



# Adaptation Strategies to Effects of Climate Change on Arable Crops Production in Southwestern Nigeria

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## Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

## Article Information

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## ABSTRACT

Agriculture is an important aspect of Nigerian economy in that it provides food, employment, raw material for industries. This sector can affect and can be affected by climate change variations in the area. These effects need to be identified and adaptation strategies ascertained on arable crop farmers. The study was designed to identify visible climate change effects on arable crop production and the adaptation strategies to these effects by arable crop farmers. It was conducted in the southwestern Nigeria. A total of 120 respondents were selected from two states of the southwestern Nigeria. Questionnaire was used to elicit information on the topic from the respondents. Data collected was analyzed using descriptive analysis and linear regression analysis was used for inferential analysis. The result showed that prominent arable crops among the respondents are maize (21.7%), yam (20.0%), cassava (14.2%), rice (9.2%) and plantain (6.7%). Annual income from arable crops farming showed that 19.2% of the respondents make between 501,000.00 and 600,000.00, 14.3% make between 601,000.00 and 700,000.00 and 18.7% of the make above 700,000.00 naira from arable crops farming annually. Reduction in crop yield (6.7%), pest and diseases infestation (21.7%), late maturity of crops (20.0%) and extinction of crops (6.7%) were identified to be the visible effects of climate change. Migration and relocation were also identified by arable crop farmers as visible effects of climate change. Crop rotation (34.2%),

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intercropping (20.0%), diversification (21.7%), resistance varieties (20.0%) and mix cropping (4.2%) were ascertained to be the adaptation strategies to climate change by arable crop farmers in the zone. Inferential analysis revealed that educational status ( $r = 0.033$ ,  $p = 0.070$ ), social status ( $r = 0.231$ ,  $p = 0.009$ ) and farming experience ( $r = 0.0292$ ,  $p = 0.023$ ) have positive coefficients and are significantly related to productivity.

*Keywords: Climate change; arable crops; adaptation strategies and food security.*

## 1. INTRODUCTION

Agriculture plays important role in the life of people in Nigeria in the area of provision of food, employment, raw materials for industries and the like. Agriculture affects and can be affected by the changes in climate of an area. Agriculture places heavy burden on the environment in the process of providing humanity with food and fiber while climate is the primary determinant of agricultural productivity [1]. The fundamental role of agriculture in human welfare has been expressed by federal agencies and others regarding the potential effect of climate on agricultural productivity [2].

The effectiveness of rainfall for crop and fish production is a function of the temperature which affect evaporation and transpiration [3]. [4] asserted that climate plays a dominant role in agriculture having a direct effect on productivity of physical production factors, for example the soil moisture and fertility.

Adverse climate effects can influence farming outputs either favourably or vice versa at any stage from cultivation through the final harvest [5]. Even if there is sufficient rain, its irregularity can affect yield adversely if rain fails to fall during the crucial growing stage of crops [6,3]. Interest in this issue has motivated a substantial body of research on climate change and agriculture [7]. Climate change is expected to influence crop and livestock production, Hydrologic balance, input supplies and other components of agricultural system including, storability and marketability of the products [2].

However, the nature of these bio-physical effects and human response to them are complex and uncertain because they cannot be predictable [2]. Though climate change is a threat to agriculture and non agriculture, socio-economic development, agricultural production activities are generally more vulnerable to climate change than other sectors [8]. [9] predicted future economic losses and increased in risk of hunger due to climate change. It seems clear that the

combination of high climatic variability, poor infrastructure, economic poverty, drought, excess rainfall, poor livestock health, reduced crop yields, low productivity and a range of other problems associated with climate variability will constitute important challenges for Nigeria in particular [10].

Arable crops farmers in south western Nigeria provide the bulk of arable crops that are mostly consumed locally within the region. The local farmers are experiencing climate change even though they have not considered its deeper implication [10]. This is evidence in the late arrival of rain, the drying up of streams and small rivers that usually flow all year round.

Also the gradual disappearances of flood recession for cropping in riverine area of Ondo State are among the effects of climate disturbance in some parts of southwestern Nigeria [11,1].

### 1.1 Statement of the Problem

Research findings has shown that the effects of climate change on agriculture especially on arable crops which constitute the stable food consumed in Nigeria has shown to be strong and that farmers perception positively associates with management of climate variability.

A variety of arable crops produced in Nigeria depend on rainfall, sunshine and other climatic factors. Despite this obvious fact, there is need of much information as possible and learned position of rural farmers, their perception and their need on what they know about climate change in order to offer adaptation practices that will meet their needs [12,1,7,13]. This study therefore intends to assess the perception of the effects of climate change on arable crop production by farmers and to identify the socio-economic characteristics of the farmers as it relates to crop production and examine the impact of climate change as it affects arable crop production and food security.

## 2. RESEARCH METHODOLOGY

This study was conducted in the southwestern geopolitical zone of Nigeria which consists of six (6) states namely: Oyo state, Ondo State Lagos state, Osun state Ekiti State and Ogun state. Simple random sampling procedure was used to select two (2) states out of the six (6) states. Oyo and Ekiti states were selected. While communities that are prone to climate change or variability were purposely selected [11,1]. The communities selected are Ogbomoso in Oyo state and Ikole Ekiti in Ekiti state. Ogbomoso agricultural zone of Oyo state consist of five (5) agricultural extension blocks out of which two (2) namely Iresa and Ajaawa were purposely selected for the study due to the rural based of these extension blocks. Also sixty (60) farmers were selected from two communities namely Ugbona and Asin communities which are selected from Ikole agricultural zone in Ekiti state. A total of one hundred and twenty (120) respondents constitute the sampling size for the study.

The study administered questionnaire and field focus group discussion (FGD) to elicit information, where valid responses were used for further analysis. Both structured questionnaire and interviews held with indigent and local government officials and other local stakeholders on climate change knowledge and adaptation. Data were analyzed using descriptive tools such as frequency count, percentages, mean, standard deviation and were represented using Tables. The study uses chi's square analysis to examine the characteristics that best explain variations in the measure of attitudes, perception and adaptation to climate change and factors that influence such decisions.

## 3. RESULTS AND DISCUSSION

### 3.1 Socio-economic Characteristics of the Respondents

The mean age of the respondents was 47.79 and the standard deviation was 12.57. About 26.0% of them have their age between 31 and 40 while 27.4% have their ages between 51 and 60 years. This implies that the respondents are within their active age. Most of the respondents (90.0) are male, 79.2 are married, 18.3% have no formal education certificate and 40.0% of them have secondary school certificate. Many of the respondents (66.7%) are head of one social group or the other. Also many of the respondents

have one other income generating activity apart from arable farming or the other ranging from civil service (20.8%), trading (29.2%), artisan (17.5 and only 32.5% have no other income generating activity apart from arable farming.

### 3.2 Arable Crops Activities of the Farmers

Table 2 showed that only 20.0% of the respondents have less than 20 years of arable farming experience while 33.3% have between 21 and 30 and 27.5% have between 31 and 40 years of arable crop farming experience. This shows that the respondents have enough experience to identify effects of climate variation and develop adaptation strategies to it. It was also revealed that 24.2% of them acquired their farm land through direct purchase, 33.3% through inheritance and 14.2% through leasing. From the study, prominent crops among the respondents are maize (21.7%), yam (20.0%), cassava (14.2%), rice (9.2%) and plantain (6.7%). These crops form the diets and the delicacies of the people in the geographical zone. Annual income from arable crops farming showed that 19.2% of the respondents make between 501,000.00 and 600,000.00, 14.3% make between 601,000.00 and 700,000.00 and 18.7% of the make above 700,000.00 naira from arable crops farming annually. This shows that if the farmers have access to production facilities such as land, capital, labour and useful information they can make high income from their farming business.

### 3.3 Visible Effects of Climate Change and Adaptation Strategies

Visible effects of climate change on arable crop production as indicated by arable crop farmers are shown in Table 3. These are reduction in crop yield (6.7%), pest and diseases (21.7%), late maturity of crops (20.0%) and extinction of crops (6.7%). Migration and relocation were also identified by arable crop farmers as visible effects of climate change. This finding is in agreement with the prediction of [10] that reduced crop yield as one of the effects of climate change that will constitute big challenge for Nigeria. [6,3] they predicted the even if there is sufficient rain, its irregularity can affect yield adversely if rain fails to fall during the crucial growing stage of crops. This can lead to reduction in crop yield, farmers' productivity and hence reduction in revenue of the farmers specifically and the nation as a whole. This implies that farmers must find ways of adapting

to climate change strategies in the zone to sustain their production and socio-economic statuses. On the other hand respondents also identified their adaptation methods to climate change effects. These are crop rotation (34.2%), intercropping (20.0%), diversification (21.7%), resistance varieties (20.0%) and mix cropping (4.2%). By crop rotation some crops that more favourable in some areas due to climate change and such crops should be planted in such area while crops that are not favourable in such areas should not be planted. This finding is in contrast with [10] that reported that local farmers are experiencing climate change even though they have not considered its deeper implication. If the local farmers have not considered deeper implication of climate change effect, they would not have developed adaptation strategies to it. From this study is established that farmers are trying to adapt to negative effects of climate

change by employing the afore mentioned adaptation strategies.

### 3.4 Relationship between Socio-economic Characteristics and Productivity

From Table 4 below among the socio-economic Characteristics considered in the study, educational status (  $r = 0.033$ ,  $p = 0.070$ ), social status (  $r = 0.231$ ,  $p = 0.009$ ) and farming experience (  $r = 0.0292$ ,  $p = 0.023$ ) have positive coefficients and are significant to productivity. Educational status has positive coefficient which means that the higher the educational status of the respondents the higher will be their productivity from their arable farming. This finding may be due to the fact that the farmers with high educational status will have access to agricultural information both in print and in official

**Table 1. Frequency distribution of socio-economic characteristics of respondents**

Socio-economic Characteristics	Frequency	Percentages (%)
<b>Age</b>		
< 30	8	6.7
31 – 40	31	25.8
41 – 50	31	25.8
51 – 60	33	27.4
> 60	17	14.0
<b>Sex</b>		
Male	108	90.0
Female	12	10.0
<b>Marital status</b>		
Single	10	8.3
Married	95	79.2
Divorced	2	1.7
Separated	4	3.3
Widowed	9	7.5
<b>Educational status</b>		
No formal education	22	18.3
Primary education	26	21.7
Secondary education	48	40.0
Tertiary education	10	8.3
Others	14	11.7
<b>Social status</b>		
Community/traditional leader	9	7.5
Village head	25	20.8
Youth leader	34	28.3
Religious leader	12	10.0
Others	40	33.3
<b>Other income generating activities</b>		
Civil servant	25	20.8
Trading	35	29.2
Artisan	21	17.5
None	39	32.5

Source: Field survey, 2012

**Table 2. Distribution of arable crops activities among respondents**

<b>Arable crops activities</b>	<b>Frequency</b>	<b>Percentages (%)</b>
<b>Years of farming experience</b>		
< 20	24	20.0
21 - 30	40	33.3
31 – 40	33	27.5
41 – 50	15	12.5
51 – 60	6	4.9
➤ 60	2	1.7
<b>Mode of land acquisition</b>		
Direct purchase	29	24.2
Inheritance	40	33.3
Gift	18	15.0
Leasing	17	14.2
other	16	13.3
<b>Type of arable crops</b>		
Rice	11	9.2
Maize	26	21.7
Cassava	17	14.2
Plantain	8	6.7
Cowpea	5	4.2
Banana	5	4.2
Cocoyam	4	3.3
Soybean	5	4.2
Potatoes	2	1.7
Yam	24	20.0
Vegetable	4	3.3
Peppers	7	5.8
Garden egg	2	1.7
<b>Annual income</b>		
< 100,000.00	1	0.8
101,000.00 – 200,000.00	6	5.1
201,000.00 – 300,000.00	15	12.7
301,000.00 - -400,000.00	16	13.4
401,000.00 – 500,000.00	20	16.8
501,000.00 – 600,000.00	23	19.2
601,000.00 – 700,000.00	17	14.3
➤ 700,000.00	22	18.7

Source: Field survey, 2012

language which they can use to improve their productivities. They are also exposed to meet other people either in conferences, workshops and association meetings where they can hear and see production technologies which people with low educational status might not have access to. Social status was also significant to productivity with positive coefficient. This also indicates that when a farmer belongs to a social association or have a leadership status in the association this will improve his or her productivity. This may be as a result of his or her exposure to meeting with other leaders from other places where they can share information

on productivity as farmers. When new innovation is coming to the communities it will first be introduce to community leaders or the elite who can also serve as contact farmers. They get the technologies before other farmers and hence better production than other farmers. Farming experience is also significant with positive coefficient. This implies that as farming experience increases, the productivity also increases. This may be due to the fact that as the years increases they gain more knowledge on their farming activities and hence this leads to increase in their productivity.

**Table 3. Visible effects of climate change and adaptation strategies of arable farmers**

Variables	Frequency	Percentages (%)
<b>Visible effects climate change</b>		
Reduction in yield	8	6.7
Pest and diseases	26	21.7
Late maturation of crops	24	20.0
Migration	10	8.3
relocation	12	10.0
Extinction of crops	8	6.7
Others	32	26.7
<b>Adaptation strategies to climate change</b>		
Mix cropping	5	4.2
Inter cropping	24	20.0
Diversification	26	21.7
Crop rotation	41	34.2
Resistance varieties	24	20.0

Source: Field survey, 2012

**Table 4. Relationship between socio-economic characteristics and productivity**

Variables	Coefficient	P value	Decision
Age	- 0.110	0.370	Not significant
Sex	- 0.044	0.614	Not significant
Marital status	- 0.050	0.562	Not significant
Educational status	0.033	0.070*	Significant
Social status	0.231	0.009**	Significant
<b>Other income generating</b>			
Activities	- 0.109	0.213	Not significant
Farming experience	0.292	0.023**	Significant

Source: Field survey, 2012

#### 4. CONCLUSION

A variety of arable crops produced in Nigeria depend on rainfall, sunshine and other climatic factors. Despite this obvious fact, there is need of much information as possible and learned position of rural farmers, their perception and their need on what they know about climate change in order to offer adaptation practices that will meet their needs. It can be concluded from the study that there are visible effects of climate change on arable crop production in the study area such as crop yield reduction, pest and disease infestation, extinction of crops and late maturity. These negative effects of climate change have led to migration and relocation of some arable crop farmers. The arable crops produce in the area are yam, cassava, rice, maize, plantain and others such as peppers, vegetables, soya beans etc. Adaptation strategies of arable crop farmers are diversification, crop rotation, mix cropping, intercropping and planting resistance varieties. Among the socio-economic characteristics considered, educational status, farming

experience and social status can be used to predict productivity of arable crop farmers as they have significant relationship with the productivity.

#### 5. RECOMMENDATION

From the study the following recommendations were made;

Arable crop farmers should be arranged into groups and assisted by providing production facilities such as improved seeds, credit facilities and extension services to help them improve their productivity. Also arable crop farmers should be considered whenever policies are to be made on agriculture and climate change because they have their own share from negative effects of climate change. Government at all levels should continue to support the organization of conferences, association meetings and workshops where farmers can learn from experience about higher level of production and used Technologies.

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## COMPETING INTERESTS

Author has declared that no competing interests exist.

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