Current Journal of Applied Science and Technology

Volume 42, Issue 6, Page 33-40, 2023; Article no.CJAST.82299
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

Assessment of Farmers' Resilience to Climate – Related Disasters in Oyo State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2023/v42i64075

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/82299

Original Research Article

Received: 25/02/2022
Accepted: 01/04/2022
Published: 24/03/2023

ABSTRACT

The study assessed farmers' resilience to climate related disasters in Oyo State, Nigeria. Simple random sampling technique was used to select 153 farmers from the list of those who have previously experienced climate related disaster in the state. Results indicate that 58.8% of the respondents were male, 37.3% did not have formal education, 80.4% were married and 59.4% used family labour. Majority (85.0%) were not aware of agricultural insurance scheme while 49.0% were aware of emergency response scheme of the government. The most available resilience options to farmers were improve variety of seeds (88.2%) and agro technologies (88.2%) while the most frequently experienced climate related disaster were drought ($\bar{x}$=1.20) and flood ($\bar{x}$=1.18). Also, drought ($\bar{x}$=1.38) and flood ($\bar{x}$ =1.37) were the most severe among the climate related disaster experienced in the study area while respondents had high capacity to mitigate pest infestation ($\bar{x}$=2.72) and forest fire ($\bar{x}$= 1.80). Low level of knowledge ($\bar{x}$ =1.50) and poor response

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from emergency management of governments ($\bar{x}$=1.46) were the major constraints to mitigation of climate related disaster in the study area. Significant relationship existed between respondents' education (χ^2=16.34;P=0.001) and their resilience to climate related disaster. Efforts should be made to provide capacity building for farmers on possible ways of mitigating negative effects of climate change in the study area.

Keywords: Resilience; capacity building; climate change; drought; flood.

1. INTRODUCTION

The resilience of farmers to climate – related disasters is inevitable especially among small scale farmers if food security is to be guaranteed and sustained in Nigeria. The unending changes in climatic conditions resulting in extreme weather events such as floods, droughts, storms and forest fire have triggered disasters which destroy farms and other agricultural processes. Farmers face challenges of tragic crop failure, reduced agricultural productivity, increased hunger, malnutrition and diseases [1].

Adebisi, Oyebode and Owoade [2] affirmed that agriculture is extremely vulnerable to climate change. Higher temperatures eventually reduce yields of desirable crops while encouraging weeds and pests proliferation. Changes in precipitation patterns increase the likelihood of short-run crop failure and long-run production declines. Also, Akinbile [3] noted that estimate of the effects to climate change on crop yields are predominantly negative for the tropics. In support of Adebisi et al. [2], Mark et al. [4] highlighted some of the direct effects of climate change on agricultural system as seasonal changes in rainfall and temperature, which could impact agro-climatic conditions, altering growing seasons, planting and harvesting calendars, water availability, pest, weed, disease populations, alteration in evapo-transpiration, photosynthesis, business production, alteration in land suitability for agricultural production. These impacts markedly affect farmers' livelihood, household sustainability and upon all make poor small-scale farmers in Nigeria to be poorer.

In the recent time, scholars have argued considerably that building resilience to disasters including extreme weather events such as flood, storm and drought is a way out for farmers to be able to bounce back and maintain their pre-disaster conditions in the aftermath of any climate related disasters. Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation or restoration of its essential basic structures and functions [5]. Also in 2009, Rockefeller foundation defines resilience as the capacity of individuals (farmers), communities and systems to survive, adapt, and grow in the face of stress and shocks and even transform when condition requires [6]. However, more recently, the Intergovernmental Panel on Climate Change [7] defines resilience as the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintain the capacity for adaptation, learning and transformation.

Resilience process in the agricultural sector include the capacity of farmers and other relevant actors such as governments and non-governmental agencies to mainstream climate-risk reduction activities adaptation and mitigation measures that will ensure farmers prevent losses in all its forms as well as bounce back to normalcy in the event of any devastating disasters. Ifejika [8] noted that in pursuance of resilience to climate – related disasters, farmers should be in total control of three main characteristics of resilience: (1) Buffer capacity, the robustness of the system to meet the challenges of uncertainty associated with change such as climate change; (2) the capacity for self organization, the degree to which the system can direct its own actions, and (3) the ability to increase the capacity for learning and adapting, that is the capacity for adaptive management.

The absence of all these among the small scale farmers in Nigeria exacerbate their level of vulnerability to climate-related disasters. This paper therefore, tries to assess the level of farmers' resilience to extreme weather events such as floods, droughts, storms and forest fires in order to provide guide towards enhancing resilience of agriculture to climate risk [9]. It also look at the existing capacity at farmers disposal which can be built upon to ensure the resilience of small-scale farmers to the negative impacts of

climate-related disasters, and recommends steps required for a resilient farming practice.

The specific objectives of this study are to:

i. Identify the respondents' personal characteristics;
ii. Assess farmers' resilience to climate – related disaster;
iii. Determine resilience capacity of the respondents; and
iv. Identify constraints militating against farmers' resilience to climate – related disasters in the study area.

2. METHODOLOGY

The study was carried out in Oyo State, one of the six States in South western Nigeria. The study made use of primary data that contains three hundred and six names of farmers that were affected by climate – related disasters in the different agro-ecological areas of Oyo State. One hundred and fifty three respondents which constitute fifty percent of the population were randomly chosen for the study. Data was collected with the aid of a structured questionnaire on respondents' personal characteristics, selected enterprise charaterstics, farmers' resilience to climate related disasters and existing farmers' capacity on resilience to climate-related disaster.

Farmers' resilience to climate-related disaster was measured by asking respondents to state how often they experience climate-related disaster in their farm on a 3 point scale of very often (2) often (1) and not often (0).

Respondents also indicated severity of the disaster and their resilience capacity. Assistance from government agencies was also measured.

Data Collected was summarized using descriptive statistics such as frequency counts, mean and percentages. Chi square was used to test the hypothesis on relationship between respondents' personal characteristics and their resilience capacity to climate-related disasters.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics

Table 1 reveals that majority of the respondents (39.2%) were between the age of (46-55) with only 17.7% between the age of 16-35 which can be categorized as youth. The average age of respondents is 45.2% .This implies that majority of the respondents are not too old, as such they can still adopt different technologies that are germane to mitigating challenges of climate change in the study area.

The data on sex reveals that majority of the respondents were male (58.5%).This is in line with Aminu and Okeowo [10] who earlier reported that farming is a male dominated profession in Nigeria. This may be due to the energy requirement and the drudgery associated with the traditional form of agriculture practiced by the farmers in the study area.

The educational background of the farmers is very low with majority (37.3%) having no formal education while 31.4% had primary education. With the low educational qualification, majority of the farmers may find it difficult to learn and adopt improved system of farming which may alleviate the negative effects of climate change on the farm.

Majority (80.4%) of the respondents were married with only (9.8%) single, the results further showed that most of the respondents (35.3%) had household size of 5 persons ($\bar{x}$= 5.04). The respondents practiced different types of farming, with 54.9% growing crops, 17.6 (fishery), 17.6 (livestock).and 9.8 involved in mixed farming.

The table reveals that the source of fund of farmers were personal savings (47.1%), cooperative (31.4) and banks (7.8%). Majority of farmers may not be able to access funds from banks due to the required collateral and the high interest rate.

80.3% of farmers were not aware of agricultural insurance programme. The implication of this to the study is that most farmers would suffer total loss anytime they experience negative effect of climate change like flood, inadequate rain etc on the farm because of lack of exposure to the insurance policy as put in place by the government. Majority of the respondents (49.0) were aware of the emergency management agency compared to the Insurance policy. This is due to the fact that most times in Nigeria, the effect of climate change on farmers were being mitigated through emergency response by all arms of government in the country.

Table 1. Socioeconomic characteristics

Variable	Frequency	Percentage	Mean
Age			**45.2**
16-25	9	5.9	
26-35	18	11.8	
36-45	42	27.5	
46-55	60	39.2	
56-65	24	15.7	
Sex			
Male	90	58.8	
Female	63	41.2	
Education			
No formal	60	37.3	
Primary	51	31.4	
Secondary	21	13.7	
Tertiary	21	13.7	
Marital Status			
Single	15	9.8	
Married	123	80.4	
Divorced	15	9.8	
Religion			
Christianity	63	39.2	
Islam	75	49.0	
Traditional	15	5.9	
Farming Type			
Crop	84	54.9	
Fishery	27	17.6	
Livestock	27	17.6	
Mixed farming	15	9.8	
Source of Fund			
Personal savings	72	47.1	
Banks	12	7.8	
Cooperative	48	31.4	
Family/Friends	21	13.7	
Awareness of Agricultural Insurance			
Yes	23	15.0	
No	130	85.0.	
Awareness of Emergency management Agency			
Yes	75	49.0	
No	78	51.0	
Labour			
Hired	50	(32.6)	
Family	(91)	(59.4)	
Borrowed	12	(8.0)	

Source: Field survey, 2021

Most of the respondents used family labour (58.8%) compared to 31.4% that depended on hired labour. This may be due to the fact that larger percentage of the farmers practiced subsistence farming with average farm size of 1.02 per hectare.

3.2 Resilience to Climate Related Disasters

Result in Table 2 shows availability and accessibility of variables that are resilient to climate related disasters. Of all the factors, improve variety of seeds ($\bar{x}$ =0.7) and agro technologies ($\bar{x}$ =0.7) were the most available options that are resilient to climate related disasters, this is followed by support from agencies ($\bar{x}$ -0.5). The least available option resilient to climate related disaster on the farm is agricultural insurance. Even though, the agricultural Insurance scheme was established in Nigeria as far back as 1987, the scheme is not yet popular and known to the farmers [11].

Table 2. Distribution of respondents according to resilience to climate – related disasters

	Variable	Available		Accessible	
		Mean	Rank	Mean	Rank
1	Improve variety of seeds and breeds	0.6	2nd	0.7	1st
2	Agricultural Insurance	0.4	5th	0.2	6th
3	Cooperative Society	0.5	3rd	0.3	4th
4	Government Policy	0.4	5th	0.3	4th
5	Agro Technologies	0.7	1st	0.7	1st
6	Support from Government Agencies	0.5	3rd	0.5	3rd

Source: Field survey, 2021

The table further shows that the most accessible options are; agro technologies ($\bar{x}$ =0.7), improve variety of seeds and breeds ($\bar{x}$=0.6), cooperative societies ($\bar{x}$ =0.5), support from government agencies ($\bar{x}$=0.5) and government policy ($\bar{x}$=0.4). The implication of this finding is that agricultural research and extension organisations are working so hard to generate technologies that would mitigate the negative effects of climate change and also disseminate same in the study area. In Nigeria, there are government agencies who are established to guide and protect farmers as regards climate related disaster and government at all levels also provide support like giving incentives and providing extension services for good agronomic practices that would enhance farmers' productivity and livelihood.

3.3 Frequency of Experiencing Climate – Related Disaster

Table 3 shows that the climate related disaster frequently experienced within the study area are; drought ($\bar{x}$ =1.20), flood ($\bar{x}$=1.18), pest infestation ($\bar{x}$=1.10), forest fires ($\bar{x}$=0.84), and storms ($\bar{x}$ =0.24).This implies that research scientists should continue to breed varieties that have short duration and resistant to pest and drought. Recently short duration varieties of cowpea (ART/BBT/22/W, ART/BBT/72/B and *Modupe*) were released by the Institute of Agricultural Research and Training (IAR&T) which have special characteristics that can mitigate against climate change. Efforts should also be made to embark on irrigation facilities.

Table 3. Distribution of respondents according to frequency of experiencing climate – related disaster

	Disaster	Mean	Rank
1	Flood	1.18	3rd
2	High Temperature	0.66	5th
3	Drought	1.20	1st
4	Storms	0.24	6th
5	Forest Fires	0.84	4th
6	Pest Infestation/Disease	1.10	2nd

Source: Field survey, 2021

Table 4. Distribution of respondents according to the severity of the climate-related disasters

	Disaster	Mean	Rank
1	Flood	1.37	2nd
2	High Temperature	0.80	5th
3	Drought	1.38	1st
4	Storms	0.43	6th
5	Forest Fires	1.08	3rd
6	Pest infestation/diseases	0.90	4th

Source: Field survey, 2021

3.4 Severity of the Climate Related Disasters

Data in Table 4 shows severity of the climate related disaster experienced by farmers on the farm. Drought ($\bar{x}$=1.38), flood ($\bar{x}$=1.37), forest fires($\bar{x}$=1.08) ,pest infestation ($\bar{x}$=0.90) and high temperature($\bar{x}$=0.80) respectively were the most severe disaster that are climate related experienced by farmers on the farm, while the least experienced climate related disaster on the farm was storms($\bar{x}$ =0.43). This implies that farmers were confronted with the challenges of either little rain, short period of rainfall, excess rain, elongated dry season and lack of resistant varieties in the study area. Government should make efforts to fund agricultural research so that researchers would concentrate on breeding varieties that are tolerant to drought and early maturing. Farmers should also be trained on different resilience strategies and advice to procure their inputs especially seeds and seedlings from reputable source such as research institutes and government agro service center where improved plantimg materials are available. The opportunity of farm irrigation should also be explored.

3.5 Capacity to Mitigate / Resilience Capacity

Table 5 shows farmers' capacity to mitigate different types of climate related disaster they were exposed to in the study area. The data reveals that pest infestation/disease ($\bar{x}$ =2.72) and forest fire ($\bar{x}$=1.80) were ranked 1st and 2nd respectively among the available options. This may be due to the fact that over the years, farmers have learnt various techniques by which pests and diseases were being controlled and also information on forest fire/bush burning have been flogged or disseminated through the media and other outlets over a long time.

Table 5. Distribution of respondents according to their resilience capacity

	Disaster	Mean	Rank
1	Flood	1.41	3rd
2	High Temperature	1.17	5th
3	Drought	1.41	3rd
4	Storms	1.05	6th
5	Forest Fires	1.80	2nd
6	Pest Infestation/Disease	2.72	1st

Source: Field survey, 2021

Table 6. Distribution of respondents according to constraints against farmers' resilience to climate related disasters

	Constraints	Mean	Rank
1	Low level of knowledge among farmers	1.50	1st
2	Lack of financial support	1.44	3rd
3	Inadequate government policy on climate resilience in the state	1.36	5th
4	Poor response from emergency management agencies of the governments	1.46	2nd
5	Poor agricultural extension services on climate resilience related issues	0.42	7th
6	Poor adoption of climate –resilience related technologies by farmers in the state	1.40	4th
7	Inadequate focus of agro based research institutes on climate related technologies	0.74	6th

Source: Fields survey.2021

Table 7. Relationship between respondents' personal characteristics and their resilience to climate related disaster

Personal characteristics	Chi square Value	DF	P Value	Decision
Age	5.82	4	0.21	Not Significant
Sex	3.28	1	0.70	Not Significant
Education	16.34	3	0.001	Significant
Marital Status	3.50	2	0.174	Not Significant
Religion	0.02	2	0.987	Not Significant

Source: Field survey, 2021

3.6 Constraints Associated with Climate Related –Disaster

Respondents identified low level of knowledge ($\bar{x}$ =1.50),poor response from emergency management of government ($\bar{x}$=1.46) and low lack of financial support ($\bar{x}$=1.44) respectively as the major constraints facing farmers on mitigation of climate related disasters in the study area .The result implies that farmers did not have adequate training or enough access to requires information and also farmers were not getting good response from government agencies set up to assist farmers when experiencing losses on the farm as a result of natural disaster due to climate change. In Nigeria, government needs to build capacity of farmers on the areas of climate change and also make available quality inputs at subsidise rates. The need for extension personnel to improve on information dissemination as regards climate change cannot be over emphasized as farmers' level of knowledge on climate change needs to be enhanced.

3.7 Results of Hypothesis Testing

Table 7 reveals that education (χ^2=16.34, p=0.001) of the respondents had significant effects on resilience to climate related disaster in the study area while on the other hand age ,sex marital status and religion did not have effect on the resilience to climate related disaster in in the study area.

4. CONCLUSION

As a result of major findings of the study, the following conclusions were drawn. The most available options of climate related disaster are improve variety of seeds and agro technologies while the least available option is agricultural insurance. The most accessible options are agro technologies and improve variety of seeds and breeds.

Climate related disaster frequently experienced within the study area are drought and flood while drought usually appeared as the most severe among the varied options of climate related disaster affecting farmers in the study area. Majority of the respondents were aware of emergency response of government as compared with agricultural insurance scheme.

Low level of knowledge among farmers and poor response of governments were the major constraints confronting farmers on climate change mitigation in the study area.

Among the personal characteristics of farmers tested, education was a factor in determining farmers' resilient to climate related disaster.

5. RECOMMENDATIONS

1. Efforts should be made to provide capacity building for farmers on possible ways of mitigating negative effects of climate change in the community.
2. Researchers and extension practitioners need to generate and disseminate proven and adoptable technologies to mitigate effects of climate change
3. Government should re-invigorate agricultural insurance scheme, provide enlightenment for farmers on the mode of operation to enhance farmers access to the scheme.
4. Government at all levels should inject more fund on emergency response scheme so that farmers who suffered losses due to climate related disaster can be compensated and come back to business.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/82299