Journal of Scientific Research & Reports

26(2): 44-51, 2020; Article no.JSRR.54260
ISSN: 2320-0227

Cocoa Farmers' Coping Strategies for Climate Change Adaptation in Ogun State, Nigeria

Alex O. Orimogunje[1], Babatunde A. Ogundeji[1*], Tolulope I. Ademola[2], Shamsudeen T. Balogun[1], David J. Awodumila[1], Rosemary T. Olorunmota[1] and Kehinde O. Oyeledun[1]

[1]Cocoa Research Institute of Nigeria, P.M.B. 5244, Ibadan, Nigeria.
[2]Forestry Research Institute of Nigeria, P.M.B. 5054, Ibadan, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author AOO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author BAO managed the literature searches and manuscript. Authors KOO, STB, DJA, RTO and TIA managed the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2020/v26i230223
Editor(s):
(1) Dr. Chen Chin Chang, Hunan Women's University, China.
Reviewers:
(1) Ali Raza, Chinese Academy of Agricultural Sciences, China.
(2) Ana Maria Arambarri, National University of La Plata, Argentina.
(3) Christopher Kalima Phiri, Lilongwe University of Agriculture and Natural Resources, Malawi.
Complete Peer review History: http://www.sdiarticle4.com/review-history/54260

Original Research Article

Received 04 December 2019
Accepted 10 February 2020
Published 11 March 2020

ABSTRACT

Aims: This study sought to identify the personal characteristics, climate adaptation/coping strategies and enterprise characteristics of cocoa farmers in Ogun State, Nigeria. The study also aimed at determining constraints faced by the cocoa farmers in the course of carrying out the coping strategies.
Study Design: Multistage sampling technique.
Place and Duration of Study: Ijebu-Igbo and Ago-Iwoye, Ogun State, Nigeria.
Methodology: This research work examined cocoa farmers' coping strategies for climate change adaptation in Ogun State, Nigeria. A sample size of 60 respondents was used. Data were collected from selected cocoa farmers with the aid of structured interview schedule and data were analyzed using descriptive and inferential statistics.
Results: The results revealed that the mean age of respondents was 46.5 years, indicating that most of them were still in their active age. The findings also revealed that majority (78.3%) of the

**Corresponding author: E-mail: tundeji1@gmail.com;*

respondents were married, while 90.0% of them were educated at various levels. Planting of cocoa under a weeded forest was ranked first in the coping strategies used by the farmers. Poor access to credit facilities was ranked first among the constraint faced by the respondents in the use of adaptation strategies in the study area. However, educational qualification ($\chi 2=22.949$, $p=0.000$) indicated that they were significantly related to the rate of adoption of farmers' coping strategies to climate change in the study area.

Conclusion: The study established that poor funding, among other challenges was a major constraint to farmers' adoption of climate change coping strategies. Researchers therefore, need to commence developmental interventions aimed at addressing the identified constraints and work towards the development of drought tolerant cocoa varieties in order to boost cocoa production and improve farmers' livelihood.

Keywords: Global warming; adaptation; coping strategies; climate change.

1. INTRODUCTION

Climate is the state of the atmosphere created by weather events over a period of time. Relative to other natural resources, climate is the predominant factor that influences agricultural production. The Inter-governmental Panel on Climate Change (IPCC), [1] defined climate change as a statistically significant variation in the mean state of climate that persists for an extended period of time. Climate change is as a result of the natural climate cycle and human activities [2]. Its effects are experienced globally, but the most adverse effects are being felt mainly by developing countries, especially those in Africa due to low level of coping capabilities [3]. Agriculture is threatened by extreme climatic events such as droughts or floods induced by climate change [4]. In Nigeria for instance, bush burning is a common method of clearing farm land. In addition, the use of firewood as cooking energy source thrives. Because of the high cost and non-availability of other cleaner sources such as natural gas. These activities increase the concentration of greenhouse gases (GHGs) in the atmosphere, trapping heat and causing global warming, climate change and rise in sea level [6]. Furthermore, the problem of deforestation is predominant in Africa. The current annual deforestation rate is put at 0.7% and the decline in forest area is expected to continue. Garba [7] noted that destruction of natural resources is one of the major causes of poverty, and this can lead to environmental degradation, high temperature, drought and consequently reduced productivity. Nigeria's forest is being depleted because of rising population, migration, land degradation, hunger, poverty and starvation.

Cocoa production has contributed immensely to the country's Gross Domestic Product (GDP). No other agricultural export crop has earned more foreign exchange than cocoa. The sub-sector offers employment both directly and indirectly to the teaming youth population, and supplies significant volume of raw materials to industries in the cocoa value chain. . According to IPCC [5], cocoa is very sensitive to climate change and it will increase existing stress on agricultural systems, particularly those in Africa for several reasons.

Firstly, higher percentage of cocoa production in Africa is still mainly rain-fed and therefore highly vulnerable to changes in climatic conditions such as droughts, higher temperatures and reduced precipitation levels [8]. Secondly, cocoa production in Africa is mostly extensive and practiced on relatively fragile environments and poor quality soils, with little use of modern inputs and farming methods to cope with climate change impacts [9]. Thirdly, the availability of multiple factors such as endemic poverty, weak institutions, inadequate health services, limited access to capital and markets, poor infrastructure and technology and conflicts over natural resources reduce farm households' adaptive capacity to manage the numerous challenges of climate change [10]. Finally, most African governments devote meager financial resources to their agricultural sectors generally, thereby reducing investment in scientific research needed to better understand and respond to climate change impacts [10].

Cocoa requires rainfall of between 900-1000 mm for optimum production and better yield, as well as adequate soil conditions and particularly adequate temperature due to its effects on evapo-transpiration. However, adverse climatic conditions could alter different stages of growth and development of cocoa, evidenced in cherelle wilt, development of cocoa pests and pathogens,

abortion of flowers and so on. All these menace has contributed to the dwindling situation of cocoa production in Nigeria. Consequently, cocoa farmers have devised some coping strategies that can be used to reduce loss of crops and fluctuations in the yield [11,12].

Coping strategy is the adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts [1]. Coping strategies refer to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate. It involves adjustments to reduce the vulnerability of communities, regions, or activities to climate change and variability and could come in a variety of forms. Coping strategies takes advantage of natural ecological measures to improve soil structure, reduce evapo-transpiration on the crops, reduce soil erosion, conserve soil moisture, reduce the incidence of pests/diseases and improve soil fertility through natural process [13].

The need to use climate-smart coping strategies to adapt to the effects of climate change on cocoa production becomes necessary, as this will protect land from being depleted and will boost production of cocoa in the study area. The major objective of this study was to assess cocoa farmers' coping strategies for climate change adaptation in Ogun State, Nigeria. The specific objectives were to:

i. Identify the personal characteristics of the respondents in the study area,
ii. Describe the enterprise characteristics of the respondents in the study area,
iii. Identify the coping strategies used by the respondents for climate change adaptation in the study area,
iv. Describe the constraints faced by respondents in carrying out the coping strategies in the study area.

1.1 Hypotheses of the Study

Ho1: There is no significant relationship between respondents selected personal characteristics and the use of coping strategies for climate change adaptation in the study area.

Ho2: There is no significant relationship between the constraints faced by respondents and coping strategies used on climate change adaptation in the study area.

2. MATERIALS AND METHODS

Multistage sampling technique was used for this study. First stage included the purposive selection of Ijebu-Igbo and Ago-Iwoye in Ijebu North Local government Area of Southwest Nigeria because of predominance of cocoa farmers. In the second stage, Japara village was purposively selected in Ijebu-Igbo because record showed it is the highest producer of cocoa in the local government, while Oke-Ogbe was also purposively selected in Ago-Iwoye because of high record of cocoa production. Third stage, simple random sampling was used to select thirty respondents from each of the villages making a total size of 60 respondents.

2.1 Measurement of the Variables of This Study

Constraints to the use of climate change coping strategies: A list of nine perceived constraints was developed and respondents were asked to indicate which of the constraint affect them according to its severity. It was measured on a 3-point scale of 'Not a constraint', 'Mild constraint' and 'Severe constraint', with scores of 0, 1 and 2 assigned respectively. The mean score for each constraint was obtained and used to rank them in order of severity.

Coping strategies to climate change: The respondents were presented with a list of nine coping strategies to climate change from which they indicated their frequency of use. It was measured on a 3-point scale of 'Never', 'Occasionally' and 'Always', with scores of 0, 1 and 2 assigned respectively. The mean score for each coping strategy was obtained and used to rank them in order of importance.

3. RESULTS AND DISCUSSION

3.1 Personal Characteristics of the Respondents

Table 1 shows that majority (76.7%) of the cocoa farmers were within the age range 47 - 56 years (mean = 46.5 years). This indicates an ageing group of farmers but they are still expected to be in their cocoa enterprise and should be in a position to use available coping strategies to climate change to maintain their cocoa plot. This is in line with Akinbile [14] finding that the average age of most rural household head was 45.2 years. Majority (66.7%) of them were male,

implying men dominate cocoa production in the study area, Ekong [15] similarly noted that there are more male household heads of productive age in rural areas of Southwest Nigeria than the females. Majority (78.3%) of the respondents were married, with 75.0% having a household of 3 - 4 persons. Marriage is known to facilitate farming activities in rural area because it creates access to unpaid labour which farmers always crave [15]. Availability of family labour in the households of married cocoa farmers can encourage the use of climate change coping strategies.

The religious inclination of the respondents showed that 56.7% were Christians, 30.0% were Muslims and 13.3% were traditional worshippers. This indicates that there are no religious discrimination in cultivation of cocoa in the study area. Finding further showed that majority (90.0%) had different levels of formal education. This conforms with the findings of Ewebiyi [16], who reported that rural dwellers had one form of formal education. High level of literacy is expected to positively influence the rate of adoption of coping strategies to climate change. Okunlola [17] also observed that level of education influences adoption of new technologies. Furthermore, 88.3% had farming as their primary occupation. This is in consonance with the report of Ewebiyi [16], who stated that though rural dwellers are involved in other livelihood activities, farming remains their principal occupation.

Table 1. Personal characteristics of the respondents

Age	Frequency	Percentage (%)	Mean
36 – 41	9	15.0	
42 – 46	4	6.6	
47 – 51	22	36.7	46.5
52 – 56	24	40.0	
57 – 61	1	1.7	
Marital status			
Single	5	8.3	
Married	47	78.3	
Divorced	5	8.3	
Widowed	3	5.0	
Sex			
Male	40	66.7	
Female	20	33.3	
Education			
No formal	6	10.0	
Primary	30	50.0	
Secondary	20	33.3	
Tertiary	4	6.7	
No. of children			
1 – 2	5	8.3	
3 – 4	47	75.0	
5 – 6	10	16.7	
Religion			
Christianity	34	56.7	
Islam	18	30.0	
Tradition	8	13.3	
Occupation			
Farming	53	88.3	
Business	3	5.0	
Civil servant	4	6.7	
Ethic group			
Yoruba	57	95.0	
Hausa	1	1.7	
Igbo	2	3.3	

Source: Field survey (2018)

Table 2. Enterprise characteristics of the respondents

Variable	Frequency	Percentage (%)
Labour source		
Family	3	5.0
Hired	29	48.3
Both	28	46.7
Capital source		
Bank loan	14	23.3
Personal saving	10	16.7
Cooperative	29	48.3
Friend	7	11.7
Year in cocoa business		
3 – 5	4	6.7
6 – 8	35	58.3
9 – 11	15	25.0
12 – 14	4	6.7
15 – 16	2	3.3
Years of irregular rainfall		
1 – 3	10	16.7
4 – 6	40	66.7
7 – 8	10	16.7
Do you experience flood		
Yes	51	85.0
No	9	15.0
Drought		
Yes	59	85.0
No	9	15.0
Spraying		
Once	5	8.3
Twice	28	46.7
Thrice	20	33.3
Four times	1	1.7
No spraying	6	10.0
Irrigation		
No	51	85.0
Yes	9	15.0
Organic manure		
No	43	71.7
Yes	17	28.3

Source: Field survey (2018)

3.2 Enterprise Characteristics of the Respondents

Table 2 shows that hired labour (48.3%) and a combination family and hired labour (46.7%) were the most utilized types of labour by the respondents, while only 5.0% used family labour. This indicates increasingly less availability of family labour in rural areas primarily due to migration of family members from rural to urban areas in search of white collar jobs. The implication of this is that it may reduce the extent to which the cocoa farmers adopt coping strategies for adaptation as they may require additional labour. This is because households with more labour are able to take on various adaptation management practices in response to climate change relative to those with limited labour [18]. Cooperative society (48.3%) was the most patronized source from which the farmers got financial support for their farming activities. Availability of capital would encourage the adoption of coping strategies. Majority (66.7%) of the farmers indicated they have been observing irregular rainfall for the past 4 – 6years. Additionally, 85.5% had experienced flooding in the last three years, while 85.5% stated they had experienced the occurrence of drought within the same period. These findings imply that the climate in the study area is changing and the

reality is dawning on the farmers. It therefore calls for the need to device strategies to cope with such changes. It was further revealed that 46.7% of the respondents sprayed their cocoa plantation three times in a year, especially during the raining season. This may be due to the increased attacks by fungi as predisposed by increased humidity caused by high rainfall.

3.3 Coping Strategies against Climate Change Effects used by Respondents

Table 3 shows the respondents' coping strategies to climate change according to frequency of use. Planting of young cocoa seedlings under a weeded forest and planting in-situ (seed) instead of seedlings ranked 1st (mean=0.80) and 2nd (mean=0.77), respectively this was due to the fact that when young cocoa seedlings are planted under a weeded forest, the rate at which transpiration occurs is greatly reduced. The trees of the forest are gradually removed or de-barked after the second year the seedlings have survived the dry season. Planting of plantain in the same hole with cocoa seedlings was ranked 3rd (mean=0.72).The most probable reason for this is that plantain suckers can supply little moisture to the young cocoa seedlings at the peak of the dry season, which can help to reduce any water-related stress.

3.4 Constraints to the use of Coping Strategies

Table 4 shows the constraints to the use of coping strategies by respondents according to their severity. Findings showed that poor access to credit facilities (mean = 1.86), inadequate input (mean=1.64) and unavailability of labour (mean = 1.41) were the most important constraints confronting the cocoa farmers as associated with the use of the identified coping strategies in order to adapt to climate change in the study area. Credit is quite crucial in agricultural production and can be a systemic problem. Credit is important for the procurement of necessary inputs such as fertilizers, agrochemical, machinery, etc. Also, the increasing unavailability of family labour in rural areas due to migration of family members to cities in search of white collar jobs implies that credit becomes necessary for payment of hired labourers. Therefore, the problem of poor access to credit which most farmers have to contend with will make it difficult for any cocoa farmer who is willing to apply coping strategies to climate change on his farm to do so. Odozi [19] stated that farmers are most times reluctant to embrace new agricultural technologies due to limited financial resources. However, those who possess better finance and other resources at their disposal will be more practically involved in the adoption of new technologies capable of improving their farm productivity [20].

Table 5 shows that cocoa farmers' educational qualification (χ^2=22.949, p=0.000) was significantly related to coping strategies to climate change. Farmers with higher education status have a greater ability to receive and process information relating to coping strategies towards climate change. Successful processing of information would translate to a greater probability of taking action against climate change in order to improve their farmland. This aligns with Mustapha et al. [21] submission that education gives farmers the ability to perceive, interpret and adequately determine actions that would possibly enhance their performance in farming activities. Hence, an educated cocoa farmer would more likely use available climate change coping strategies because of his exposure and access to relevant agro-climatic information.

Table 3. Coping strategies used by respondent

SN	Coping strategies	Mean	Rank
1	Mulching of cocoa with plantain/ banana stem debris	0.53	8th
2.	Planting of plantain in the same hole with cocoa seedling	0.72	3rd
3.	Planting of cassava as a shade crop	0.67	5th
4.	Planting of plantain as shade crops	0.71	4th
5.	Planting of drought tolerant cocoa	0.65	6th
6	Planting cocoa seedlings under a weeded forest	0.80	1st
7	Irrigation/watering during the dry season	0.50	9th
8	Ring weeding instead of total clearing during the dry season	0.54	7th
9	Planting in-situ (seed) instead of planting seedling	0.77	2nd

Source: Field survey, 2018

Table 4. Constraints to the use of coping strategies by respondents

S/N	Perceived constraints	Mean	Rank
1.	Poor access to credit facilities (for irrigation facilities etc)	1.86	1st
2.	Unavailability of labour	1.41	3rd
3.	Limited access to information on weather forecast by NIMET	0.94	5th
4.	Unavailability storage facilities	0.20	9th
5.	Unpredictable climatic condition	0.71	7th
6.	Unstable government policies	0.72	6th
7.	Inadequacy of inputs(drought tolerant seedlings, chemicals)	1.64	2nd
8.	Theft/ pilfering	0.32	8th
9	High incidence of pests and diseases	1.01	4th

Source: Field survey, 2018

Table 5. Chi-square analysis of relationship between cocoa farmers' personal characteristics and coping strategies to climate change

Variables	X^2	Df	P- value	Remark
Sex	0.02	1	0.961	Not significant
Marital status	7.342	3	0.62	Not significant
Education	22.949	2	0.000	Significant
Primary occupation	3.51	2	0.172	Not significant

4. CONCLUSION AND RECOMMENDATION

The most common climate change coping strategies used in the study area by cocoa farmers were planting of young cocoa seedlings under a weeded forest, planting *in situ* (seed), and planting of plantain in the same hole with cocoa seedlings. The study established that poor access to credit facilities, inadequacy of input and unavailability of labour were the most important constraints to the use of coping strategies to climate change. There is therefore need for policymakers to commence developmental interventions aimed at addressing the identified constraints so as to boost cocoa production and improve farmers' livelihood. Researchers should also start directing their findings toward a climate-smart agriculture and work more on drought tolerant cocoa varieties that can withstand harsh weather conditions.

CONSENT

As per international standard respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. IPCC (Inter-governmental Panel on Climate Change). Climate Change 2001: Impacts, Adaptation, and Vulnerability. New York; 2001.
2. Ziervogel GA, Nyong B, Osman C, Conde S, Dowing T. Climate variability and change: Implications for household food security. Assessments of Impacts and Adaptations to Climate Change (AIACC) Working Paper No. 20. The AIACC Project Office, International START Secretariat, Washington DC, USA; 2006.
3. Nwafor JC. Global climate change: The driver of multiple causes of flood intensity in Sub-Saharan Africa. Paper Presented at the International Conference on Climate Change and Economic Sustainability held at Nnamdi Azikiwe University, Enugu, Nigeria; 2007.
4. FAO (Food and Agricultural Organization). Agricultural Insurance in Asia and the Pacific Region, RAP Publication 2011/12; 2011.
5. IPCC (Inter-governmental Panel on Climate Change). Climate change: Synthesis report and summary for policymakers; 2014.
(Accessed 20 February 2016)
Available:www.ipcc.ch/report/ar5/syr/

6. Medugu NI. Nigeria: Climate Change - A Threat to the Country's Development; 2009. Available:http://www.allafrica.com/nigeria/
7. Garba A. Alleviating poverty in Northern Nigeria. Being a Paper Presented at the Annual Convention of Zumunta Association at Minneapolis United State of America; 2006.
8. World Bank. World Development Report 2008, Washington, DC; 2008.
9. Mendelsohn R, Dinar A. Climate change, agriculture and developing countries: Does adaptation matter? World Bank Research Observer. 1999;14(2):277-293.
10. Hassan R. Implications of climate change for agricultural sector performance in Africa: Policy challenges and research agenda. Journal of African Economies. 2010;19(2):ii77-ii105.
11. Ajewole DO, Iyanda S. Effect of climate change on cocoa yield: A case of Cocoa Research Institute (CRIN) Farm, Oluyole Local Government Ibadan Oyo State. Journal of Sustainable Development in Africa. 2010;12(1):350-358.
12. Anim-Kwapong GJ, Frimpong EB. Vulnerability of agriculture to climate–change impact of climate on Cocoa production. Cocoa Research Institute, New Tafo Akim, Ghana; 2005.
13. Jarungrattanapong R, Manasboonphempool A. Adaptation strategies to address coastal erosion/ flooding: A case study of the communities in BangKhun District, Bangkok, Thailand. Economy and Environment Program for Southeast Asia. 2009;36. (Accessed 3 October, 2012) Available:www.ccsea.org/pub/tr/12628446591Rawadee_and_Areeya_-_Coastal_Erosion.pdf
14. Akinbile LA. Determinant of productivity level among rice farmers in Ogun State, Nigeria. African Crop Science Conference Proceeding. 2007; 8:134-136.
15. Ekong EE. Rural development in Nigeria: An introduction and analysis of rural Nigeria, Uyo, Nigeria, Dove Educational Publishers; 2003.
16. Ewebiyi IO. Livelihood diversification among rural dwellers in Southwestern, Nigeria; An Unpublished Ph.D Thesis Submitted to the Department of Agricultural Extension and Rural Development, University of Ibadan. 2004;23-27.
17. Okunlola JO. Factors associated with the adoption of food crops production technologies by small scale farmers in Niger Republic. Ogun Journal of Agricultural Production; 2006.
18. Onyegbula ICB. Effects of utilization of climate change adaptation strategies on rice farmers' productivity in Nigeria. PhD Unpublished Thesis Submitted to the Department of Agricultural Extension and Rural Development, University of Ibadan, Ibadan; 2015.
19. Odozi JC. Rice self-sufficiency and farm households: the role of climate change and technology response in Nigeria. Journal of Poverty, Investment and Development. 2014;3(1):7.
20. Amusat AS. Effectiveness of research-extension-farmers-input linkage system on maize production in Nigeria. Unpublished PhD Thesis submitted to the Department of Agricultural Extension and Rural Development, University of Ibadan; 2018.
21. Mustapha SB, Sanda AH, Shehu H. Farmers' perception of climate change in central agricultural zone of Borno state, Nigeria. Journal of Environmental and Earth Sciences. 2012;2(11).

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/54260