry season is between November and April with a monthly temperature of about 32^0 and lowest in June. It has a mean annual rainfall range of 1000 mm – 1450mm. The projected figure of 5,631,578 million persons in 2018 using growth rate of 2.6 percent of (National Population Commission (NPC, 2006). The total land area of the State is about 76,481 Kilometer square or about 8.3 million hectares which represent 8% of the total area of Nigeria (Wikipedia, 2008; (Niger State Bureau of Statistics,(NSBS), 2012). Agriculture is the major occupation of the people with about 85% of the population engaged in farming. Major crops grown are yam, rice, millet, beans, guinea corn, maize; groundnut and sugarcane, Livestock reared include cattle, sheep, goat and poultry. The populations of the study were register small scale farmers from the selected 27 villages numbered 2,400. These farmers mostly specialized in growing crops which include Rice, Sorghum, Maize, Cassava, Cowpea and Millet. They also reared animal which include cattle, sheep, goat and poultry.

Sampling procedure and sample size

A multi-stage sampling technique was used for the study. First stage involved random selection of Agricultural zone 1 from the 3 Agriculture zones of the state using simple random sampling. The second stage involved random selection of three Local Government Areas (LGAs) from Agricultural zone 1. The third stage involved random selection of one (1) extension Block from each local government Area selected. The fourth stage involved random selection of three extension cells from each Extension blocks. The fifth stage involved random selection of three villages from each extension cell. The sixth and last involved proportional selection of 188 respondent. Data for this study was mainly from primary source. A well- structured interview schedule and questionnaire were designed to illicit information data from the respondents, using trained enumerators under the supervision of the researcher. The data collected ware analyzed using descriptive, inferential statistics. Objective I and II were achieved using descriptive statistics. Objective III, was achieved through descriptive statistic to determine numbers of adaptation strategies adopt by respondents. Objective v**.** The constraints of the respondents to adopt adaptation strategies to climate change and variability were measured using descriptive statistics: 3- point Likert type-rating scale was used to measure the constraints. it was determine as follow: (Very severe (VS) = 3. Severe (S) = 2, Not severe (NS) = 1. The decision rule was based on bench mean score obtain by adding 3+2+1= 6/3 to get 2.0, any value $\geq$ 2.0 was classify as severe, any value less than < 2.0 classify not severe.

Results and Discussion

Socio-Economic Characteristics of respondents

Table 1 show that majority 88.3% of the respondents were male. This implies that men were engaged in farming activities who are also believed to be the head of the household. The results revealed that mean age of the respondents was 27 years. This implies that majority of the respondents were still in their active and productive age. The result of the study revealed that the mean household size is 7persons. This is an indication that there was number of capable hands that can contributed to labour force. This result is in line with the findings of (Muchara, 2011), who stated that the level of education of respondents play a major role in adaptation strategies. Mean farming experience was 23years, this means that farmers have gather enough experience that will guide them in their farming activities It also guides farmers on adaptation of new technologies as well the application of different techniques or strategies. Majority 93.6% own farm size of between 1-5ha.This showed that respondents had access to arable land and is a clear indication that respondents can easily adopt to adaption strategies to climate change and variability due to availability of having access to farmland. This result is in with the findings of Umogbai., (2011) who reported that farming in the Northern of Nigeria are mostly practiced by small scale farmers. Majority 81% of the respondents belong to one co-operative association or the other.. This implies that the farmers can benefit from help that is usually rendered through cooperative society by government, non-governmental organization and great philanthropist.

Table 1. Distribution of respondents based on Socio-economics characteristics

Variables	Frequency	Percentage	Mean
Age			
25 and below	6	3.2	27
26 -30	26	13.8	
31 -35	28	14.9	
36 -40	50	20.6	

41 -45	30	16.0	
46 -50	23	12.2	
51 –and above	25	13.3	
Sex			
Male	166	88.3	94
Female	22	11.7	
Household Size			
1 -5	55	29.2	
6 -10	80	42.6	
11 -15	37	19.7	
16 -20	12	6.4	
21 -25	3	1.6	
26 -30	1	0.5	
Education level			
Primary	66	32.4	
Secondary	57	30.4	
Post-secondary	26	13.8	
Non-formal	44	23.4	
Farming experience			
1 -10	30	16.0	23
11 -20	71	37.8	
21 -30	58	30.9	
31 -40	21	11.2	
41 -50	8	4.3	
Farm size (ha)			
Less than 1	6	3.2	47
1 -5	176	93.6	
6 -10	5	2.7	
11 -15	1	0.5	
Membership to co-operative			
Member	153	81.9	
Non- member	34	18.1	

Source; Field Survey, 2019

Knowledge level of climate change and variability

The results in Table 2 revealed knowledge level of the respondents on the incident of heavy rainfall and high temperature had the highest mean score $\dot{x}=2.71$ and $\dot{x}=2.56$ respectively. This result is in line with the finding on perception of farming household by Adegnandjou *et al.,* (2018), who confirmed that climate has change changed and varies, and the changes observed were rainfall

disturbances such as rainfall delays and early cessation, shortening of dry season, increasing temperature, violent winds and extreme occasion such as flood which causes destruction to crop and livestock, washing away of top fertile soil that is capable of supporting plant growth.

Table 2. Distribution of respondent base on the knowledge level of climate change

Variables	HK	MK	LK	Mean	Rank	Remarks
Does the incidence heavy rain fall cause damage crop and livestock production	135	52	1	2.71	1st	HK
Does the incidence high temperature cause damage crop and livestock production	111	72	5	2.56	2nd	HK
Does the timing of rain fall in the season been shifted over the year	95	92	1	2.50	3rd	HK
Have you observed any variation on rainfall pattern in the last ten years	94	90	4	2.48	4th	HK
Have you observed any increase in the average rain fall over the years	83	102	3	2.43	5th	HK
Have you observed temperature variation in the past ten years	73	115	-	2.39	6th	HK
Have you observed increase in the average temperature amount over the years	66	116	6	2.32	7th	HK
Does the incident of drought experience during raining season cause damage to crops and livestock production	56	129	3	2.28	8th	HK
Have you observed constant in average temperature amount in the past 10 years	40	85	63	1.88	9th	HK
Have you observed decrease in the average rainfall amount over past ten years	43	59	86	1,77	10th	LK
Have you observed constant in average rainfall amount over the years	24	96	68	1.77	10th	LK
Have you observed decrease in average temperature amount in the year	29	54	105	1.6	12th	LK

Source: Field Survey; 2019.
KEYS: HK=High knowledgeable LK=Low Knowledgeable

Adaptation strategies adopted by respondents to mitigate climate change and variability

The result revealed the hierarchy in adoption of adaptation strategies to climate change and variability with planting early maturing varieties and planting of high yielding varieties were 100%

adopted. These variables were closely followed by use of agro-chemicals and use of manure (organic or inorganic). This result corroborate the findings of Howden and White (2016) who observed that climate change and variability inhibit crop and livestock growth. It affects the choice of crop varieties and other farm management decision. The result further revealed planting of drought tolerant varieties 97.9%, crop rotation 94.1% and used of irrigation scheme 93.6% were also adopted by majority of the respondents who think deeply and are highly experienced that this adaptation strategies could be a way out of the effect climate change and variability pose to crop and livestock production. This result also agreed with (Acqual., *et al* 2011) who reported in his study on farmers perception and adaptation to climate change, that farmers had adopted to timely in planting and harvested their crops before flood set in on their farm.

Table 3: Distribution of respondents on adaptation strategies adopted to mitigate climate change and variability (n=188)

Variables	Frequency	Percentage
Planting early maturing varieties	188	100
Planting of high yielding varieties	188	100
Use of agro-chemical	187	99.5
Use of manure(organic or inorganic)	186	98.9
Planting drought tolerant varieties	184	97.9
Crop rotation	177	94.1
Use of irrigation scheme	175	93.6
Vegetation cover	165	87.8
Timely of farm operation	165	87.8
Diversifying from farm to non-farm activities	122	64.9
Rural- urban migration	83	44.1
Reduce the size of cultivated farm land	79	42.0

Source: Field survey 2019

Perception of respondents on adaptation strategies adopted and their effectiveness.

The results in Table 3 revealed that planting of early maturing varieties of crop and high yielding varieties were more effective among the adaptation strategies adopted by the respondents with mean ($\bar{X}$=4.49) and ($\bar{X}$=4.25) respectively. This implies that majority of respondents are fully aware of the effect climate change and variability could posed to them and their entire household, if planting of early maturing and high yielding varieties were not adopted among the strategies as its effect may led to reduced yield of crops, there by resulted into increased global food demand, and lowering of food reserves (F A O, 2008b).

Table 3: Distribution of respondents on perception of effectiveness of adaptation strategies adopted.

Variables	VE	E	U	FE	NE	Mean	Rank	Remarks
Planting of early maturing varieties	106	75	2	4	1	4.49	1st	E
Planting high yielding varieties	66	112	3	5	2	4.25	2nd	E
Use of Irrigation scheme	75	89	10	14		4.20	3rd	E
Planting drought tolerant varieties	69	101	3	14	1	4.19	4th	E
Use of manure (organic or inorganic	55	119	1	11	2	4.14	5th	E
Use of agro –Chemicals	47	113	1	27	-	3.96	6th	E
Timely in farm operations	75	55	19	36	3	3.87	7th	E
Vegetation cover	26	80	28	52	2	3.40	8th	E
Membership to co-operatives	31	81	3	63	10	3.32	9th	E
Reduce cultivated farm size	10	41	78	24	35	2.85	10th	NE
Diversifying from farm to non- farm activities	12	35	38	78	24	2.64	11th	NE
Rural urban migration	12	18	42	27	89	2.13	12th	NE

Source; Field Survey; 2019

E=Effective; NE=Not Effective

Constraints faced by respondents on adoption of mitigating strategies in the study area

Table revealed inadequate capital to procure equipment's and facilities needed to mitigate climate change and variability with mean score of ($\bar{X}$=2.55), poor extension services delivery ($\bar{X}$=2.53), as

the major severe constraints face by the respondents in the study area. This result is in line with Jost., *et al.,* (2015),who identified poor extension service and training as major constraints to technologies adoption.

Table 4:   Distribution of respondents on the constraints faced in adapting to climate change and variability adaptation strategies.

Variables	VS	S	NS	Mean	Rank	Remarks
Inadequate capital.	108	75	5	2.55	1st	Severe
Poor extension services delivery	106	78	6	2.53	2nd	Severe
Low technical know-how	77	107	4	2.39	3rd	Severe
Inadequate credit facilities and incentives	68	116	4	2.34	4th	Severe
Inadequate information about climate Change and variability	55	113	20	2.19	5th	Severe
Low access to high yielding and early maturing varieties	51	118	19	2.17	6th	Severe
Insect pest and disease	47	123	18	2.15	7th	Severe
Land tenure issues	30	139	19	2.06	8th	Severe
Inadequate access to good agro-chemicals	53	81	54	1.99	9th	Not severe
Inadequate of labour availability	21	86	81	1.68	10th	Not severe

Source: Field survey, 2019.

CONCLUSION AND RECOMMENDATIONS

Conclusion

It was concluded that the adaptation strategies to climate change and variability were found to be effective and In adequate capital to procure equipments and facilities of mitigate climate change and variability. It was recommended that provision of credit facilities and incentives should be made available to farmers by well to do   individuals who are into marketing of Agricultural products and Government to motivate   them in production.

ii.   Extension services delivery should be re-awakening back and be given adequate attention by   the government to ensure provision of agricultural based skills to the farmers.

iii. Weather information that is more reliable should be adequately related to farmers using

right   channel and farmers dilate by the National Metrological agency.

i. High yielding and early maturing varieties should be made available to farmers at

subsidized rate and timely by the releasing institutions and organization (Seed council of

Nigeria).

ii. Land use act of 1978 should be revisit to correct abnormality in that act for farmers to have

access to farm land irrespective of gender by the National assembly.

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