STRATEGIES ADOPTED BY YAM FARMERS IN COMBATING CLIMATE CHANGE IN KOGI STATE NIGERIA

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Abstract

Climate change has always been a thing of concern in agricultural production, especially in yam production. The study investigated farmer adaptation strategies to the effect of climate change on yam production in Kogi State with the specific objectives of assessing the socio-economic characteristics of farmers, farmers' climate related constraints, the adaptation strategies employed by farmers, and yam farmers' level of knowledge on climate change. A multistage sampling technique was used to select one hundred and twenty respondents from the different communities selected in the study area in year 2019. Data were collected through structured interview schedule. The data were analysed using frequency counts, percentages and Pearson Product Moment Correlation. Results obtained showed that farmers in the study area were mostly males with a mean age of 44.5 years. Most of the yam farmers in Kogi State got information on climate change from other farmers (77.3%) and (81.3%) of the respondents aware of climate change. Furthermore, the major effects of climate change as identified by the respondents were pest infestation (90.8%) and high rate weed growth (88.3%). Various strategies adopted by yam farmers include mulching (Mean=5.0), intercropping yam with other crops (Mean=4.5), use of weather-resistant variety (Mean=4.1) and use of early maturing crop varieties (Mean=3.8). Pearson product moment correlation shows that there is a significant relationship between estimated annual (r = 0.887), income farming experience (r = 0.274) and the farmers' level of awareness. Therefore, efforts should be made towards developing and making available, yam seeds and yam tubers that can adapt to the change in climate and weather elements like flood and drought. These findings suggest the need for more training on climate change, the adaptation methods, environmental education and sustainability of yam cropping.

Key words: Adaptation strategies, climate change, pest infestation , mulching, sustainability

INTRODUCTION

Climate change is one of the most challenging issues that need urgent attention especially in the recent time with widespread implications for the earth's ecosystems and human development in all sphere of life. [1] claim that impacts of climate change are extensive ranging from the aggravation of poverty, the collapse of infrastructure, to the loss of environmental, political, economic and social security. Climate change impacts on agriculture and ecosystems run through rising temperature and changes in rainfall variability and seasonality as well as through extreme heat, floods and droughts [6]. Also, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [6] indicated that warming of the climate system is now unequivocal clearly shown that global warming is mostly due to man-made emissions of greenhouse gases (mostly CO_2). Climate change has serious implication on smallholder and subsistence farmers production at a landscape, watershed, or community level and also compounded by environmental and physical processes. Moreso, agricultural production severely affected due to loss of land, shorter growing seasons, more uncertainty about what and when to plant crops which in turn worsening of food insecurity and increase in the number of people at risk from hunger. West Africa is one of the most vulnerable to the vagaries of the climate, as the scope of the impacts of climate variability over the last three or four decades [8]. Climate change have wide-ranging effects on the environment, and on socio-economic and related sectors, including water resources, agriculture and food security, human health, terrestrial ecosystems and biodiversity and coastal zones [14].

Adaptation to Climate Change refers to a set of strategies put in place to reduce climate change effects with respect to agricultural and economic system [2, 5]. According to [13], adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It further refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change. Climate change adaptation methods according to [10] are those strategies that enable the individual or community to adjust to the impact of the change in climate. Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts.

Climate variation already poses significant impacts on the agricultural sector and there has been little commitment to make adaptation a national priority in the country. Conspicuously, the associated impacts of climate variation are predominantly negative, with the most severe impacts being experienced in vulnerable communities made up of the bulk of Nigerian farmers practicing farming at subsistent levels, where capacity to adapt is very weak [14].

It is known fact that most of the rural people have little or no technology and also might encounter greater problems caused by the change in climate or adverse change in the climatic condition of an area. In Africa rural farmers have been practicing a range of agricultural techniques as coping strategies and tactics to enable sustainable food production and deal with extreme events. These include intercropping and crop diversification; use of home gardens, diversification of herds and incomes [14].

Despite the fact the rural farmers have inadequate technologies to cope with climate change, fortunately, there are many practices that farmers can improved on in adopt and changes that can be made to our agricultural production system to make the system more resilient to our changing climate. Thus, the study assesses yam farmers strategies adopted in combating climatic change.

The specific objectives are to:
(i) describe socio- economic characteristics of yam farmers in the study area.
(ii) assess the level of knowledge of yam farmers in adaptation to climate change.
(iii) determines yam farmers' perceptions of climate change
(iv) examine the constraints of adaptation to climate change.
(v) identify different adaptation measures used by yam farmers to mitigate the effects of climate change.

Hypothesis:
(i) There is no significant relationship between the socio-economic characteristics of the farmers and adaptation strategy methods adopted to combat climate change.

MATERIALS AND METHODS

The study was conducted in Kogi State which is located in the North-central geo-political zones of Nigeria. Extends from latitude 6.33° N to 8.44° N and latitude 5.40° E to 7.49° E. It shares boundaries with 10 other states having Federal Capital Territory (Nigeria) to the north, Nasarawa State to the north east, Benue State to the east, Enugu State to the south east, Anambra State to the south, Edo State to the south west, Ondo State to the west, Ekiti State to the west, Kwara State to the west, Niger State to the north and also the two major rivers in Nigeria, River Niger and River Benue form a confluence with the state. The temperature ranges from 21°C to 35°C with high humidity. The vegetation consists of rainforest in the southern part of the state and the woody derived savannah and Guinea savannah in the northern extreme. Generally, the land mass is flat or gently undulating and lies at 50m to 700m above sea level.

Agriculture is the central component of the economy. There are many farm produces from the state notably yam, coffee, cocoa, palm oil, cashews, groundnuts, maize, cassava, rice and melon.

A multi stage sampling procedure was used to select respondents in the study area. At first stage, 5 local governments (Ankpa, Dekiha, Omala, Idah, and Ofu) were purposefully

selected being the major yam producing community in the study area.

Second stage involved selection of two communities in each of the local government making a total of 10 communities in the 5 local government areas. The third stage involve selection of 12 farmers from each community making a total of 120 yam farmers Data for the study was obtained through the use of interview schedule. Data was collected on the following socio-economic characteristics of farmers such as household size, sex, age, years spent in acquiring education, access to credit, extension services, personal income and farm size in hectares. Others were effect of climatic change such as temperature and precipitation; awareness and knowledge level, adaptation measures adopted by farmers in the study area such as change in planting dates, crop diversification, soil conservation and changing tillage operations.

The data was analysed using descriptive statistical tools such as frequency, percentage, mean and standard deviation to describe parameters such as age, sex, household size, year of schooling and extension contacts, Inferential statistics such as Pearson correlation, chi square, were used to analyse the data.

To examine their knowledge of climate change causes and effects, respondents were asked to tick "yes" or "no" if they were aware of climate change. They were also required to tick against a list of options on the perceived causes and effects of climate change. Options provided in the list for the causes of climate change included: bush burning, deforestation, use of excess chemicals such as pesticides on farms, high rate of weed growth, prolong rainfall, delayed onset of rain etc. based on correctness of responses on the twenty-one questions measuring knowledge.

To assess the effect, total scores for each respondent for extent to which the factors causing climate change affects farming and the constraints of climate change, they were grouped into 4 categories "To a very great extent"," To a great extent", "To a little extent" and "To no extent at all".

RESULTS AND DISCUSSIONS

Analysis on the socio-economic characteristics of yam farmers

From the data presented in Table 1, it is observed that preponderance of the yam farmers in Kogi state are males (63.3%). Above average 59.2% of the respondents are married persons and within the age range of 30-60 years (59.1%). This indicated that majority were responsible were at a productive age.

Table 1. Socio-economic characteristics of the respondents

Characteristics	Frequency	%	Mean
Sex			
Male	76	63.3	
Female	44	36.7	
Marital status			
Single	25	20.8	
Married	71	59.2	
Divorced	9	7.5	
Widowed	15	12.5	
Age (years)			
≤30	28	23.3	
31-60	71	59.1	48 ± 9.7
≥ 61	21	17.6	
Farming experience (years)			
≤ 10	20	16.7	
11-20	33	27.5	22.4 ± 11.2
≥ 21	67	55.8	
Years spent in acquiring formal education			
Never	24	20.0	
≤6	50	41.6	8.1 ± 3.2
≤12	32	26.7	
≥13	14	11.7	
Household size			
≤ 5	21	17.5	
6 -10	77	64.3	6.22 ± 1.7
≥10	22	18.3	
Farm size (hectares)			
≤ 5	64	53.3	
6 -10	36	30.0	4.5 ± 1.6
≥10	20	16.7	
Annual income (₦)			
≤ 500,000	77	64.0	
500, 000 -1000,000	41	34.2	571,500 ± 169, 511
≥1000,000	41	43.2	

Source: Field survey, 2019.

Furthermore, 81.3% of the respondents had farming experience of over 10 years, Data retrieved from the study also revealed that preponderance (64.3%) of the farmers in Kogi state have a household size of 5-10 persons per house, The implication of the household size is that there will be enough labour to work on the farm lands.

Above average (53.3%) of the farmers indicated that they had 3 hectares of farm

land. Furthermore, 64.0% of the yam farmers in Kogi state had an annual income between ₦500,000-1,000,000 ($1,041 –2,082). This an indication that majority of the farmers ought to be able to practice climate adaptation strategies.

Source of information of respondents on climate change

Further analysis on their source of information on climate change revealed that most of the yam farmers in Kogi state got their information from other farmers (77.3%) while (70%) rely on radio broadcast for information. However, low percentage (38.6%) engage the television as a source of information, extension agents (38.6%) resp3ectively. Furthermore (33.0%) choose the newspaper as a source of information about climate change. This implies that other farmers and radio were the major source of information in Kogi. State Agricultural Development Programmes (ADPs)) that were in charge of disseminating information to farmers were not always on ground to give reliable information to farmers on the technical skill they required to assist the farmers on different methods of adaptation to climate change (Table 2).

Table 1. Sources of information on climate change

Variable	Frequency	Percentage	Rank
Other farmers	92	76.7	1st
Radio	84	70.0	2nd
Television	46	38.3	3rd
NGOs	44	36.7	4th
Internet	42	35.0	5th
Newspaper	40	33.3	6th
Extension Agents	38	31.7	7th

Source: Source: Field survey, 2019.

Yam Farmers awareness on climate change

The data presented in Figure 1 reveals that a large proportion (81.3%) of the respondents aware of climate change. However, 18.7% of the respondents indicated that they are not aware of climate change. This implies that majority of the farmers are aware of climate change which has a possible influence of the production of yam. This study is in line with the findings of [12] who reported that majority of the farmers in Oyo state are aware of climate change (Figure 1).
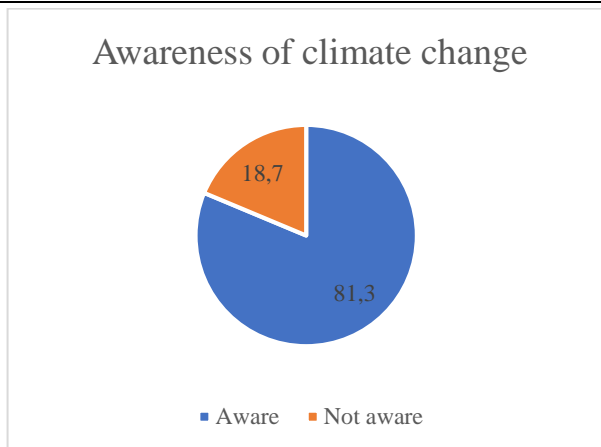

Fig. 1. Awareness on climate change
Source: Own design based on field survey.

Farmer's knowledge about perceived causes of climate change

The majority of respondents showed a good knowledge on the causes of climate change such as deforestation (81.3%), use of excess chemicals such as pesticide (81.3%), the high intensity rainfall (81.0%), increase in the size of the sun (78.0%), and bushing burning (72.0%).

Table 3. Yam farmers' knowledge of the causes of climate change

Causes of climate change	Yes (%)	No (%)
Deforestation/cutting down of trees	81.3	18.7
Use of excess chemicals in farming like pesticide	81.3	18.7
Bush burning	72.0	28.0
High rainfall intensity	81.7	18.3
Use of generator to generate electricity by many households	67.3	32.7
Increase in size on the sun	70.0	30.0
Gases released from industries	65.3	34.7
Cooking with firewood	35.3	64.7
Late onset of rainfall	33.3	66.7
Abandoned deities	29.3	70.7
Gas flaring from oil companies	23.7	65.3

Source: Field survey, 2019.

A large proportion of the respondents also believed that use of generators (67.3%), and gas releases from industries (65.3.0%) are amongst the causes of climate change. However, preponderance of the respondents (64.7%) had no knowledge of the use of firewood as a major contributor to climate change. Bush burning and deforestation have

been found in other studies to contribute to climate change [3, 11].

This finding is also in consonant with the Fifth Assessment report of [7] which provides scientific evidence that human impacts, especially greenhouse gas emissions, are the primary factor in global warming (Table 3).

Perceived effect of climate change on yam production

The effects of climate change as identified by the respondents include pest infestation (90.8%) and high rate weed growth (88.3%). yam spoilage in the soil (87.5%) respectively Moreover, majority (85.0%) of respondents were of opinion that climate change causes destruction of field crop by heavy wind. Others include increase erosion (82.5%), low crop yield (80.8%), premature ripening of crops (70.8%), reduction of soil nutrients (70.8%) and excessive soil moisture (68.3%), This result is an indication that climate change had serious effects on yam production which might resulted into economics loss for the farmer and in long run affect food sufficiency in the country. Hence the need for the adaptive measures to climate change to be put in place to ensure proper management of yam production (Table 4).

Table 4. The effects of climate change on yam production N=120

Variables	Yes (%)	No (%)
Disease and pest infestations	109 (90.8)	11 (9.2)
High rate of weed growth	106 (88.3)	14 (11.7)
Yam spoilage in the soil	(105) 87.5	15 (12.5)
Destruction of field crop by heavy wind	102 (85.0)	18 (15.0)
Increase erosion	99 (82.5)	21 (17.5)
Low crop yield	97 (80.8)	23 (19.2)
Premature ripening of crops	85 (70.8)	35 (29.2)
Reduction in soil nutrients	85 (70.8)	35 (29.2)
Excessive soil moisture	82 (68.3)	38 (31.7)

Source: Field survey, 2019.

Strategies adopted in order to adapt to climate change

The finding presented in Table 4 below outlines various strategies adopted by yam farmers to coped with climate change in descending order adoption in the study area. All the yam farmers interviewed used mulching (Mean=5.0) which was followed by intercropping yam with other crops (Mean=4.5), Other strategies include use of weather-resistant variety (Mean=4.1), use of early maturing crop varieties (Mean=3.8), planting of crop with early rainfall (Mean=3.6), change of planting dates (Mean=3.5), migration to a different farming location (Mean=3.4), using of irrigation systems (Mean=3.2), diversification into planting of other crops (Mean=3.2) and Listening to information about climate change (Mean=3.0) respectively. However, harvesting of rain water for use during the dry period and purchase of agricultural insurance had low level of adoption (1.8) which mighty be as a result of inadequate technical knowledge of rain harvest and storage by yam farmer and usefulness of insurance in mitigating against climate change.The implication of the finding is that most of the farmer practiced various strategies to mitigate climate change in yam production except rain harvest which might aid in water supply for yam production and purchase of agricultural insurance which mighty serve as buffer during the crop loss due to drought or flooding. This finding corroborates the findings of the study conducted by [4] that farmers used adaptation measures such as multiple/intercropping, agroforestry, expansion of cultivated land area, use of herbicides and pesticides and purchase/harvesting of water for irrigation were identified to mitigate climate change. [3] in another study, reported that the following adaptation measures were in use in the Niger Delta area of the country: use of improved crop varieties, use of early maturing crop varieties, and change of planting dates which is in line with the strategies put in place and used for this study. According to [9], adaptation helps farmers achieve and get food, income and livelihood security objectives in the face of changing climatic and socio-economic conditions including climatic change, extreme weather conditions such as drought, flood, volatile short-term changes in local send large scale markets (Table 5).

Table 5. Distribution of respondents' adaptation strategies on climate variation

Adaptation strategies	Mean	Rank
Mulching	**5.0**	**1st**
Intercropping yam with other crops	4.5	2nd
Use of weather-resistant variety	4.1	3rd
Use of early maturing crop varieties	3.8	4th
Planting of crop with early rainfall	3.6	5th
Change of planting dates	3.5	6th
Migration to other location	3.4	7th
Use of irrigation system	3.2	8th
Diversification into other activities	3.2	8th
Listening to information about climate change	3.0	10th
Harvesting of rain water for use during the dry period	2.0	11th
Purchase of agricultural insurance	1.8	12th

Source: Field survey, 2019.

Testing of Hypothesis

Pearson product moment correlation (PPMC) analysis showing correlation between age, estimated annual income, farming experience and adaptation strategy methods adopted to combat climate change shows that there is a significant relationship between annual income (r = 0.887), farming experience (r = 0.274) and adaptation strategy methods adopted to combat climate change.

This implies that adaptation strategy methods adopted to combat climate change increase with increase in estimated annual income and their farming experience (Table 6).

Table 6. Pearson product moment correlation

Variables	r-value	p-value	Decision
Age	-0.066	0.570	Not significant
Estimated annual income	0.887	0.000	Significant
Farming experience	0.274	0.006	Significant
Farm size	0.354		Significant

Source: Field survey, 2019.

CONCLUSIONS

Majority of the farmers had high knowledge of climate change issues. The effects of climate change were manifest in the study and these include: low crop yield and increase in pest and disease outbreak. These situations are being increasingly linked to decrease in farmers' income and hence, increase in vulnerability.

There were conscious efforts made by yam farmers to adapt to climate change. For example, farmers are already practicing changes in planting dates and processing of farm produce to minimize post-harvest loss, etc. Constraints that limited farmers' ability to adapt to climate change include inadequate access to information and training. Despite the constraints that farmers experienced in accessing information, they made efforts to access information on climate change issues from other farmers and radio. It was also noted that information on causes, effects and adaptation to climate change are necessary to aid them in adapting to the negative consequences of climate change.

Based on the findings of this study, it was recommended that:

-There is need for government and non-governmental bodies to provide necessary technologies to help rural farmers become better in their adaptation to climate change.

-There is need to train on the issues of climate change, especially in the rural areas by Extension personnel and non-governmental organizations

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