

*Full Length Research Paper*

# Coping measures required by farmers in managing climate change stress for effective agricultural crop production: Case study of Abia State, Nigeria

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This study was carried out to identify coping measures required by farmers in managing climate change stress for effective agricultural production in Abia State, Nigeria. Design of the study was descriptive survey. The study was carried out in Abia State. Two research questions guided the study while two null hypotheses were formulated and tested. Population for the study was 1,009 made up of 768 farmers and 241 extension agents in Abia State. Sample for the study was 302 made up of 230 farmers and 72 extension agents obtained through proportionate (30%) stratified random sampling technique. A 30 item questionnaire was developed and used to collect data for the study. Data obtained were analyzed using mean and standard deviation to answer the research questions while t-test statistic was used to test the hypotheses at probability level of 0.05. It was found by the study that crop farmers require the 30 coping measures identified in managing climate change stress among which include; use of high yielding and tolerant crop varieties, harvesting of water for irrigation and advertising agricultural produce. It was therefore recommended that the identified coping measures be packaged into a training programme by relevant stakeholders for training or retraining of farmers through seminars or workshops to enable them manage climate change stress for effective agricultural crop production in Abia State, Nigeria.

**Key words:** Agriculture, climate change, extension service, marketing, production.

## INTRODUCTION

Climate change has become a global issue being discussed and researched due to its impact on numerous economic activities in many countries. Climate change is a shift in the normal weather cycle over time as a result of human or earth's activities. Climate change is any prolonged alteration in average weather due to natural

variability or as a result of human activities (IPCC, 2007). Climate change is the variation in the statistical distribution of average weather conditions over a prolonged period of time in any region of the world (Adetayo and Owolade, 2012; Ikehi, 2014; Ikehi et al., 2014a). According to the authors, results of climatic

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studies have shown that compared to the pre-industrial era, the world temperature has warmed by at least 1/2°C. The major causes of this worldwide warming have been linked to rising amount of Green House Gases (GHG) in the atmosphere. Adger et al. (2003) stated that negative impacts of extreme events such as floods and droughts are expected to be high in developing countries particularly in rural areas due to climate changes and the stress it poses. Adebayo et al. (2012) explained that climate change impacts on agriculture include adverse effects on crop yield, prices of agricultural goods as well as per capita income and malnutrition. Adetayo and Owolade (2012) stated that climate related risks are major causes of human suffering, poverty and reduced opportunity for people. According to the authors frequent incidents of extreme weather events such as flooding, droughts, desertification, hurricane and other forms of disaster have plagued different parts of the world. The authors further stated that farmers require coping measures to reduce effects and negative impacts of climate change on agriculture and the farmer.

Coping is expending conscious effort to solve personal and interpersonal problems, and seeking to master, minimize or tolerate stress or conflict (Weiten and Lloyd, 2008) are thoughts and actions that are used in dealing with stress. Dealing with stress depends on whether one has the coping resources to handle the challenges. In this study, coping is the process through which farmers can adjust, deal with or manage difficult situations posed by climate change stress by adopting some measures. Coping measures in relation to this study are actions, steps or procedures directed to helping farmers adjust, deal with and manage climate change stress for effective agricultural crop production.

The farmers work with agricultural extension agents who have been trained to provide them with information, advice, guidance and counseling towards solving problems they encounter in agricultural production. It was observed by the researchers that crop farmers in Abia State make low returns in yields and revenues from their farms due to the incidence of extreme weather conditions such as high and fluctuating rainfall patterns, flooding, droughts, high temperature and other unfavorable weather conditions. These weather conditions cause the loss of soil nutrients, planted crops, farm lands and damage of stored farm produce. The crop farmer is vulnerable to the menace of any or a combination of these in which he becomes helpless and discouraged due to stress associated with the weather conditions. It is therefore necessary to expose the farmers to coping measures which would help them in the management of climate change stress for effective agricultural crop production and marketing for profit.

Stress in the view of Warheit in Belkin (1988) is the altered state of an organism produced by agents in the psychological, social, cultural and physical environment. This altered state, the author continued, negatively

affects the well being of individuals; also, it has noticeable physiological indices which together constitute what is often called stress reaction in which an individual's characteristic psychological way of responding to stress is manifested. According to the author, stress should not be viewed simply as a problem; it prepares one to deal with a situation from which one might otherwise retreat and shapes one into a physical condition to do so. Allen (1999) explained that stress is a force or system of forces which tend to produce deformation in a body on which it acts. Bayne and Horton (2003) viewed stress as the experience of unpleasant over or under stimulation that can actually or potentially lead to ill-health. According to the author, it is accompanied by feeling of threat and strain to the extent of being overwhelmed and includes too much or too little stimulation or being bored out of ones mind. In the context of this study, stress is the experience of unpleasant weather conditions caused by climate change in which farmers are exposed to menace of flood, droughts, excessive heat and other extreme weather conditions that do not favour agricultural production and marketing which leads to physical and mental trauma as well as ill-health to the farmers. The extent which an individual can accommodate or withstand stress depends on the coping measures or strategies adopted by the individual against the stressful condition. Agricultural production as explained by Olaitan et al. (2010) is a process of utilizing farm inputs such as land, finance and labour in producing a product following approved logical steps. In this study, agricultural production is the process of utilizing farm inputs such as land, labour and finance as well as adopting coping measures in managing climate change stress for effective production and marketing of plant materials (crops) by crop farmers. Like other produced commodity, agricultural products are distributed to the final consumers to buying and selling.

Agricultural marketing as explained by Abbott and Makeham (1990) are the series of activities that take place between production and consumption of farm produce. According to the authors, it begins at the farm when the farmer plans his production to meet specific demands and market prospects. It involves activities like harvesting, processing, storage, transportation, sorting, grading, packaging and fixing of prices on agricultural produce. Agricultural marketing, the authors further explained, includes the selling to farmers of supplies needed for production such as fertilizers, pesticides and other agricultural chemicals, livestock feed, farm machinery, tools and equipment, and the distribution of produces to consumers after agreed terms of exchange. In this study, agricultural marketing are the series of activities which the crop farmer will carry out from the point of production till the farm produce gets to the consumer. The agricultural produce in their raw state are perishable, their perishability would be worsened by the excessive weather conditions unless the farmer is able to

cope effectively with them. The purpose of this study therefore is to identify coping measures required by farmers in managing climate change stress for effective agricultural production in Abia State, Nigeria. Specifically this study sought to identify;

- 1) Coping measures at farm level practices required by farmers in managing climate change stress in Abia State, Nigeria.
- 2) Coping measures required by farmers for effective marketing of agricultural produce in Abia State, Nigeria.

**Hypothesis 1:** There is no significant difference between the mean ratings of farmers and extension agents on the coping measures at farm level practices required by crop farmers in managing climate change stress in Abia State, Nigeria.

**Hypothesis 2:** There is no significant difference in the mean ratings of farmers and extension agents on the coping measures required by farmers for effective marketing of agricultural produce in managing climate change stress in Abia State, Nigeria.

## METHODS

Two research questions guided the study and two hypotheses were formulated and tested at probability level of 0.05. Descriptive survey research design was adopted for the study. Eboh (2009) explained that descriptive survey research design is a design employed for the study of a population to discover the relative incidence, distribution and inter relations of sociological and psychological variable through the use of interview or questionnaire. Descriptive survey design was found suitable for this study because questionnaire was used to collect data through the opinions of respondents. The study was carried out in the three agricultural zones in Abia State of Nigeria. The zones are Aba, Ohafia and Umuahia. The population for the study was 1,009 made up of 768 farmers and 241 extension agents in Abia State. The sample for the study was 302 consisting of 203 farmers and 72 extension agents. The sample was obtained through proportionate (30%) stratified random sampling technique. A 30 item questionnaire was developed for collecting data from respondents. The questionnaire had two parts A and B. Part A was used to obtain information on personal data of respondents. That is, whether the respondent was a farmer or an agricultural extension agent. Part B was used to obtain data on the coping measures required by farmers for managing climate change stress. Each questionnaire item had a four (4) point response options of Highly Required (HR), Averagely Required (AR), Slightly Required (SR) and Not Required (NR) with corresponding values of 4, 3, 2 and 1 respectively. The agricultural extension agents and farmers responded to the questionnaire to provide information on coping measures that were required by crop farmers. The questionnaire was validated by three experts: one from Department of Agricultural and Bio-resources Education; one from Department of Agricultural Economics and one from Department of Crop Science, all from University of Nigeria Nsukka. Cronbach alpha method was used to determine the internal consistency of the questionnaire which yielded a coefficient of 0.81. Three hundred and two (302) copies of the questionnaire were administered to the respondents through the help of three research assistants. All the copies of the questionnaire were retrieved from the respondents and analyzed. Weighted mean and standard deviation were used to answer the research questions while t-test

statistic was used to test the hypotheses at  $P \leq 0.05$  level of significance. In taking decision on the coping measures that are required, the real limit was utilized as follows: 3.50 to 4.00 (highly required), 2.50 to 3.49 (averagely required), 1.50 to 2.49 (slightly required) and 0.50 to 1.49 (not required). Any item with a standard deviation between zero (0) and 1.96 indicated that the respondents were close to one another in their responses. The null hypothesis of no significant difference was accepted for any item whose t-cal is lower than the t-table value, while any item whose t-cal is greater than the t-table value was rejected at probability level of 0.05 and relevant degree of freedom.

## RESULTS

Data on Table 1 revealed that all the 14 items had their means ranged from 2.78 to 3.42. This showed that the means were above the real limit of 1.5 which indicated that all the 14 items were required as coping measures by farmers in managing climate change stress in the production of agricultural crops. Table 1 also revealed that all the 14 items had their standard deviations ranged from 0.39 to 0.79 which were below 1.96 indicating that the respondents were not far from the mean and were close to one another in their responses. The Table 1 also showed that each item had its t-calculated lower than the t-table (critical) value of 1.96 at probability of 0.05 level of significance and 300 degree of freedom. This revealed that there is no significant difference in the mean ratings of the responses of farmers and agricultural extension agents on the 14 items on coping measures at farm level practices required by farmers in managing climate change stress. The hypothesis of no significant difference was therefore, accepted for each of the items.

Data in Table 2 revealed that all the 16 items identified as coping measures had their means ranged from 2.71 to 3.46. This showed that the means were above the real limit of 1.5 which indicated that all the 16 items were required by farmers as coping measures for marketing of agricultural products in managing climate change stress. Table 2 also revealed that all the items had their standard deviations ranged from 0.26 to 0.85 which were below 1.96 indicating that the respondents were not far from the mean and were close to one another in their responses. This strengthened the value of the mean. Table 2 further revealed that each item had its t-calculated value lower than t-table (critical) value of 1.96 at probability of 0.05 levels of significance and 300 degree of freedom. This indicated that there is no significant difference in the mean ratings of the responses of farmers and agricultural extension agents on the 16 items on coping measures required by farmers for marketing of agricultural produce in managing climate change stress. Therefore the hypothesis of no significant difference is upheld for each of the items.

## DISCUSSION

A close look at the means of the strategies in Tables 1

**Table 1.** Mean ratings and t-test analysis of the respondents on coping measures at farm level practices required by crop farmers in managing climate change stress in Abia State, Nigeria (N=302).

S/N	Item statement	$\bar{X}$	SD	$\bar{X}_e$	$\bar{X}_t$	$S_1^2$	$S_2^2$	T-cal	Remarks	
									RQ	Ho
1	Construction of drainage system around the farmland.	2.79	0.59	2.94	2.7	0.50	0.47	0.27	Required	N.S
2	Making of bunds in the farm.	3.26	0.43	3.18	3.34	0.35	0.38	0.47	"	N.S
3	Use of sand bags to divert movement of running water.	2.83	0.55	2.93	2.76	0.28	0.21	1.35	"	"
4	Making of ridges across slope to slow down water movement.	3.08	0.50	3.21	2.83	0.38	0.54	0.67	"	"
5	Planting of trees around and within farmland.	3.12	0.62	3.19	3.06	0.52	0.57	0.89	"	"
6	Planting of cover crops in the farm.	3.31	0.71	3.38	3.21	0.46	0.30	1.33	"	"
7	Use of organic manures for crop production.	3.22	0.44	3.08	3.37	0.55	0.28	-0.61	"	"
8	Use of high yielding and tolerant crop varieties.	3.38	0.76	3.62	3.49	0.64	0.46	0.84	"	"
9	Multicropping using appropriate or recommended spacing.	3.21	0.43	3.18	3.94	0.58	0.71	0.27	"	"
10	Mulching soil surface using plant materials.	3.41	0.49	3.32	3.38	0.44	0.35	-1.15	"	"
11	Harvesting water for irrigation purposes.	2.78	0.59	2.73	2.88	0.61	0.53	-1.02	"	"
12	Use of irrigation facilities.	3.37	0.79	2.97	3.42	0.56	0.41	-1.25	"	"
13	Use of insecticides, rodenticides and herbicides to check crop damages.	3.42	0.39	3.49	3.44	0.42	0.39	0.46	"	"
14	Adopting rotational cropping.	3.36	0.43	3.58	3.42	0.25	0.42	0.26	"	"

Df=300, T-tab=1.96,  $\bar{X}$ =mean for items required SD=standard deviation,  $\bar{X}_e$ =mean for extension agents on each item,  $\bar{X}_t$ =mean for farmers on each item,  $S^2$ =variance.

and 2 reveals that items 6, 8, 10, 12, 13 and 14 from Table 1 and items 1, 12 and 16 from Table 2 had mean range of 3.28 to 3.46. These items happen to have high mean ratings by the respondents. For items 6 and 10 in Table 1 (planting cover crops in the farm and mulching soil surface using plant materials) with mean values of 3.31 and 3.41, cover cropping and mulching have been known to help conserve soil water for ease of nutrient circulation and absorption thus favouring production and market values and reducing climate stressing for the farmers. These approaches in turn reduce the direct impact, especially sunlight intensity, of climate change on the soil. Using high yielding and tolerant crop variety as indicated in Table 1 item 8 with a mean value of 3.38 helps to cover up for the crop failure that could have occurred in a climate trouble cultivation. The extra yields could cover for losses that would have occurred in normal cultivates that could not tolerate the change weather. With the changed rainfall pattern relying on irrigation (Table 1 item 12 with 3.37 mean) would be a good adaptation strategy in areas with prolonged drought. However, the cost to own and run irrigation facility for the indigent farmers in Abia state will strongly discourage this strategy except in the case of interventions by governmental and/or non-governmental bodies. Crop rotation and use of insecticides/herbicides/rodenticides (Table 1 item 13 and 14 with 3.36 and 3.42 means) have been known to control pests and insects of particular crops. In climate change era efficient use of these approaches could reduce farmers' physical efforts in pest and insect control thus reducing farming stress. Result of

the study in Table 1 revealed that the 14 items identified as coping measures at farm level practices were required by farmers in managing climate change stress. The measures include making of bunds, use of sand bags to divert water movement, planting of cover crops, use of organic manures, mulching soil surface using plant materials and rotational cropping.

Items at Table 2 aim at organizing and improving the farmer's sales and income during crop marketing in climate change era. The prolonged cultivating period coupled with farming difficulties and increased labour cost probably informed the need for growing fast maturing crops (Table 2 item 1 with 3.32 mean). Grading farm product improves pricing and market values of agricultural produce. Agricultural products are never of the same size weight and quality thus grading enhances sales and reduces loss and marketing stress. This strategy seems to be the most favoured approach as suggested by the mean rating of the item. The item has the highest mean value (3.46) of all the 30 strategies mentioned both in practice and marketing of agricultural products in managing climate change stress. It is not out of place for this strategy to rank high as the focus of any enterprise is to make profit through improved product marketability. So even in climate change scenario, the focus of the farmers as suggested by the respondents would be to increase product sales, attract more profit and raise fund for production continuity while adopting other strategies. Result of the study in Table 2 showed that the 16 items were coping measures for marketing of agricultural produce required by farmers in managing

**Table 2.** Mean ratings and t-test analysis of the respondents on coping measures required by farmers for effective marketing of agricultural produce in managing climate change stress in Abia state, Nigeria (N=302).

S/N	Item statement	$\bar{X}$	SD	$\bar{X}_e$	$\bar{X}_t$	$S_1^2$	$S_2^2$	T-cal	Remarks	
									RQ	Ho
1	Grow fast maturing crops.	3.32	0.77	3.42	3.36	0.21	0.30	0.45	Required	N.S
2	Harvest farm produce at the appropriate time.	2.84	0.63	3.31	2.93	0.57	0.28	1.33	"	N.S
3	Access processing facilities.	3.16	0.74	2.98	3.23	0.29	0.32	-0.66	"	"
4	Access good storage facilities.	2.71	0.59	3.08	2.88	0.53	0.26	1.35	"	"
5	Store farm produce before selling.	2.68	0.67	3.18	2.86	0.37	0.52	0.68	"	"
6	Membership to a cooperative society.	3.24	0.71	3.37	3.19	0.48	0.30	1.33	"	"
7	Access good transport facilities.	2.86	0.60	2.96	2.92	0.58	0.31	0.28	"	"
8	Advertise agricultural produce.	3.31	0.43	3.49	3.28	0.42	0.29	1.38	"	"
9	Make contact with buyers.	3.08	0.69	3.20	3.11	0.52	0.34	0.38	"	"
10	Access to market channels.	2.90	0.85	2.84	3.22	0.35	0.29	-0.68	"	"
11	Sort farm produce based on size, weight and quality for appropriate grading.	2.88	0.70	3.27	2.96	0.58	0.26	0.29	"	"
12	Grade farm produce based on size, weight and quality for appropriate pricing.	3.46	0.26	3.62	3.48	0.64	0.47	0.82	"	"
13	Package graded farm produce.	3.22	0.44	3.58	3.37	0.50	0.42	0.27	"	"
14	Fix price on farm produce based on grade.	3.19	0.50	3.34	3.22	0.49	0.38	0.28	"	"
15	Sell off farm produce before they spoil at reasonable prices.	2.81	0.71	2.94	3.16	0.56	0.36	-1.27	"	"
16	Keep record of sales of farm produce in order to check profits and losses.	3.28	0.62	3.32	3.20	0.54	0.48	1.57	"	"

Df=300, T-tab=1.96,  $\bar{X}$ =mean for items required SD=standard deviation,  $\bar{X}_e$ =mean for extension agents on each item,  $\bar{X}_t$ =mean for farmers on each item,  $S^2$ =variance

climate change stress. Some of the measures are harvest farm produce at the appropriate time, access processing facilities, store farm produce before selling, access good transport facilities, make contact with buyers and access to market. The findings of this study is in line with the findings of Nicholls et al. (2007) in a study where measures similar to the findings of this study was recommended. The findings of this study is also in conformity with that of Enete and Amusa (2010) that farmers require the use of irrigation facilities, drainage infrastructures, access to information on climate change, drought resistant and short duration high yielding crops and extension services which are all crucial for coping with climate change stress. The findings of this study further resonant that of UNESCO (2012) report on 'climate change education for sustainable development in small Island developing states' where it was found out that farming communities need to strengthen their adaptive capacity through such measures like accessing information on climate change, providing education to local communities in areas on climate related threats, use of indigenous resources and knowledge among others. The results of the hypothesis tested revealed that there is no significant difference in the mean ratings of the two groups of respondents on the 30 items on coping measures required by farmers at farm level practices and in marketing of agricultural products in managing climate

change stress. This implies that the level of training or/and experiences of each of the two groups of respondents did not influence their responses significantly on the 30 items.

## Conclusion

In Abia State most crop farmers make low returns from their farms due to the incidents of extreme weather conditions such as high and fluctuating rainfall patterns, flooding, droughts, high temperature, and other unfavourable weather conditions caused by climate change. These conditions in effect cause the loss of soil nutrients, planted crops, farm lands and spoilage of stored farm produce. This study therefore was carried out to identifying coping measures that are required by the farmers in managing climate change stress. It was found out by the study that, the farmers require the 30 coping measures identified in managing climate change stress. The most prominent practice was the use of insecticides/rodenticides/herbicides and mulching while the most suggested marketing strategy was the sorting and grading of farm produces to enhance marketability and reduce both farming and marketing stress. It was therefore recommended that the identified coping measures be packaged into a training programme by relevant

stakeholders for training or retraining farmers through seminars and workshops to enable them manage climate change stress for effective agricultural crop production and marketing in Abia State, Nigeria.

### Conflict of Interests

The authors have not declared any conflict of interests.

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