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SOURCES OF INFORMATION TO CLIMATE EVENTS AND ADOPTION OF COPING PRACTICES BY ARABLE CROPS FARMERS IN KANO STATE NIGERIA

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ABSTRACT

Agriculture is among factors affecting environment in satisfying human daily needs which tremendously contributes to climate change, to help in understanding of change farmers' perception of climate change and knowledge sources at local levels were examined. A total 250 farmers were sampled through stratified random sampling techniques. The data and information gathered via returned instruments (88%) were analysed using descriptive and inferential statistics. The results revealed that male respondents accounted for 92.2% as the majority while female farmers accounted for 7.8% of farmers and mean(33) years. More than 86.53% had education background, 75.46% perceived changes in temperature, wind action (8.18%), sunlight (86.3%),flood and change in the rainy days(90.9%) while (74.55) of farmers had changed their cropping patterns,42.8% farmers obtained their information on climate change from extension agents (22.3%) while 17.8% acquired Knowledge from interactions of friends and families and NGOs(.4%).Cover cropping(80.90%)5th, planting economic trees(82.47%)4th,mixed farming (77.27%)7th and early maturing vanities(1965)1st and other practices were adopted in coping with changes. Some of the problems identified were lack of improved sustainable technologies, lack of regular update on effects of climate change on their production practices. The study recommends boosting production support mechanism for farmers' climate change awareness, improvement in Agricultural agency services-farmers delivery mechanisms, appropriate technology strategies and availability of high-yielding varieties.

Keywords: Arable crops farmers, sources of Knowledge and coping practices climate change.

1. INTRODUCTION

Agriculture is among the factors affecting the environment in satisfying human daily production needs. Agriculture tremendously contributes to climate change. Climate change is a global environmental challenge that has potential to causing some profound consequences, particularly on plants in the developing countries like Nigeria. Climate is the primary a determinant of agricultural productivity(Apata,*et al.*, 2009).The rate and magnitude of changes in climate characteristics determine agronomic and economic impacts (Pearce*et al*., 2001).Though climate change is a threat to agriculture and even non-agricultural socio-economic development aspects, "agricultural production activities are generally more vulnerable to climate change than other sectors" (Ayanwuyi*et al*., 2010).Climate change is becoming an increasingly high profile issue both from the social and economic viewpoints. It is not only the scientists and environmentalists who are concerned about climate change. This call need for farmers to learn and cope with the

effects of climate change and to be able to appreciate its positive contribution in agronomic practices.

1.2 Statement of the Research Problem

Coping with climate change is widely understood as global environmental challenge due to very wide-ranging effects of climate changes on the environment, socio-economic activities and related sectors including water resources, agriculture and food security, terrestrial ecosystems and biodiversity. Land degradation, especially soil erosion, soil nutrient depletion and soil moisture stress, are of the major problems confronting cultivable soil globally. Nigeria's soils and climate allow cultivation of a wide variety of food crops (Millet, sorghum, maize and other food crops). Nevertheless, the state of agriculture in Nigeria in recent times shows a continuous decline in exportation plummeted (from over 70 per cent in the 1960s to less than 2 per cent in 2010 and increase in importation of agricultural products into the country. Climate change will act as a multiplier of existing threats to food security Akoroda, 2010).It is evident still that there are shortcomings and very wide gap that required filling. These gaps are in four main areas: integrating climate into policy, integrating climate into practice; climate services and climate data.

On the basis of the aforesaid, the main objective of this study was to determine climatic changes sources of Knowledge and coping practices specifically on arable crop farmers and factors influencing their coping practice in the study has these objectives:

1.3 Aim and Objectives

The aim of the study is to assess farmers responses on sources of climate change Knowledge and coping practices in the study area. The aim would be achieved through the following objectives:

I. To examine sources of farmers information for Climate change.
II. To find out the types of coping practices adopted by farmers in the study area.
III. To identify main challenges of farmers on climate change with view to recommend strategies for improving agriculture in the study area.

1.4 Literature Review and Conceptual Framework

The concepts of climate change terms have been variously defined. According to Mendelsohn *et al;*(2006) it is an environmental, social and economic hazards and challenges on a global scale. Houghton, (2001) defined it as a change in the statistical properties of the climate system over periods of decades regardless of the cause. Intergovernmental Panel on Climate Change (IPCC, 2001) defined climate change as a statistically significant variation in climate conditions that persist for an extended period, typically for decades or longer. It refers to the long term average weather conditions of a region while weather is the daily fluctuating state of the atmosphere.

1.4.1 Theoretical Framework

Climate is dynamics; sometimes there's climate trend, fluctuations, climate cycles and anomaly. According to Postnote, 2006 and IPCC, (2001) climate change possesses a serious threat to development and poverty reduction in the poorest and most vulnerable regions of the world. Climate change is central to global warming and implies so as summarily put it by Hannah et al;(2009), that climate change refers to the short, medium and long term changes in weather patterns and temperature that are predicted to happen or are already happening as a result of anthropogenic emission of greenhouse gases(GHG), weather events such as drought and floods a well as greater unpredictability and variability are expected long-term changes such as temperature and sea level rises and low or higher rainfall regimes. It has been reported that these changes have already led to multiple social-economic impacts. These climate change impacts include floods droughts, storms, heat waves change,change in the growing seasons in some areas, changes in water quality and quantity, sea level rise and glacier melt (Postnote, 2006, IRIN 2005).

2.0 METHODOLOGY

2.1 Study Area

2.2 Location and Extent

The study was conducted within Dambatta Local Government Area (LGA) of Kano State. The LGA is one of the 44 Local Government Areas (LEAs) of the state. It covered an area of 732 Square Kilometers (Km^2).The area lies geographically between the latitude 12º 14`49" N to 12º 36`7.4"N and longitude 8º29`5.7" E to 8º49`12¨ E. The LGA is situated between Kano, Kazaure bordering Daura, enroute to Katsina State and bounded to Babura local government area of Jigawa state towards east, in the west bounded by Makoda Local Government and towards south bounded by Minjibir Local Government Area. The climate of the area is tropical savanna and characterized by two seasons that are wet and dry seasons. The dry season begins from November to February and comes in two phases; the cool and dry seasons. Rainy season begins from May to September and the mean annual rainfall for the area falls around 800mm (Olofin, 1987).The natural vegetation of the area is the savanna type. Most of the region is contained within the Sudan savanna variety (Udeh, 2014). The area has about 750 hectares of land covered by wood belt as forest reserve (KNARDA, 2008).

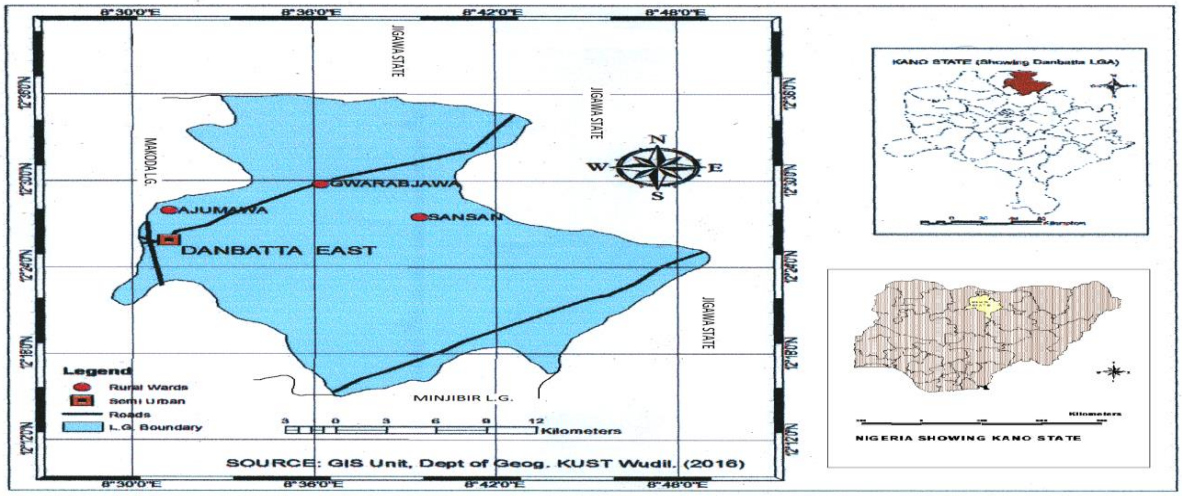

Figure 1: Map of Danbatta LGA showing the wards under study

Source: Designed by GIS Unit(KUST,2016).

2.3 Types of Data

Primary data was used in this study information sourced were data on farmers' perception of climate change, types of crops cultivated, perceived impact of climate change, Knowledge sources and coping practices. The instrument was used and designed based on the objectives stated and gathered the necessary information from the farmers.

2.4 Sampling Frame

In the first place Dambatta LGA was sampled as representative of zone ii and other two (2) Agricultural Development Project (ADP) headquarters(zones i,ii,iii), purposively. The area is designated as Urban (U) area due to its farming infrastructures and influence of these farming areas to degradation largely and the occurrence of climate change that affect agricultural production in the area. In the second place; four (4) wards out of the ten (10) wards, were chosen, using a simple ratio. It was done by picking the first and the last, after arranging the wards alphabetically. These were done in order to minimize as much as possible urban influence and minimize sampling biases as supported by Udeh,(2014).

2.5 Selection of Sampling Sites

Selection of sites was done by picking the second after arranging the whole ten (1-10) wards in the LGA, numerically. The same principles as followed above were also applied in the wards selection.

Table 1: Procedure for Wards Sampled

Wards selection procedure	
a) *Dambatta East*	*f) Ajumawa*
b) *Dambatta west*	*g) Saidawa*
c) *Goronmaje*	*h) Gwanda*
d) *Kore*	*i) Fagwalawa*
e) *Gwarabjawa*	j) SanSan

Source: Field survey,(2016) a,e,f and j

2.5 Sampling Techniques and Size

To arrive at sample size two (2) wards (*Gwarabjawa*, *San-san*) out of the ten (10) areas wards were sampled as representatives to rural areas (r) while *Dambatta-east* and *Ajumawa* were sampled as urban (U) areas to arrive at four (4) wards in the district. In all total of 250 farmers were randomly sampled to elicit sufficient sample representativeness for the study.

Table 2: Sample Size

Wards Sampled		Designation	Respondents	(%)-
I.	*Dambatta*	(Urban[1]**DB/East**^{U}**)**	100	
II.	*Ajumawa*	(Urban[1]**AJW**^{U}**)**	50	
III.	*San-san*	(Rural[2] (**SAN**^{R}**)**	50	
IV.	*Gwarabjawa*	(Rural[3] **GWJ**^{R}**)**	50	
Total			**250(100)**	

Source: Field survey, 2016.

2.6 Questionnaire Instruments Returned

It was realised that out of the 250 survey instruments prepared, a total of two hundred and twenty 220(88%) were retrieved and sorted. Responses were coded accordingly for analysis. The responses rate was computed as follows:

Table 3: Instruments Gathered and Response Rate

Wards Sampled		Designation	Instrument Retuned
I.	*Dambatta*	**DB/East**	94
II.	*Ajumawa*	**AJW**	38
III.	*San-San*	**SAN**	45
IV.	*Gwarabjawa*	**GWJ**	43
	Total	**4**	**220**

Source: Field survey, 2016.

* Response Rate 220/250*100= (88%)

2.7 Data Analysis

Data and other information collected were analyzed using Statistical Package Software for Social Sciences (SPSS) version 21. Descriptive statistical tools such as percentages (%), frequency (f).

Models Specification as used in the Analysis

I) **Percentage**

$P = f / N * 100\%$ ……...1

Where:

P=percentage,

f=Frequency to be converted to percentage,

N= number of frequencies population.

II) **Mean**

$Mean=\sum X_i/n$……...2

$Mean=\sum X_i f_i/\sum f_i$

Where:

∑ =means total population of respondents.

N= population mean.

X=number of responses (frequencies).

n= number of observations 1, 2, 3...i-j,

%=percentage (out of hundred).

III) **Regression**

$YC_{i\text{-}j=}$ $f(b+ b_1A_1+ b_2G_2+ b_3E_3+b_4Hh_4+ b_5In_5+b_6Es_6+b_7Cr_7+b_8Ct_8+ b_9Cs_9+\ldots b_nX_n$.....*4*

Where

A=Age, G=Gender, E=Level of Education, Hh=Householdsize,In=Climate_info, Es=Extension_servi,Cr=change_in_temp,Ct=Change_in_Tempreture,Cs=change_in_sunlight.

b =Coefficient
Y =Endogenous variable (determinant for coping practices)
X =Known exogenous variable
n =Variable no observed
e = error term

3.0 RESULTS AND DISCUSSIONS

3.1 Result and discussion

Farmers socio-demographic characteristics, sources of information to climate event experience, perception of climate variables, adoption of coping practices and problems militating against adoption of climate change coping practices by the arable crop farmers presented.

3.2 Socio-Demographic characteristics

It has been revealed that age can serve as a vehicle of understanding and controlling climate change and its' induced related effects. In this study result shows that the age of farmer ranged from 40 to above, substantial number of farmers (57.3%) between 46 and 51 years. Empirical studies on agricultural technology adoption by Gbetibouo, (2009) and Adesina and Fordson,(1995) observed that there is no consensus in the literature as to the exact effect of age in the adoption of farming technologies. Age may have a negative effect on the decision to practice new cropping technologies; this simply because older farmers may be more risk-averse and therefore, less likely to be flexible than younger crop farmers. On the other hand, age may have a positive effect on the decision of the farmer production. Since, older farmers may have more experience in farming and therefore, better able to assess the features of a new crop, cropping system and patterns than the younger farmers.

3.2.1 Farmers Gender

Result in table 4 shows male respondents accounted for 92.2% as the majority, while female farmers accounted for 7.8% of them across the study location. Typically it depicts to which the activity of male counterpart dominated farming activity in the area. The findings agreed with other related studies for examples, Ishaya and Abaje (2008); Abraham, Bamidele, Adebola and Kobe (2012) that agricultural sector and the tedious activities related to climate change adaptation strategies are dominated by males. This does not mean that womenfolk who do not partaken in farm activities were not more responsive compared menfolk in farm activities.

3.2.2 Farmers Educational Background

Table 4 reveals 46.81% farmers had experienced of secondary education, proportion of 32.7% had primary education and only 7.73% of the respondents had tertiary education. The findings

manifested in the fact that farmers' level of awareness is appreciable. Education level determines to greater extent level of one's awareness. Climate change may be perceived differently or conceptualization as put forward by (Diggs, 1991; West *et al*, 2007). Thus; the finding revealed that there are diverse understandings of climate change depending on the level of education, awareness and perception or experience.

Table 4: Farmers Age Groups, Gender and Educational Backgrounds

Variables	**Frequency**					**df=219*N=220***
Wards	DBEAST	AJW	SAN	GWR	Total	Percentage
Age						
40 to 45	10	8	7	6	31	(14.0)
46 to 51	51	20	29	26	126	(57.3)
52 and above	33	10	9	11	63	(28.7
Mean Age					**33.0**	
Total					**220**	**(100)**
Gender						
Males	91	35	39	38	203	(92.2)
Females	3	3	6	5	17	(7.8)
Total					**220**	**(100)**
Edu. Levels						
Primary school	25	15	15	17	72	(32.7)
Secondary School	47	17	21	18	103	(46.8)
Tertiary Education	10	2	3	2	17	(7.8)
Qur'anic school	8	4	6	10	28	(12.7**)**
Total					**220**	**100**

Source: Field survey, 2016

Arable crop farmers' Perception towards climate change

The result in Figure 2 reveals that 75.46% of farmers had a perceived all the factors, small number (10.46) pointed that there were changes associated with the rainfall followed by 5.90% who experienced Change in Temperature while proportion of 8.18% indicated change in wind action. This finding agrees with findings of Abaje *et al*.,(2013), who reported that farmers perceive climate change effects from sustained changes over time in environmental temperature, rainfall intensity and pattern of wind changes.

3.2.3 Farmers' perception on Weather Elements

The result in Fig.3 depicts farmers majority (90.9%) of them had perceived changes with the rainfall; cessation and amount. A small proportion (2.7%) of respondents revealed rain cessation as a factor, while (1.8%) recognized rainfall timing as important element to recognized climate change manifestation in the area. The finding justifies with the findings of George, (2010), who reported that farmers perceive climate change effects from over time in temperature, rainfall intensity and pattern of wind changes. Even though farmers responded differently to its impacts based on their farming practices, level of awareness and perception this agrees with the report by Diggs, 1991 and West *et al*, (2007).

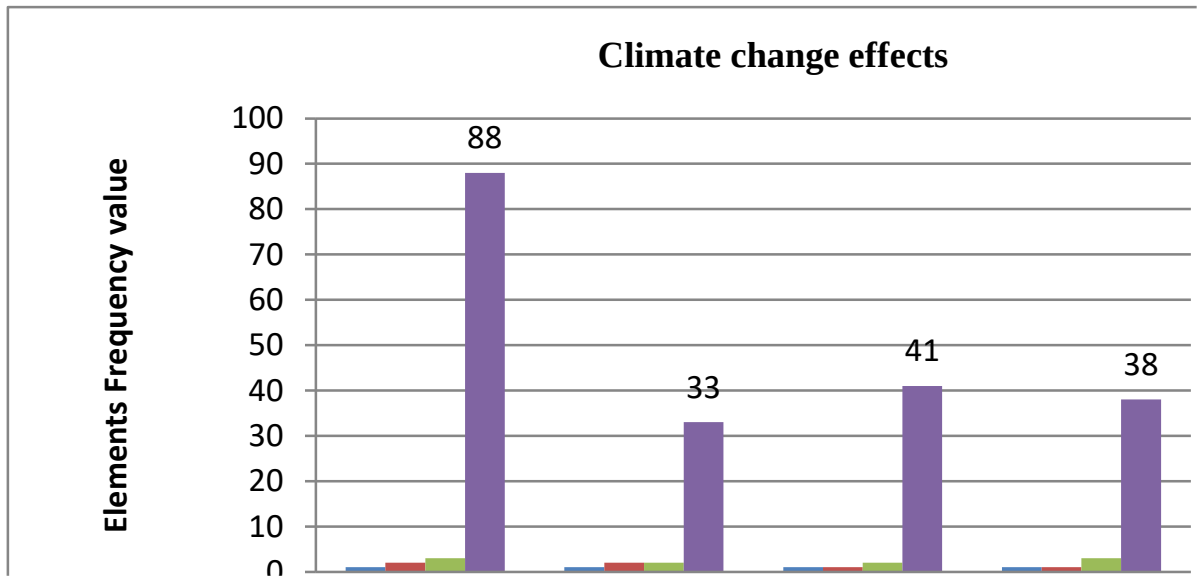

Figure 3: Farmers Responses on Weather Elements perceptions

Source: Field Survey, 2016.

3.2.4 Arable crops Farmers responses to climatic elements Experience

Table 5 reveals the farmers response with temperatures accounted for 87.2, effect of sunlight (86.3), Drought (78.7%), Pest and disease accounted for 78.1% proportions of the farmers. These results were in line with the findings of Idowu, *et al*., (2011), Porter and Brown (1991) who had reported that earth is likely to experience an average rise in temperatures ranging from 1.5 to 4.5^{O}C in year 2000s

Table 5: Distribution of Arable crops Farmers responses on climatic elements Experience

Climate Variables	Frequency Responses					
Wards	DB/East^{U}	AJW^{U}	SAN^{R}	GWJ^{R}	Agrd(%)	No idea
1. Temperature	88	36	37	33	194(87.2)	26(11.8)
2. Rainfall	82	28	30	28	168(76.3)	52(23.7)
3. Wind	45	24	27	26	122(55.4)	98(44.6)
4. Sunlight	84	34	36	36	190(86.3)	30(13.7)
5. Flood	33	28	29	09	099(45.0)	121(55.0)
6. Drought	54	42	38	39	173(78.7)	47(21.3)
7. Rainy days	57	42	43	42	181(82.2)	39(17.8)
8. Pest/disease	62	39	38	33	172(78.1)	48(21.9)
9. All Changes	63	44	43	42	192(87.2)	28(12.8)

*Values Computed as Multiple responses. *Agrd=Agreed; No idea =Not Agreed*

***Values in bracket as percentage of the multiple response (%)*

3.2.5 Farmers Sources of Knowledge for Climate change

Figure 4 reveals farmers who were influenced by radio and television enlightenment as their major source of information on the aspect of climate change accounted for the majority 42.8%.Some farmers obtained their information regarding climate change from the extension agents for 22.3%, while 17.8% acquired Knowledge related to climate change from friends and families while 9(4.0%) acquired it from non-governmental organizations (NGOs) with 0.4% acquired the information from co-operative members. This finding corroborates with findings of Egbule, (2010) who reported that the major sources through which the farmers in Nigeria receive information on climate change were Radio/Television, Newspapers and self-initiatives. The findings also agreed with the findings of Norris and Batie (1987) who reported that farmers with more education are more likely to have enhanced access to technological information than poorly educated farmers. Furthermore, Igoden *et al.*, (1990) and (1991) observe a positive relationship between the education level of the household head and level of improved technologies and climate change.

Access to climate change information and other extension services by farmers is another essential factor which may influence the coping with climate change. The finding agrees with reports by Maddison (2006) Nhemachena and Hassan (2007) in their studies where it revealed that awareness by farmers of climate change attributes were influenced by their level of education and awareness. Information on climate may strongly help to conceive a right decision to adapt to climate change (Maddison, 2006; Nhemachena & Hassan, 2007;Deressa *et al.*, 2008)

; access to weather and climate information increases the probability of perceiving changes in temperature and rainfall (Gbetibouo, 2009).

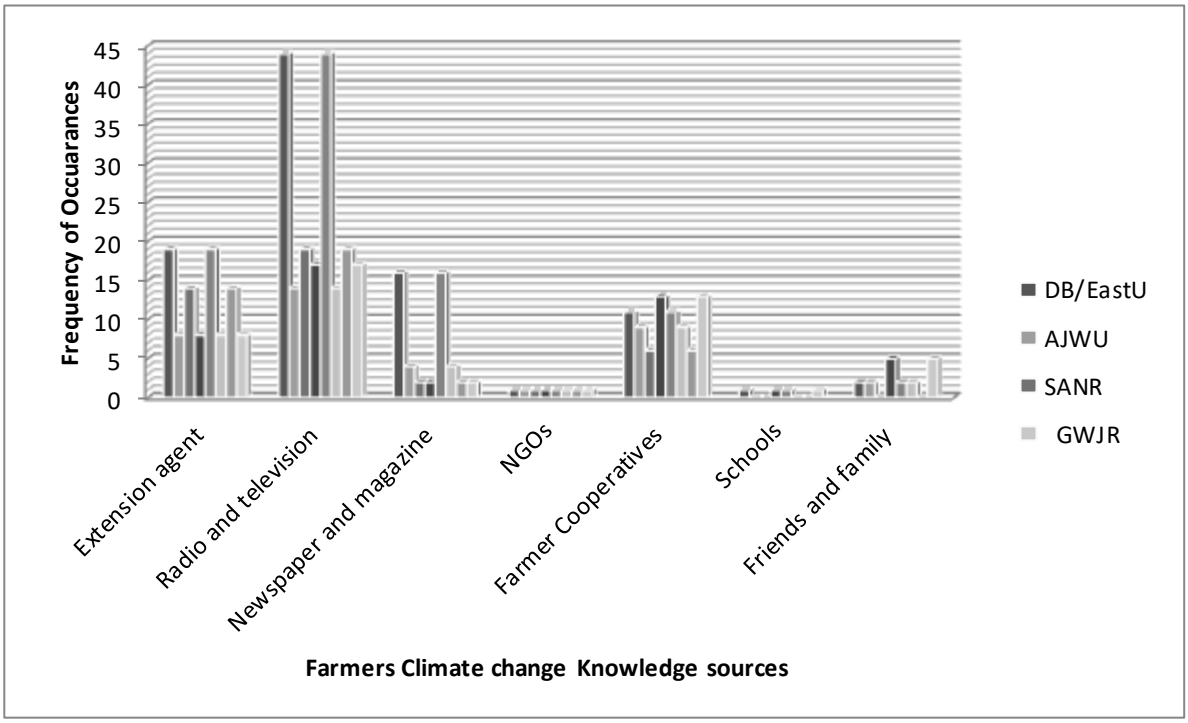

Figure 4: Farmers Sources of Knowledge for Climate change Source: Field Survey, 2016. *DB/EastU=DAMBATTA-EAST,AJW=AJUMAWA SAN=SANSAN,*

GWJ=GWARABJAWA WARDS

3.2.6 Types of Crops cultivated and their maturity periods

Result in table 6 reveals crop farmers use of the Local crops verities as well as improved and exotic introduced crops. Practically, it reveals that the prevalent ones took longer period in terms of duration, yield, and drought and pest resistance. Thus; Indigenous crops used by farmers were presented as well as the introduced Exotic crops varieties by Agricultural Development Projects.

Table 6: Some Indigenous and Improved Crop Varieties as used by farmers and their Maturity Periods

s/n	Indigenous	Maturity period(Day)	ImprovedVerities	Maturity period(Days)
1	Millet (*Pennisetumtyphoidium):* i. *Zango, ii. Borno*	75 to 90 days	i.SOSAT,ii. Jirani iii. UDUS iv. Maina	55 to 60 days
2	GuineaCorn (*Sorghum vulgare)*	100 to 120	**i.**Yar`Washa,ii.Yar`Gumeliii.Kaura, iv.Farfarav. Maiwavi. Dandalama-vii. Zango (Mai-lema).	90 to 100
3	Groundnut.(*Arachis hypogea)*	90 to 100	Ex-dakar, `Yar-shotan	40 to 50 days
4	Rice(*Oryzassativum*) Badankama, ii.Kilaki	90 to 100	-i.SIPI,ii.FARO-44, iii.FARO-45,iv.NERICA, v. JAMILA	50 to 60 days
5	Maize(Zea mays)	90 to 100	i.ACR-98,ii.ExtraEarly, iii. OBA-S**uper**	40 to 50
6	Cowpea wake (Beans) mai-yado ii. Mai-`yaya Imro	70 to 120 days	i.216-kwankwasiyya, ii. ITAK-5,7,3-1-1.	40 to 50 days

Source: Field Survey, 2016

3.2.7 Arable crops farmers Climate Change coping practices

Table 7 reveals some practices undertaken by farmers which included planting drought resistant crops and early maturing crops (89.09%)1st which enabled them coping with climate effect. Other practices were erosion control(88.63%)2nd , planting /cover cropping (80.90) and practicing irrigation recommended practices (82.27%)4th , planting drought resistant crops (83.63)3rd and planting exotic crop species (83.63%)3rd .Other identified mitigation practices included adoption of mixed farming could drastically reduce the severity of climate change phenomenon. The farmers' understanding on pattern of rain and cessations periods is that rainfall is more frequent than before.

Table 7: Distribution of Farmers by their main Coping strategies

	Farmers/farming practices.	Frequency	Percentage (%)	Ranked
a)	Cover cropping/Mulching	178	80.90	5th
b)	Practicing irrigation farming	181	82.27	4th
c)	Planting of economic trees	176	80.03	6th

d) Erosion control (wind/water)	195	88.63	2nd
e) Planting early maturing crop	196	89.09	1st
f) Planting exotic crop species	184	83.63	3rd
g) Planting drought resistant crops	184	83.63	3rd
h) Adoption of mixed farming	170	77.27	7th
i) Other specify	15	06.81	8th

*Computed as Multiple responses DB/East[U]=DAMBATTA EAST, AJW=AJUMAWA SAN=SANSAN, GWJ=GWARABJAWA WARDS

3.2.8 Coping strategy between Age, Sex, Level of Education and Household Size

These factors indicated in table 8 shows there were positive correlation between the demographic characteristics and response to coping of climate change elements. Age of household head was found to impact significantly on the perception response that the amount of rainfall and heat is increasing. The implication of this is that a farmer who perceives a decrease or increase in amount of rainfall or water flow might have perceived differently if the ages were different. To some extent aged farmers are better able to identify changes over long period of time say 35 to 40 years spread. It may require great experienced for farmers to identify that rainfall, sunlight and wind were not as before. Age of household head was found to also impact significantly on the perception that there are changes. Gender status of household head had some significant impact on the perception and capacity to cope with these changes.

Table 8: Summary of Statistics Perception and Coping practices

(Elements)	**Perception**		**Coping Practices**		
Variables	Coefficient	P-values	Coefficient	P-values	Wald
Age_of_Farmer	-0.0027	0.0030	-0.0044	0.891	0.345
Gender_of_Farmer	0.5734	0.0340	1.159	0.000	0.453
Level_of_Education	0.0759	0.9020	-0.023	0.049	0.352
Household_Size_of_Farmer	0.0073	0.2620	-0.044	0.044	0.234
Information_on_Climate change	0.406	0.029	0.079	0.073	1.352
Extension_services	-0.005	0.936	0.006	0.945	1.234
Change_in_Tempreture	0.552	0.0000	0.056	0.033	0.232
Change_in_Rainfall	0.445	0.0000	0.56**	0.015	0.343
Change_in_Sunlight	0.455	0.0000	0.045	0.056	1.213

Source: Field survey, 2016 Source: Field survey, 2016 *t-ratio* at 10% and 5%

3.2.9 Challenges Associated with Climate Change Coping Practices

Table 9 revealed a mutually inclusive responses as the farmers' attempted many (multiple) responses based on their responses on climate change. These constraints as reported among others were inadequate information (88.18%), majority had reported problem of farm ownerships (87.27), shortage of improved seeds (78.18), absence of modern techniques (78.18%), inadequate or lack of access to water for irrigation (65.90%) and inadequate to funds or credit (55.00%),

lack of modern technologies/techniques (78.18) as the most important among the stated problems reported from farmers.

Table 9: Farmers Challenges associated to Climate Change on Crop Production

Challenges	Frequency	Percentages(%)	No response
Shortage of improved seeds	172	78.18	48(21.82)
Inadequate information	194	88.18	26(11.82)
Inadequate of access to water for irrigation	145	65.90	75(34.1)
Inadequate of access to funds or credit	121	55.00	99(45.0)
Lack of Modern techniques	172	78.18	48(52.0)
Problem Farm ownerships	192	87.27	28(12.73)

*Values cumulative computed as multiple responses.
Source: Field survey, 2016

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The study revealed how farmers perceive climate change and how they adopt coping practices to climate phenomenon. The choice of adoption and coping practices depends on their Knowledge and information sources. Arable crop farmers in the study area were not only faced with changing physical environmental conditions and factors, rather they had been coping within rainfall variability, temperature stresses due to variability and wind action etc. resulting from climate changes.

4.2 Recommendations

In line with findings the following recommendations were put forward that:

- Use of high yielding technologies such as drought-tolerant, drought resistant should be intensified and sustained.
- Strong Extension service delivery mechanism should be improved and sustained.
- Extension services should be intensified by Government and private institutions and organizations.
- Wider publicity and farm level Campaigns should be intensified through various methods for outreaching farmers.

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