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ARTICLE

Adaptation Strategies to Mitigate Impact of Climate Change on Food Crops Farming in Oyo State, Nigeria

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ABSTRACT

The research investigated the adaptation strategies to mitigate consequence of climate change on food crops farming in Oyo State. 120 respondents were selected for this study using multi- stage sampling procedures. Primary data was collected through interview schedule and analyzed using both descriptive and inferential statistics. Available results indicated that 84.2% of the respondents were male, 93.3% of them were married and maize (45.8%), cassava (37.5%) are the mainly crops cultivated. Results also revealed that 70.0% of the respondents have knowledge of climate change with majority (84.17%) of them regularly accessed information on climate change through radio and 88.3% of them claimed to adopt planting crops favorable for the present weather condition as an adaptation techniques to mitigate the consequences of climate change more frequently. Chi-square and Correlation results revealed a significant relationship existed between farmers educational levels (X2= 4.861; p= 0.003); household size (r= -0.089; p=0.002); knowledge (r= -0.157; p= 0.002), and adaptation strategies to reduce the consequences of climate change on the food crops farming. It was recommended that food crop farmers should be provided with better education and sensitized in order for them to be acquainted with adaptation techniques and coping mechanisms that are currently been offered by research.

1. Introduction

Climate change shows multiple stresses on the biophysical, social and institutional environments that corroborate agricultural production [9]. A modification in the vegetation type, distribution and coverage may occur given a change in the climate. Some modifications in climate may lead to an increased in precipitation, warmth, improved plant growth and the subsequent sequestration of airborne carbon dioxide. Gradual increase in warmth in a region will result to alteration in the timing of life cycles of dependent organisms, earlier fruiting and flowering times, however, cold will cause plant bio-cycles too late. Larger, faster or more radical changes conversely may result in vegetation stress, rapid crops loss and desertification in certain circumstances.

Agricultural crops are drastically vulnerable to climate change, higher temperatures reduces the yields of desirable's crop, encouraging weeds and pests

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proliferation. Changes in patterns of precipitation increases the likelihood of short-run crop failures and long-run production declines, however, there may be gained in some crops in some regions of the world but the overall effects of climate change on agriculture are expected to be negative. According to [4], assessment of the consequences of climate change on crop yields is frequently negative for the tropics. [11] emphasized some of the direct consequences of climate change on agricultural system as seasonal changes in rainfall and temperature which could influence agro-climatic conditions, changing growing seasons, planting and harvesting periods, water availability, pests and diseases infestation, weeds, alteration in land suitability for crops production, evapo-transpiration and photosynthesis. The most devastating consequences of climate change in Nigeria and other subtropical countries includes environmental damage, pests and diseases infestation of crops, drought and biodiversity loss [1]. [12] reported that variations in rainfall pattern affect s crop development and phonology thereby resulted to yields loss.

In an attempt to address food crops loss and insecurity, adaptation techniques adopted by food crops farmers have become necessary particularly in Nigeria where farmers are drastically affected. Adaptation to climate change is modification made to human, ecological or physical system in response to vulnerability [2]. Climate change adaptation through the modifications or improvement of agricultural practices become imperative to continue meeting the growing food demands of modern society [13]. Adaptation is one of the policy options that helps farmers achieved their food, livelihood security and income objectives in the face of changing climatic conditions [10]. Farmers especially food crops farmers can reduce the potential damage by making tactical responses to climate effects such as irrigation methods, use of hybrids crop, mixed cropping, changing of planting dates and diversification of crops [5,8]. Analyzing adaptation strategies is therefore important for finding ways to help food crops farmers in rural economies of Nigeria, hence, the study sought information on the socioeconomic characteristics of the respondents, their enterprise characteristics, sources of information on climate change and degree of accessibility, knowledge of climate change and adaptation strategies to reduce the consequences of climate change on food crops farming. It was hypothesized that no significant relationship existed between respondent's socioeconomic characteristics, knowledge of climate change and adaptation strategies mitigate consequences of climate change.

2. Methodology

The study was carried out in Oyo State, Nigeria and the state lies between latitude 7.0^{o}N and 9.3^{o}N of the equator and between latitude 2.5^{o}E to 5.0^{o}E of the prime meridian. 120 respondents were selected using multi-stage sampling procedure. The first stage involved the categorization of local government areas of Oyo state into rural and urban. The second stage involved simple random selection of 4 rural local governments out of 21 rural local governments areas which are Ido , Egbeda , Afijio , and Akinyele local governments which represented 20%. The third stage involved simple random selection of eight (8) wards in selected four rural local governments which represented 20% of the wards in each of the local government areas namely Egbeda local government area(11 wards), Ido local government area (10 wards),Akinyele local government area (12 wards), Afijio local government area (10 wards). The fourth stage involved simple random selection of 2 communities from each selected wards giving a total of sixteen (16) communities. The fifth stage involved simple random selection of 8 food crops farmers from the selected communities which gives a total sample size of 128 food crops farmers; however, sampling rate was 94% which represented 120 farmers. Data for this study were obtained through the use of interview schedule and analyzed through the use of descriptive statistics that involved frequency, percentage and inferential statistics (Chi-square and PPMC - Pearson Product Moment Correlation) at 0.05 level of significance.

3. Result and Discussion

3.1 Socio-economic Characteristics of the Respondents

Available statistics in Table 1 revealed that the respondents have a mean age of 44.4 years, this suffices to say that food crop farmers in Oyo state are in their active age, this is in agreement with [3] that population within this age group are energetic and constitute active work force. 84.2% of the respondents were male and this may be due to the fact that women are more involved in off-farm activities as postulated by [7] that women are more involved in off-farm activities than men, especially in the area of transportation of farm produce, fire wood fetching, processing of farm produce, feeding of household members and reproductive functions. Also, 93.3% of the respondents were married and they were Christians (68.3%).In terms of their level of education a sizeable proportion (45.0%) had primary education, 37.5% had secondary education which signified their low level of educational attainment which likely to prevent them from climate change information access, this view is supported by [15] that higher levels of educational

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attainment give farmers the advantage of awareness of innovation on agriculture via communication channels (radio, television of print media). Also revealed is income of the respondents, it is shocking to know that a chunk (51%) of the respondents still earned as low as ₦ 100,000 per cropping season, this suggests that majority are still into subsistence production. Only a few (15.7%) earned above #350,000 per cropping season, suggesting that more efforts should be made to intensify production with mean income of N235, 725.00k which implies that majority of the respondents earned low from this venture. Other income generating activities farmers engaged in include poultry production (26.67%), transportation service (21.66%), bee keeping (14.17%), fish production (13.33%),petty trading (11.67%),artisan services (8.33%) and fish processing (4.17%).It is viewed that crop farmers engaged in these income generating activities at their leisure and obtained income from these venture to augment income got from crop farming. With regards to household size respondents have a fairly large household size of between 4-6, this shows that rural household heads have fairly large household size to cater for, hence, these household size can be deployed as work force. Household size has a great role to play in family labour provision in the agricultural sector [14].

Table 1. Distribution of the respondents based on their socio-economic characteristics

Characteristics	Frequency	Percentage
Age (mean=44 years)		
21-30	15	12.5
31-40	34	28.3
41-50	33	27.5
51-60	30	25.0
61-70	8	6.7
Gender		
Female	19	15.8
Male	101	84.2
Marital status		
Married	112	93.3
Single	3	2.5
Divorced	2	1.7
Widowed	3	2.5
Religion		
Islam	36	30.0
Christianity	82	68.3
Traditional	2	1.7
Educational status		
Adult education	7	5.8
No formal education	8	6.7
Primary education	54	45.0
Secondary education	45	37.5
Tertiary education	6	5.0
Income (per cropping Season) mean=235,725.0		
(#) <50,000	24	21.2
50,001-100,000	41	29.8
100,001-150,000	13	10.7
150,001-200,000	6	5.0
200,001-250,000	8	6.7
250,001-300,000	7	5.9
300,001-350,000	6	5.0
Above 350,000	15	15.7
Other Income generating activities		
Fish processing	5	4.17
Petty trading	14	11.67
Artisan	10	8.33
Bee keeping	17	14.17
Poultry Production	32	26.67
Fish production	16	13.33
Transportation	26	21.66
Household size(mean=5.25)		
1-3	14	11.7
4-6	81	67.5
7-9	24	20.0
Above 9	1	0.8
Total	**120**	**100**

3.2 Production Characteristics

Available data in table 2 revealed that 60.0% of the respondents have farm size between 1-5 acres and 26.7 % of the respondents have between 6-10 acres which signified that most crop farmers are involved in subsistence production with a mean farm size of 6.98 acres cultivated. Half (50%) of the respondents practice mixed cropping system and close to half 40.8 are into mono cropping while none of the respondents practice taungya cropping system. A substantial proportion of the respondents 61.7% engaged in crop rotation, this is an indication of food crop farmers acquainted with the benefits accrued from engaging in crop rotation, an ample proportion of the respondents 47.5% had betwwen1-10 years of farming experience while 27.5% had between 11-20 years of farming experience and 17.5% had between 21-30 years of experience in food crops activities, with an average value of 14.04 years of food crops farming it portrays that the farmers are not new in this business and have ample experience of the consequences of climate change. In addition, 51.7% of crop farmers made use of inorganic manure while 48.3% made use of organic manure as a means of replenishing soil nutrients, it suggests that crop farmers made use of inorganic to reduce cost of production as majority are small scale producers. Source of finance used by respondents include personal savings (63.3%), cooperative societies (27.5%), microfinance banks (5.0%) and from family members

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(4.2%), it is evident crop farmers plow in the funds got from other income generating activities into their main venture (crop production) and have not fully explored the benefits attached to sourcing funds from cooperative societies. Ample proportion of the respondents cultivated maize (45.8%) and cassava (37.5%) other crops cultivated include yam, rice, cowpea with 14.4%, 1.67% and 0.83% respectively, this is a reflection of the crops we have relative advantage in growing in this state.

Table 2. Distribution of respondents based on their production characteristics

Characteristics	Frequency	Percentage
Size of the farms (Acres)(mean=6.98)		
1-5	72	60.0
6-10	32	26.7
11-15	5	4.1
16-20	2	1.7
Above 20	9	7.5
Cropping system		
Mono cropping	49	40.8
Continuous cropping	11	9.2
Mixed cropping	60	50.0
Taungya system	-	-
Farming system		
Shifting cultivation	4	3.3
Crop rotation	74	61.7
Mixed farming	42	35.0
Farming experience (mean=14.04 years)		
1-10	57	47.5
11-20	33	27.5
21-30	21	17.5
31-40	8	6.7
Above 40	1	0.8
Main means of replenishing soil nutrient		
Organic manure	58	48.3
Inorganic manure	62	51.7
Main Source of labour		
Family member	74	61.7
Paid labour	19	15.8
Friends	2	1.7
Self	25	20.8
Main Source of finance		
Personal savings	76	63.3
Family member	5	4.2
Micro finance banks	6	5.0
Cooperative society	33	27.5
Crops cultivated		
Cassava	45	37.5
Rice	2	1.67
Cowpea	1	0.83
Maize	55	45.8
Yam	17	14.2
Total	120	100.0

3.3 Climate Change Information Sources Accessible to Farmers

Available data in table 3 revealed that 84.17% of the respondents regularly accessed information on climate change through radio, this is in consonance with the study of [6] which emphasized on radio as the most frequently accessed source of information by rural dwellers .A sizable proportion of the farmers (68.33%) depend on agricultural extension agents as their source of information on climate change and this can be adduced to the increase in sensitization carried out by agricultural extension agents to expose farmers to the vagaries of weather, its effects and adaptation strategies to be deployed in mitigating it, this is corroborated by the findings of Yahaya [16] which highlighted that extension agents is the second most readily accessible source of agricultural information to farmers. A notable proportion (62.50%) of the farmers accessed information on climate change from farmers association, it should be appreciated that farmers regularly share information and experiences of climate change during meetings, it is also noted that formidable groups like farmers association are usually identified with and receive sensitization and capacity building at regular interval from individual NGOs and government agencies

Table 3. Distribution of respondents according to their sources and degree of accessibility to information on climate change

Sources of Information	Degree of Accessibility					
	Regularly accessible		Occasionally accessible		Not accessible	
	F	%	F	%	F	%
Radio	101	84.17	19	15.83	_	_
Friends	15	12.50	60	50	45	37.50
Agricultural extension agents	82	68.33	15	12.50	23	19.17
Television	45	37.50	20	16.67	55	45.83
Farmers Association	75	62.50	16	13.33	29	24.17
Newspapers	40	33.33	10	8.33	70	58.33
NGOs	_	_	25	20.83	95	79.17
Internet	25	20.83	15	12.50	80	66.67

3.4 Knowledge of Climate Change

Available data in table 4 revealed that a substantial proportion of crop farmers view climate change as change in the timing of rains or period of rains (98.3%), it is associated with unpredictable seasons and instability in temperature when it is compared with previous years

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(93.3%), climate change results in global warming (90.8%), it results in changes in the timing of sunshine and that long or an extension in the number of hot days during dry season is attributed to climate change (90.0%). Crop farmers' knowledge about climate change can be attributed to the wide enlightenment and knowledge sharing on consequences of climate change and adaptation strategies to mitigate its effects that is relayed via print and electronic media, extension agents, farmers groups and associations, cooperative societies, co-farmers.

Table 4. Distribution of respondents based on their knowledge of climate change

KNOWLEDGE STATEMENTS ABOUT CLIMATE CHANGE	Freq	Percent
Increase in the number of days of dry spell indicates climate change	97	80.8
A change in the timing of rains is an indication of climate change	118	98.3
Delay in rainfall reflects climate change	76	63.3
Changes in the timing of sunshine is attributed to climate change	108	90.0
A shorter rainfall season is attributed to climate change	108	90.0
Longer periods or extension of numbers of hot days during dry season is attributed to climate	105	87.5
Reduction in the number of hot days during rainy season is attributed to climate change	99	82.5
Unpredictable seasons is a manifestation of climate change	112	93.3
Climate change is about shift in rainfall patterns	83	62.2
Climate change results instability temperature when it is compared with previous years	112	93.3
Climate change results in global warming	109	90.8
Climate change brings is about abnormal rainy season and dry season	82	68.3
Change in the elements of weather is attributed to climate change	75	62.5

3.5 Level of Knowledge on Climate Change among Respondents

Respondents level of knowledge on climate change was determined by using the mean criterion, respondents below the mean were categorized as those having low knowledge while those above the mean were categorized as those having high knowledge of climate change.

Result in table 5 revealed that 70% of respondents have high knowledge of climate change while 30% of them have low knowledge of climate change. Appreciating that a significant proportion of the crop farmers have high knowledge about climate change, with this statistics it shows that there is still need to intensify efforts towards increasing the knowledge base of the respondents, some potent means that can be deployed include translating information about climate change in local language as nuggets in news letter, handbook, bulletins etc., group sensitization, running of programmes in the media (radio) on the topic, information dissemination through various groups and associations across crop lines etc. on a frequent basis, as these will increase farmers capacity on the subject.

Table 5. Distribution of respondents based on their level of knowledge on climate change

Knowledge	Frequency	Percentage	Minimum	Maximum	Mean
Low	36	30.0	6.00	13.00	10.08
High	84	70.0			

3.6 Adaptation Techniques Adopted to Mitigate Effects of Climate Change

Table 6 indicated the adaptation techniques or coping mechanisms employed to ameliorate the impact of climate change. 88.3%, 87.5%, 83.3% of the respondents claimed to adopt planting crops favorable for the present weather condition, use of hybrid seedlings and planting different crops as adaptation techniques to reduce the impact of climate change more frequently. Also, 64.2% and 63.3% of the respondents also claimed to adopt changing planting date and use of chemical as other techniques or coping mechanisms adopted to mitigate impact of climate changes more frequently..

3.7 Relationship between Respondents' Socioeconomic Characteristics and Adaptation Strategies

Result of correlation analysis in table 7 shows that respondent's income (r= -0.096; p=0.299); age (r= -0.172; p=0.374) were not related to adaptation techniques adopted to mitigate impact of climate change on food crops farming. However, significant relationship existed between household size (r= -0.089; p=0.002) and adaptation techniques to reduce the impact of climate change on food crops, this suggests that farmers household size influence the adoption of adaptation strategies to mitigate effects of climate change on food crop production because the numbers of household size determine the farm labours in the application and the use of strategies which consequently may influence crop production outputs. Chi-square analysis also reveals that educational level of farmers (X^2= 4.861; p= 0.003) was related to adaptation strategies because education influences farmers access to climate information particularly adaptation strategies that are mostly concern to farmers for better outputs.

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Table 6. Distribution of respondents according to their adaptation strategies adopted to militate impact of climate change

Strategies Adopted F (%)	More frequently F (%)	Moderately frequently F (%)	Frequently F (%)	Not frequently	weighted score	Rank
Increased water conservation	66 (55.0)	35 (29.2)	6 (%.0)	13 (1.08)	228	6th
Planting of different crops	100 (83.3)	13(10.8)	4 (3.3)	3 (2.5)	266	3rd
Changing planting date	77 (64.2)	37 (30.8)	5 (4.2)	1 (0.8)	258	4th
Irrigation	20 (16.7)	38 (31.7)	28 (23.3)	34 (28.3)	137	12th
Use of chemical	54 (45.0)	26 (21.7)	32 (26.7)	8 (6.7)	205	7th
Use of fertilizer	76 (63.3)	21 (17.5)	18 (15.0)	5 (4.2)	240	5th
Use of hybrid seedlings	105(87.5)	7 (5.8)	5 (4.2)	3 (2.5)	278	2nd
Mulching	64 (53.3)	11(9.2)	7 (5.8)	38 (31.7)	184	8th
Relocation to another site	50 (41.7)	9 (7.5)	10 (8.3)	51 (42.5)	148	11th
Agro-forestry product	16 (13.3)	12 (10.0)	13 (10.8)	79 (65.8)	71	13th
Mixed farming	55 (45.8)	11 (9.2)	24 (20.0)	30 (25.0)	176	9th
Planting a crop favorable for the present whether condition	106 (88.3)	7 (5.8)	3 (2.5)	4 (3.3)	279	1st

Table 7. Relationship between socioeconomic characteristics of the respondents and adaptation strategies to reduce impact of climate change

Variable	X^2	df	r-value	CC	p-value
Sex	2.729	1		0.149	0.099
Marital status	2.238	3		0.135	0.524
Level of education	4.861	4		0.197	0.003
Religion Age	0.059	2	 -0.172	0.022	0.971 0.374
Income			-0.096		0.299
Household size			-0.089		0.002

3.8 Relationship between Respondent's Knowledge of Climate Change and the Adaptation Strategies

The result of the analysis in Table 8 shows that there is significant relationship between the respondents knowledge of climate change and the adaptation techniques ($r= -0.157; p= 0.002$), it implies that knowledge of farmers on climate change determines the coping strategies farmers adopts to cushion the climate change impacts on food crops, farmers that are knowledgeable embarked on practices that suitable and appropriate to cushion the climate effects on food crops production.

Table 8. Respondents knowledge of climate change and the adaptation techniques

Variable	r-value	p-value
Knowledge	-0.157	0.002

4. Conclusion and Recommendations

The findings established that majority of food crop farmers were male, active in their age, attained below secondary education and earned an average of #235,725.00k per cropping season which was low. It further established that they cultivated an average of 6.98 acres of land, have an average of 14.04 year of farming experience with majority cultivated maize. Majority have knowledge on climate change effect and radio was regularly accessed as source of information on climate change. Majority claimed to adopt planting crops favorable for the present weather condition, use of hybrid seedlings and planting different crops as an adaptation techniques and coping

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mechanisms to reduce the climate change impact on food crops more frequently. Significant relationship existed between household size, educational level, knowledge and adaptation techniques and coping mechanisms to alleviate climate change impact on food crops. It was recommended that Private extension particularly NGOs should intensify more efforts and incorporate alleviation of climate change impact on crops as part of their programme component and food crop farmers should be better educated and sensitized in order for them to be well furnished with coping mechanisms and adaptation techniques that are currently been offered by research. There is a need to deviate from total reliance on rain-fed food crops production and utilization of irrigation system should be given proper attention, therefore, there is need for adequate provision of irrigation and drainage infrastructures to absorb climate change impact on food crops production.

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