IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 13, Issue 3 Ser. II (March 2020), PP 56-60
www.iosrjournals.org

Coping Strategies for Climate Change Adopted by Farmers for Sustainable Crop Production in SamaruAgriculturalZone of Kaduna State, Nigeria

ALKALI, Marajos& EZEKIEL, Joyce
Department of Agricultural Education, College of Education GidanWaya, Kafanchan Kaduna State, Nigeria.

Abstract: *This study focused on strategies that are adopted by crop farmers in coping with climate change in Samaru Agricultural Zone Kaduna state, Nigeria. Descriptive survey research design was adopted. Two research questions and one hypothesis guided the study. The population for the study was 3,230 made up of 3,200 registered farmers and 30 extension agents (E.As). Structured questionnaire was used to collect data. The instrument was face validated by three experts. Cronbach alpha method was used to determine the internal consistency of the questionnaire items which yielded a coefficient of 0.89. Mean, standard deviation and t-test were used for data analysis. The findings of the study revealed that climate change has adversely affected crop production in the area studied. Some of the effects of climate change in the area are reduced crop yield, declining prices of crop produces, increased incidence of flooding; pests and diseases among others. Findings further indicated that some of the coping strategies to climate change employed by crop farmers include planting early maturing and disease resistant crop varieties, irrigation farming, among others. Provision of weather information ahead of time among other measures will help farmers survive.*

Key word*: Farmer, climate, coping strategy, adoption*

Date of Submission: 18-03-2020 Date of Acceptance: 03-04-2020

I. Introduction

Crop farming is a major occupation and important source of livelihood to the rural majority in Nigeria. It is the backbone of Nigeria's economy with about 70% farmers getting involved in one form of crop production activity or the other (Kabirat, 2013). Crop farming serves as a source of food for humans, feed for animals, income to the farming households, marketers and processors of agricultural products and revenue to government. It also provides raw materials to industries and employment for many. However, crop farming is very sensitive to climate change.

Climate change is the alteration in the weather conditions in a particular place. Ikehi andZimoghen (2015) described climate change as the variation in the statistical distribution of average weather conditions over a prolonged period of time. In the expression of Lobell, Burke, Tebaldi, Mastrandrea, Falcon and Naylor (2008), climate change is the total or average variation of the atmosphere over a period of time, usually from decades to many years.

It is believed that climate change is one of the challenges threatening the very existence of man globally (International Activities of the National Academies of Science, Engineering and Medicine 2018; Worldwide University Network, 2018 & World Economic Forum, 2017) through it's effects on agriculture especially crops. This is because of the sensitivity of crops to weather extreme events such as flooding, drought, storm, rising temperatures among others. Ifeanyieze, Alkali, Ikehi and Okoye (2016) opined that extreme weathers events such as thunderstorm, heavy wind and flood devastate farm lands and can lead to crop failure leading to increased hunger and poverty. Other top-most concerned world issues according to Worldwide University Network (2018) include lack of economic opportunity and employment, safety/security, lack of education, corruption, food and water supply, poverty, religious conflicts, inequalities (income, discrimination) and large scale conflict/war.

The main effect of climate change is increasing average temperature which causes a variety of secondary effects (Intergovernmental Panel on Climate Change, IPCC, 2007). The secondary effects include changes in pattern of precipitation affecting rainfall, rising sea levels, expansion of the range of tropical diseases, droughts among others (IPCC, 2007, Ogundele 2012, WORLD Economic Forum 2015 and Alkali &Kabitat, 2015).

Research findings have shown that agriculture in developing countries is generally rain fed and currently being affected by climate change (Food and Agricultural Organization, FAO, 2007 &International Food Policy Research Institute, IFPRI, 2009), and it has been noted that changes in climate constitute a very

serious threat to sustainable agricultural production and food security (Adeboye, Onu, Adebayo &Anyanwu and Nigeria Agricultural Digest, 2010) also threatening the realization of the United Nations Sustainable Developments Goals 1 and 1 of ending poverty and hunger for all persons. In Kaduna state and in Samaru Agricultural Zone in particular, evidence of climate change include flooding, delayed onset of rains, increase in number of dry days during raining season, increase in maximum temperature, early cessation of rains, among others (Alkali &Kabirat, 2015). Farmers in the area have recently been complaining of crop failure arising from climate variability particularly the delayed onset of rains, increasing length and frequency of dry spells. Incidents of flooding have become a recurrent decimal in the area. Hundreds of thousands of acres of farmlands have been submerged while several buildings and properties worth millions of naira destroyed including loss of human lives. These have drastically affected yields and economic returns from crop farms and consequently increased poverty and malnutrition in the area.

Sustainable agricultural production, food security and economic prosperity will continue to be an illusion due to climate change menace unless appropriate mitigation and coping strategies are taken. Thus it becomes imperative to identify crop farmer's response and coping strategies to the problem. Further, it is necessary to know if both male and female farmers have the same coping strategies.

Purpose of the Study

The major purpose of this study was to investigate the climate change coping strategies adopted by crop farmers in Samaru Agricultural Zone. Specifically, the study determined the:

1. Perceived effects of climate change on crop production in Samaru Agricultural zone
2. Important coping strategies that should be adopted and those adopted by crop farmers in Samaru Agricultural zone.

Research Questions:

1. What are the perceived effects of climate change on crop production in Samaru Agricultural zone?
2. What are the important climate change coping strategies that should be adopted and those adopted by crop farmers in Samaru Agricultural zone?

Research Hypothesis

The study was guided by the following null hypothesis

HO: There is no significant difference in the mean ratings of male and female farmers on the effects of climate change on crop productionin Samaru Agricultural zone

II. Methodology

The study was carried out in samara agricultural zone of Kaduna state. The area is located in the savanna vegetational zone of Nigeria with large expanse of cultivatable and favorable climate for both arable crop and animal farming.

A survey research design was adopted for the study. A survey research design is one in which a group of people or items is studied by collecting data through interview and questionnaire and analyzing them and using the findings to generalize to the population (Nworgu, 2015). The design was appropriate for the study because data were collected and described in a systematical manner in line with the characteristic feature or facts about a given population which findings of the research are generalized to the population.The population for the study was 3230 consisting of 3200 registered crop farmers in the five (5) extension blocks of the agricultural zone which include Zango, Kafanchan, Kagarko, Kachia and Sanga and 30 Extension Agents (E.As) in the zone. Information on the total number of registered farmers and E.As was obtained from the administrative office, SamaruAgricultural zone. The multistage and purposive sampling techniques were employed in getting a sample of farmers that was involved in the study. First two extension cells were purposively selected from each of the five extension blocks in the zone. The criterion was two extension cells in each block with the highest number of crop farmers. The procedure produced 1,100 crop farmers at this stage. Finally, ten percent of the crop farmers in the ten extension cells were randomly sampled which gave a total of 110 farmers. All the 30 E.As were involved in the study. This gave a total sample size of 140.

A structured questionnaire called "Climate Change Coping Strategies Questionnaire (CCCSQ)" was developed and used for the study. The instrument was divided into two sections each addressing one research question. Section one of the questionnaire which was responded to by only crop farmers had 21 items and a four point response options of High Effect (HE), Moderate Effect (ME), Low Effect (LE) and No Effect weighted 4, 3, 2 and 1 respectively. Section two of the instrument was responded to by both Extension Agents (EAs) and crop farmers. This section had 10 items with a four point response option of Very Important (VI), Important (IMP), Low Importance (LI) and Not Important (NI) for E.As and another four response option of High Practice

(HP), Moderate Practice (MP), Low Practice (LP) and Not Practiced (NP) for crop farmers. The four response options for both EAs and crop farmers were weighted 4,3,2, and 1 in that order. The instrument was subjected to face validation by three expertsand pilot tested for internal consistency. A reliability coefficient of 0.89 was obtained with Crombach Alfa technique and the instrument was considered reliable.Data collection was carried out through personal contact with the help of two research assistants. 140 copies of the questionnaire were administered on the respondent (110 for farmers and 30 for EAs). All copies of the instrument administered were retrieved, giving a 100% return.

Mean scores were used in answering research questions while the standard deviation was employed to validate the closeness of the respondents from the mean and from each other in their responses. A two tailed t-rest was used to test whether male and female farmers differed in their responses, using 0.05 level of significance. Decisions were made at criterion value point of 2.50. To arrive at 2.50 criterion value, the average of the mean weights was calculated. Items in section one with mean values equal or greater than 2.50were regarded as"Adverse Effect (AE)" whereas those with mean values lower than the value point were regarded as "Non Adverse Effects(NAE)" affecting crop production.Items in section two for EAs with mean values equal or greater than 2.50 were regarded as "Important (IMP)"and Not Important if lower than this criterion value. Items in section two for crop farmers that had mean value equal or greater than 2.50 criterion value were considered "Practiced (P)"coping strategy by farmers while those with lower mean values were regarded "Not Practiced (NP)" coping strategy.The null hypothesis of no significant difference was accepted for any item whose significant value was greater than the alpha level of 0.05 whereas it was rejected for any item whose significant value was less than the alpha level of significance of 0.05.

III. Results

Answers to the research questions and test of hypothesis were given below as results of the study

Effects of climate change on crop production in Kaduna state

Data on the effects of climate change on crop production and test of hypothesis are presented in Table 1

Table 1. Mean, Standard deviation and t-test scores of farmers on the effects of climate change on crop production in Kaduna state (N=110)

s/no	Effects on crop production	X	SD	R	T	*sig.	R
1	Flooding due to increasing rainfall	2.51	1.10	AE	-2.98	0.00	S
2	Increasing cases of dry spells	1.59	1.02	NAE	1.86	0.08	NS
3	Emergence and spread of new crop pests and diseases	2.87	1.16	AE	1.34	0.13	NS
4	Rapid spread of weeds	3.42	0.76	AE	-4.32	0.10	NS
5	Delayed onset of rains	2.75	0.32	AE	0.23	0.31	NS
6	Early onset of rains	1.67	1.07	NAE	1.45	0.03	NS
7	Reduced water availability for irrigation	3.52	1.28	AE	1.21	0.00	S
8	Damage of stored grains	2.55	1.08	AE	5.50	0.12	NS
9	increased difficulty and cost in weed, pest and disease control	3.12	1.11	AE	-2.45	0.33	NS
10	Poorer germination of crop plant seeds	2.90	0.98	AE	-5.00	0.16	NS
11	Diminished crop yield	3.01	0.14	AE	0.50	0.21	NS
12	Increased cases of deaths due to heat scorching	2.60	1.80	AE	2.30	0.11	NS
13	Wilting of crops	3.20	0.21	AE	-1.03	0.25	NS
14	Increased difficulty of work done on the farm	2.65	0.35	AE	3.12	0.20	NS
15	Increased labor cost	2.64	0.11	AE	0.32	0.03	S
16	Increased loss of crop land	3.59	1.09	AE	2.58	0.12	NS
17	Increased cost of production	2.80	0.13	AE	0.43	0.29	NS
18	Declining farm profitability	3.60	1.05	AE	0.24	0.10	NS
19	Reduced marketability of produce	3.21	1.02	AE	-3.20	0.15	NS
20	Low motivation and capability for crop farm expansion	2.60	0.20	AE	1.02	0.30	NS
21	Spoilage of perishable farm produce due to high temperatures	3.21	0.03	AE	2.51	0.10	NS
	Cluster value	2.86	0.76	AE	0.27	0.15	NS

R: Remark; AE: adverse effect; NAE: non adverse effect; SD: standard deviation; X: mean; NS: non significant; p= sig (2-tailed)

Data on Table 1 revealed that nineteen items (S/N 1,3,4,5 and 7-21) as responded by farmers were adverse effects (AE) of climate change on crop production as their means ranged from2.51-3.60 which is higher than the criterion mean value2.50. the remaining two items (S/N 2 and 6) were regarded as non adverse effects (NAE) on crop production as their means were 1.59 and 1.57 which were lower than 2.50 criterion mean. That table also showed that the Standard Deviation (SD) of the 21 items ranged from 0.03-1.80 indicating that the respondents were close to the mean and to one another in their responses. Data on Table 1 revealed that there is a significant difference (S) in the opinions of male and female farmers in three items(S/N 1, 7 and 15), and a non-significant (NS) difference in eighteen items (S/N 2-6 , 8-14 and 16-21). However, the clustered value indicated that the difference in their opinions is NS. The null hypothesis of no significant difference of the items with remark NS was upheld as p-value is greater than the a-value ($p \geq a$) at the t-calculated value of the items.At

the cluster value, p=0.15 and t=0.27, while significant value=0.05. thus, the null hypothesis of no significant difference is not rejected but upheld as p≥a (0.15>0.05).

Climate change coping strategies that should be adopted and those adopted by crop farmers in Samaru Agricultural zone

Data on climate change coping strategies that should be adopted and those adopted by crop farmers in Samaru agricultural zone are presented in Table 2

Table 2:mean, Standard deviation and t-test scores of respondents on climate change coping strategies that should be adopted and those adopted by crop farmers in Samaru Agricultural zone (N_1=110, N_2=30)

s/no		Extension Agents			Farmers		
	Important climate change coping strategies	X_1	SD_1	R	X_2	SD_2	R
1	Altering plant schedule	2.85	0.72	IMP	2.43	0.90	NP
2	Using different tillage system	3.90	0.96	IMP	1.90	0.15	NP
3	Planting early maturing crop varieties	2.56	1.15	IMP	2.87	1.09	P
4	Planting tolerant crop varieties	2.80	1.06	IMP	2.48	0.05	NP
5	Practicing irrigation farming	2.72	0.09	IMP	3.70	0.11	P
6	Planting disease resistant crop varieties	2.98	1.15	IMP	2.39	0.08	NP
7	Early planting of crops	2.90	0.97	IMP	2.89	0.34	P
8	Adoption of improved farm technologies	3.98	0.35	IMP	2.56	0.54	P
9	Water harvesting and storage	3.45	1.03	IMP	1.85	0.12	NP
10	Use of improved storage facilities	2.90	0.23	IMP	3.54	0.32	P

R: Remark; X_1: mean of extension agents; SD_1: standard deviation of extension agents; X_2:mean of farmers; SD_2: standard deviation of farmers

Data in Table 2 indicate that all the ten items as responded by Extension Agents (EA) were important (IMP) strategies for coping climate change menace as their means ranged from 2.56-3.98 which is higher than the criterion mean of 2.50. The standard deviation (SD) of the ten items as responded to by the EAs ranged from 0.09-1.15, indicating that the EAs were close to the mean and to one another in their responses. Data on Table 2 also revealed that five items (S/N 3,5,7,8 and 10)were climate coping strategies practiced (P) by farmers as their means ranged from 2.56-3.70 whereas the remaining five items (S/N 1,2,4,6 and 9) were not practiced (NP) by the farmers as their means ranged from 1.85-3.70. The standard deviation of the items in Table 2 as responded to by crop farmers ranged from 0.05-0.90 indicating that the farmers were close to the mean and to one another in their responses.

IV. Discussion of Findings

Samara Agricultural zone, just as many parts of the globe is experiencing variations in climatic conditions. Evidence of climate change in the area include delayed onset of rains, early cessation of rains, prolonged dry spells, flooding among others. Changes in climate has resulted to more adverse effects affecting crop production and livelihood of farmers. In Table 1, items such as diminished crop yield, declining farm profit, spread of crop pests and diseases had mean values of 3.01, 3.60 and 2.87 in that order. Indications like this reveal that farmers could be spending more than usual. Diminished crop yield means declining return to farm investment, while increased labour and other input costs results to increased cost of production. The scenario no doubt has negative effects on economic viability of crop farming as a sustainable means of livelihood. The findings of this study as presented in Table 1 are in agreement with that of Miguel and Koohafkan (2010), Ikehi et al (2014) and Ifeanyieze et al (2016) who stated that difficulty and cost of agricultural production will increase with decreasing returns to the farmer. Most of the effects of climate change in the area as responded by the respondents are true situations. However, increase in cases of dry spells tied directly to climate change in the area was not indicated by the respondents. This finding disagrees with Alkali and Kabirat (2015) who stated that there are increasing cases of prolonged dry spells in the area.

In Table 2, E.As considered all items as vital measures of coping with climate change. Items such as planting early maturing crop varieties, practicing irrigation farming, early planting of crops among others were rated high by farmers. The respondents are not far from reality. Altering planting schedule could check the cycle andspread of pests and diseases. Planting of early maturing crop varieties will ensure that losses due to early cessation of rains are averted while practicing irrigation farming will augment water shortage for crop production experienced during periods of dry spells and off-season. This findings concur with that of authors such as Adebayo et al (2012), andAlkali and Kabirat (2015) who outlined coping strategies to climate change to include planting disease resistant and early maturing varieties, irrigation farming among others. Findings of the study revealed that significant difference does not exist between the mean responses of male and female farmers on effects of climate change on crop production in Samaru Agricultural Zone of Kaduna state as indicated by t-test of the hypothesis of the study. Therefore, any observed difference is not a statistical difference, but a mere chance which could have resulted from sampling error.

V. Conclusion

Findings of this study served as a premise for making the following conclusions: Climate change has become a threat to sustainable and profitable crop production. Delayed onset of rains, prolonged periods of dry spells, flooding, among others are major threats to profitable and sustainable crop production in the area resulting in increased poverty level. As coping strategies of this monster, farmers adopt measures such as altering plant schedule, irrigation farming, planting early maturing plants among others.

VI. Recommendations

Based on the findings of the study, the following recommendations are made:

1. Since crop production in the area is majorly rain-fed, it is necessary for the government and other relevant authorities to constantly provide weather information such as rainfall distribution ahead of time to help the farmers plan. This could be done through the radio or extension service.
2. Since input purchase capacity of farmers is affected due to changing climate, farmers should be encouraged through provision of incentives such as subsidies by government and other Non-Governmental Organizations. This will go a long way in improving production.
3. Extension agents should sensitize farmers on the need to plant early maturing and disease resistant varieties.

References

[1]. Adebayo, A.A., Onu, J.J., Adebayo, F.E. &Anyanwu, S.O. (2012). Farmer's Awareness, Vulnerability and Adaptation to Climate Change in Adamawa State, Nigeria. British Journal of Arts and Social Sciences 9(11). Pp. 104-115.

[2]. Alkali, M. &Kabirat, N. (2015). Impact of Climate Change on Yield and Income of Crop Farmers in Samaru Agricultural Zone of Kaduna State, Nigeria. Paper presented at the HERAN 2015 conference held at University of Nigeria, Nsukka 23th-26 September.

[3]. Food and Agricultural Organization (FAO, 2007). Adaptation to climate change in agriculture, forestry and fisheries. Perspective, framework and priorities. Food and agricultural organization (FAO) Rome.http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

[4]. Ifeanyieze, F.O., Alkali, M., Okoye, R.N. &Ikehi, M.E. (2016). Altered climate and livelihood of farming families in Niger Delta Region of Nigeria. African Journal of Agricultural Research. 11(10). Pp. 882-888.

[5]. Ikehi, M.E. &Zimoghen, J (2015). Impacts of Climate change on fishing and fish farming in Niger Delta Region of Nigeria. Direct research journal of Agriculture and Food Science. 3(1).pp.1-6.

[6]. Ikehi, M.E., Onu, F.M., Ifeanyieze, F.O. &Paradang, S.P. (2014). Farming Families and Climate Change Issues in Niger Delta Region of Nigeria: Extent of Impacts and Adaptation Strategies. Journal of Agricultural Science. 5. Pp. 1140-1151.

[7]. International Food Policy Research Institute (IFPRI, 2009). Climate Change Impact on Agriculture and Costs of Adaptation. International Food Policy Research Institute, Washington, DC.

[8]. IPCC - Intergovernmental Panel on Climate Change. (2007). Impacts, Adaptation and Vulnerability. Summary for Policymakers, in ClimateChange: Contribution of Working Group II to the Fourth AssessmentReport Cambridge, UK. Cambridge University Press. Available at:

[9]. Lobell, D.B., Burke, M.B., Tebaldi, C., Manstrandrea, M.D., Falcon, W.P. & Naylor, R.L. (2008). Priotizing climate change adaptation needs for food security in 2030. Science 319(5863). Pp. 607-610.

[10]. Miguel, A.A. &Koohafkan, P. (2010). Impacts of climate change on traditional family farming communities. Oxford university press, New York.

[11]. Nigeria Agricultural Digest (2010). Nigeria Agriculture at 50 years of feeding the nation- Special 50th Independence Anniversary Edition, Garki, Abuja: Farms and Information Foundation (FIF) publishers.

[12]. Nworgu, B.G. (2015). Educational Research. Basic issues and methodology. Third edition. Nsukka, Enugu.University Trust Publishers.

[13]. Ogundele, B. (2012). Flood disasters will be greatest humanitarian crisisafter civil war as flood sacks more rivers' communities.Nigerian Tribune.

[14]. The International Activities of the National Academies of Science, Engineering and Medicine (2018). Working Toward a Better World. Nationalacademies.org/inter

[15]. World Economic Forum (2015). The Inclusive Growth and Development. www.weforum.org/ag

[16]. World Economic Forum (2017). Global Shapes Survey. https://www.inc

[17]. Worldwide University Network (2018). https://wun.ac.uk/wun/globalchallenges