
STRATEGIES FOR CLIMATE CHANGE ADAPTATION AMONG CROP FARMERS IN ONDO STATE, NIGERIA

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Abstract

Impacts of climate change are responsible for the numerous challenges bedeviling agriculture. Impacts are both positive as well as negative, such as changes in the rainfall patterns, flooding and increase in air temperature. There have been noticeable impacts on plant population, food crop production, climate change, therefore, our study focus on the strategies adopted by smallholder farmers in Ondo State to reduce the impact of climate change on crop production. A research design using survey method was adopted where five villages were purposively selected from a predominantly farming settlement and thirty-six (36) respondents were chosen in each village to give 180 respondents. A structured questionnaire was used to collect data. The questionnaire is divided into two parts, Section A and B. Section A elicits demographic information of the respondents such as age, sex, class. The findings show that majority of the respondents have been trying to put in place local strategies such as crop rotation, gate against the effects of climate change. Therefore, the study recommends that government should put in place the strategies that will assist farmers to increase their output in face of the global climate change.

Keywords: Climate change, Strategies, Farmers, Nigeria.

Introduction

Climate change in recent decades has caused impacts on natural and human systems on all continents including the oceans (International Panel on Climate Change, 2021). Intergovernmental panel on climate change (IPCC) 2021, revealed that evidence of climate change impacts is strongest and most comprehensive for natural systems. In many regions, changes in precipitation or melting snow and ice are altering hydrological systems, affecting both the quantity and quality of water resources. In high latitude and high elevation regions, climate change is also causing permafrost warming and thawing. The IPCC (2021) argued that climate change which is as a result of global warming is affecting every part of the world and affecting agriculture more than any other.

Climate change impacts according to IPCC (2021) report refer to the effects of extreme weather and climate events and of climate change on natural and human systems. Climate change can have positive as well as negative impacts, but negative or adverse impacts are projected to predominate for much of the world. For example, the IPCC (2021) report found out that the negative impacts of climate change on crop yields are more than the positive impacts. The positive impacts relate mainly to high-latitude regions.

In rural areas, the impacts of climate change on settlement patterns, livelihoods and incomes are based on the result of two causal chains of impact. One category of the impact involves extreme events such as floods and storms, as they impact on rural infrastructure and cause direct loss of life; while the other category involves impacts on agriculture or ecosystems on which rural community people depend on (Dasgupta, 2014). The impact of climate change on agriculture and ecosystems is through increasing temperature and changes in rainfall patterns (variability and seasonality) as well as through extreme events such as floods and droughts. For example, the Hurricane Stan of October 2005 affected nearly 600,000 people on the Chiapas coast as a result of flooding and loss of lives and crops production in some communities in Ilaje area of Ondo State.

Visible impacts from climate change greatly impact agricultural practices through changes in rainfall patterns, air temperature, crop species diversity and changing planting periods. There have been noticeable impacts on crop production, disease and weed dynamics, and microbial compositions in farming systems (Rosegrant, 2008; Khanal, 2009). Inter-governmental Panel on Climate Change (IPCC) in her synthesis report on climate change explained how hard it is to find evidence of negative consequences of climate on the world agricultural productivity in aggregate agricultural statistics. One reason is the positive gains from global warming observed in the temperate regions due to reduced risk of frost and longer growing season. The other important reason is that world agriculture in general but particularly in temperate regions had witnessed noticeable increases in productivity of most crops as a result of major technological advances (breeding and improved fertility and pest and diseases management) Nigeria is in the tropical area, however. Crop production is currently under significant pressure to meet the demand of rising population using finite, often degraded soil and water resources, which are now further stressed by the impact of climate change (Awotoye & Mathew, 2010). As a result, it is of interest to stakeholders in the agricultural sector to understand the kind of impact climate change will have on food crop production. There will undoubtedly be shifts in agro-ecological conditions that will warrant changes in processes and practices in order to meet daily food requirements. In addition, climate change could become a significant constraint on economic development in developing countries that rely on agriculture for a substantial share of gross domestic production and employment.

Some changes in agricultural practices are taking place across the agro-ecologies of Southwestern Nigeria in order to ensure food security in the zone, a region that feeds about 45 per cent of the nation's population (Awotoye & Mathew, 2010). Climate change is another challenge to the initial inability of food production to meet up with the demand which is already identified in Nigeria. Impacts of climate change on the socio-economic sector are projected to include; decline in yield and production, reduced marginal GDP from agriculture, fluctuation in world market price, change in

geographical distribution of trade regimes, increased number of people at risk of hunger and food security and migration and civil unrest. Increase in temperature, at the same time, might affect both the physical and chemical properties in the soil.

Adaptation such as planting drought-resistant crops helps farmers achieve their food, income and livelihood security objectives in the face of changing climatic and socioeconomic conditions, including volatile short-term changes in local and large-scale markets. Food crop farmers can reduce the potential damage by making tactical actions to these changes. Jagtap (2005) identified crop diversification, mixed cropping, using different crop varieties, changing planting and harvesting dates, drought-resistant varieties, while Enete *et al.* (2011) also identified multiple/intercropping, agro-forestry/afforestation, mulching, purchase/harvest of water for irrigation, among others as some of the climate change adaptation strategies in Southeastern Nigeria. Analyzing adaptation strategies is important for finding ways to help food crop farmers adapt in the rural economies of Africa. There is evidence of changes in agronomic and management practices in order to cope with climate change and variability across the agroecologist in the Southwestern Nigeria (Adebayo, 2011). Such changes is introduction of new varieties of crops in order to survive climate conditions being experiencing.

The ability of farmers to employ the best practice in the production process will bring about an increase in the level of output this is referred to as technical efficiency. But profit efficiency as defined by Abdulai and Huffman (2000) is the ability of a firm to achieve potential maximum profit, given the level of fixed factors and prices faced by the firm. This study will then want to know how crop farmers are coping with climate change in Ondo State, Nigeria.

Purpose of the Study

The main purpose of the study is to identify strategies that are being put in place by the farmers in tackling climate change in their area. The specific objectives are to:

- i. identify the types of climate change adaptation strategies used by rural farmers in the study area;
- ii. examine the factors influence the choice of climate change adaptation strategies used by rural dwellers; and
- iii. determine the constraints on climate change adaptation affect the respondents in the study area.

Research Questions

The following research questions guided the study:

- i. What types of climate change adaptation strategies used by rural farmers in the study area?
- ii. What factors influence the choice of climate change adaptation strategies used by rural dwellers?
- iii. Does constraints on climate change adaptation affect the respondents in the study area?

Methods

The research was done using a survey approach. This was considered appropriate because survey design generally can be used to effectively investigate problems in realistic settings. The survey technique would allow the researcher to examine several variables and use multivariate statistics to analyze data. The population of this study consisted of all household crop farmers in five major villages in Ondo State, who are majorly specialist in planting crop in small scale. A total of 180 household crop farmers were selected from five major villages in Ondo State. The selected five major villages were selected in Akoko South West Local Government Area of Ondo State because residents in the area are predominantly farmers which specialize in planting of fruits, yam, and cassava in large quantity. A structured questionnaire was used to collect data. The questionnaire is divided into two parts, Section A and B. Section A elicits demographic information of the respondents such as age, sex, class. While section B requires the respondents to either tick 'Agree or Strongly Agree' and 'Disagree or Strongly Disagree' to the questions regarding the strategies for climate change adaptation

among rural resident of Akoko South West local government area of Ondo State.

Results

Research Question One: What types of climate change adaptation strategies used by rural farmers in the study area?

Table 1: Climate Change Adaptation Strategies used by Rural Farmers

S/N	Questions		SA Agreed	A Disagreed	D Disagreed	SD Total
1	Plant drought resistant crops	Freq	137	13		150
		%	91.3	8.7		100.0
2	Changes in cropping pattern and calendar of planting	Freq	144	6		150
		%	96.0	4.0		100.0
3	Improving irrigation efficiency and planting of trees	Freq	125	25		150
		%	83.3	16.7		100.0
4	Involvement in community and individual level savings to buy chemical and to improve plant growth	Freq	116	34		150
		%	77.3	22.7		100.0
5	Greenhouse gases is important in maintaining the earth temperature	Freq	117	33		150
		%	78.0	22.0		100.0

Source: Researcher's Field Survey 2021.

Table 1 item 1 revealed that 137(91.3%) of the respondents agreed that plant drought resistant crops, while 13(8.7%) disagreed. Item 2 affirmed that 144(96%) of the respondents agreed that changes in cropping pattern and calendar of planting, while 6(4%) disagreed. In a similar trend item 3, shows that 125(83.3%) of the respondents agreed that improving irrigation efficiency and planting of trees while, 25(16.7%) disagreed with the statement. Furthermore item 4 revealed that 116(77.3%) of the respondents agreed that involvement in community and individual level savings to buy chemical and to improve plant growth, while 34(22.7%) disagreed with the statement. This implies that Greenhouse gases make up only about 1 per cent of the Earth's atmosphere. Finally,

item 5 shows that 117(78.0%) of the respondents agreed that plants varieties of crops to mitigate against climate change, while only 33(22%) disagreed with the statement. The result from research question one shows that majority of the respondents abide with adaptation of the *climate change strategies used by rural farmers in the study area planting drought resistant's crops*, Changes in cropping pattern and calendar of planting, improving irrigation efficiency and planting of trees, involvement in community and individual level savings to buy chemical and to improve plant growth and plants varieties of crops to mitigate against climate change.

Research Questions Two: What factors that influence the choice of climate change adaptation strategies used by rural dwellers?

Table 2: Factors that influence the choice of Climate Change Adaptation Strategies

S/N	Questions		SA Agreed	A Disagreed	SD Total
6	Lack of access to weather forecast technologies	%	88.7	11.3	100.0
7	Lack of or inadequate government policies to empower food crop farmers	Freq %	131 87.3	19 12.7	150 100.0
8	Lack of access to supporting institutional facilities	Freq %	122 81.3	28 18.7	150 100.0
9	Lack of access to and awareness about NGOs programme on climate change adaptation	Freq %	129 86.0	21 14.0	150 100.0
10	Lack of access to weather and climate forecast information	Freq %	125 83.3	25 16.7	150 100.0
11	Limited Government irresponsiveness to climate risk management	Freq %	125 83.3	25 16.7	150 100.0

Source: Researcher's Field Survey 2021.

The result from Table 2 item 6 indicated that majority of the respondents 133(88.7%) agreed that lack of access to weather forecast technologies are one of the factor influencing choice of climate change, while 17(11.3%) disagreed with the statement.

Item 7 also explained that majority of the respondents 131(87.3%) agreed that lack of or inadequate government policies to empower food crop farmers, while 19(12.7%) disagreed. Item 8, observed that most of the respondents 122(81.3%) agreed that lack of access to supporting institutional facilities, such as loans facilities, machines while, 28(18.7%) disagreed about the statement. Item 9, shows that 129(86%) of the respondents agreed that lack of access to and awareness about NGOs programme on climate change adaptation, while 21(14%) disagreed with the statement. Item 10, shows that 120(80%) of the respondents agreed that lack of access to weather and climate forecast information, while 30(20%) disagreed with the statement. Finally, it was affirmed that majority respondents agreed 125(83.3%) that limited Government irresponsiveness to climate risk management, while 25(16.7%) disagreed with the statement.

The result on research question two shows that majority of the respondents agreed that factors that influence the choice of climate change adaptation strategies used by rural dwellers are, lack of access to weather forecast technologies, lack of or inadequate government policies to empower food crop farmers, lack of access to supporting institutional facilities, lack of access to and awareness about NGOs programme on climate change adaptation, lack of access to weather and climate forecast information and limited Government irresponsiveness to climate risk management.

Research Question Three: Does constraints on climate change adaptation affect the respondents in the study area?

Table 3: Constraints on Climate Change Adaptation

S/N	Questions		SA Agreed	A Disagreed	SD Total
12	Lack of access to weather forecast technologies	Freq %	143 95.3	7 4.7	150 100.0
13	Tedious nature of climate change adaptation strategies	Freq %	129 86.0	21 14.0	150 100.0
14	Lack of /or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production	Freq %	130 86.7	20 13.3	150 100.0
15	Lack of /or inadequate government policies to empower food crop farmers	Freq %	129 86.0	21 14.0	150 100.0
16	Lack of collateral security required to secure loan to support food crop farming	Freq %	125 83.3	25 16.7	150 100.0

Source: Researcher's Field Survey 2021.

Table 3 item 12 above indicated that 143(95.3%) of the respondents agreed with that lack of access to weather forecast technologies while 7(4.7%) disagreed with the statement. This implies that Lack of access to weather forecast technologies can be major constraints to climate change adaptation. Item 13 shows that 129(86%) of the respondents agreed that tedious nature of climate change adaptation strategies, while 21(14%) disagreed with the statement. This implies that tedious nature of climate change adaptation strategies are affecting farmers in the study area. Item 14 of the respondents agreed 130(86.7%) shows that lack of/or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production, while 20(13.3%) disagreed with the statement. Item 15 observed that 129(86%) of the respondents agreed that lack of /or inadequate government policies to empower food crop farmers, while 21(14%) disagreed. Finally, item 16 shows that 125(83.3%) agreed that lack of collateral security required to secure loan to support food crop farming, while 25(16.7%) disagreed with the statement.

The findings from research question three shows that constraints to climate change adaptation by the respondents in the study area as follows; lack of access to weather forecast technologies, tedious nature of climate change adaptation strategies, lack of /or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production, lack of /or inadequate government policies to empower food crop farmers and lack of collateral security required to secure loan to support food crop farming.

Discussions

The result from research question one shows that majority of the respondents are abide with adaptation of the climate change strategies used by rural farmers in the study area planting drought resistant's crops. Changes in cropping pattern and calendar of planting, improving irrigation efficiency and planting of trees, involvement in community and individual level savings to buy chemical and to improve plant growth and plants varieties of crops to mitigate against climate change. The result disagreed with the finding of Nhemachena and Hassan (2007) explained adaptation to climate change as changes in agricultural management practices in response to changes in climate conditions. Various types of adaptation can be distinguished, including (i). anticipatory and reactive adaptation, (ii). private and public adaptation, and (iii). autonomous and planned adaptation. Adaptation is an important component of climate change impact and vulnerability assessment. Adaptation responses can be categorized by the level of ownership of the adaptation measure or strategy.

The result on research question two shows that majority of the respondents agreed that factors that influence the choice of climate change adaptation strategies used by rural dwellers are, lack of access to weather forecast technologies, lack of or inadequate government policies to empower food crop farmers, lack of access to supporting institutional facilities, lack of access to and awareness about NGOs programme on climate change adaptation, lack of access to weather and climate forecast information and limited

Government irresponsiveness to climate risk management. The result agreed with the finding of Fernandez-Cornejo (2002; 2007) hypothesized that tenants can be assumed less likely than landowners to adopt new technological innovations, as the benefits may not necessarily flow to them, while land ownership is likely to influence the adoption decision. It was also found out by Birungi and Hassan (2010) that land tenure security increases the probability of adoption of most technologies. However, there has been some disagreement in the literature regarding this hypothesis (Feder, 1985). It has been suggested that the inconsistencies in the literature are likely due to the nature of the technological innovation being examined. Regardless of these disagreements, the effect of tenure on the adoption of new technologies should be examined.

The findings result from research question three shows that constraints to climate change adaptation by the respondents in the study area as follows; lack of access to weather forecast technologies, tedious nature of climate change adaptation strategies, lack of /or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production, lack of /or inadequate government policies to empower food crop farmers and lack of collateral security required to secure loan to support food crop farming. The result agreed with the finding of Amaza, Bila and Iheanacho (2006) which examined the determinants of food crop production and technical efficiency in the guinea savanna of Borno State, Nigeria. Land area, fertilizer and hired labour had positive effects on output and their coefficients are significant at 1%. The mean farmers' technical efficiency index was found to be 0.68 (68%). Farmer-specific efficiency factors, which comprise age, education, credit, extension had positive coefficients and were significant at 1% but crop diversification had negative coefficient and was significant at 5%.

Conclusion

The result of findings shows that majority of the crop farmers in the study area planting drought resistant's crops, Changes in cropping pattern and calendar of planting, improving irrigation

efficiency and planting of trees, involvement in community and individual level savings to buy chemical and to improve plant growth and plants varieties of crops to mitigate against climate change, also the causes and consequences of Greenhouse effects are majorly caused by gases in the atmosphere, human-made, human activities, halons are present in the atmosphere as a result of human activities, fossil fuels and deforestation. The result also shows that constraints to climate change adaptation by the respondents in the study area as follows; lack of access to weather forecast technologies, tedious nature of climate change adaptation strategies, lack of /or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production, lack of /or inadequate government policies to empower food crop farmers and lack of collateral security required to secure loan to support food crop farming. Therefore, the study concluded that early planning can help reduce future adverse health effects and mitigation strategies, for example using a number of renewable energy sources, can improve health by reducing air pollution as well as addressing climate change.

Recommendations

The study suggests that planting of drought resistant crops be more encouraged among the farmers in the Akoko area of Ondo State. These results imply that Nigerian government should make changing in cropping pattern and calendar of planting be encouraged. Governments should make provision for irrigation system and planting of trees.

References

- ABCnews (2018). The woes of too much CO2 <http://www.abcnews.com/sections/science/DailyNews/globalwarming980520.html>
- Abdulai, S. & Huffman, M. (2000). Methane emissions from wastewater management. *Environ. Pollut*; 114, 177-185.
- Dasgupta, R. (2014). Implications of climatic variability for food security in the Southern African development community. *Internet Journal of African Studies*, Issue No. 2 – March.

- Dhumal, Y. R. & Chitode, J. S. (2013). Green house automation using Zigbee and smart phone: *International Journal of Advanced Research in Computer Science and Software Engineering Research Paper*, 3(5).
- Enete, D. & Ponting, C. (2011). A green history of the world: Farmers' attitude to farming now adays: Papers in honour of farmers loss during the climate change, pp. 378-392. Penguin Books, New York.
- Environmental Protection Agency (EPA) (2009-2012). United States Greenhouse Emission Gases.
- European Environment Agency. Annual European Union greenhouse gas inventory 1990–2012 and inventory report (2014). Submission to the UNFCCC Secretariat: Technical Report 09/2014. Brussels, Belgium.
- Fasola, K. Z. (2007). Causes and consequences of greenhouse effect and its catastrophic problems for earth. *International Journal of Sustainability Management and Information Technologies*, 3(4). 34-39.
- Intergovernmental Panel on Climate Change (IPCC) (2014). *The scientific basis*. Cambridge, UK: Cambridge University Press.
- IPCC (2007). Climate change – The IPCC Scientific assessment Houghton, J.T., Jenkins, G.I., Ephraums, J.J. (Eds.) Cambridge University Press, Cambridge (UK).
- IPCC (2021). ARS Climate change; The physical science basis, Assessment Report, <https://interactive-atlas.ipcc.ch>
- Oladapo, S. O. (2019). Knowledge and perception of secondary school teachers on global warming in Ibadan, Oyo State, Nigeria: *American International Journal of Education and Linguistic Research*, 2 (2), 29-34. Retrieved from <http://www.acseusa.org/journal/index.php/aijelr/article/view/84>. USA.