

ADAPTATION STRATEGIES OF ARABLE CROP FARMERS TO CLIMATE CHANGE AND VARIABILITY: IMPLICATIONS AND PROSPECTS ON FOOD PRODUCTION IN OVIA NORTH-EAST LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA

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Abstract

This study examined the adaptation strategies adopted by arable crop farmers for climate change and variability, implications and prospects on food crop production in Ovia North-East Local Government Area of Edo State, Nigeria. Survey research design was used and the study population was 430 food crop farmers, 207 respondents were selected using the simple random sampling (SRS) technique and questionnaire was administered to them by the researchers. The instrument was validated by one expert from the Department of Vocational and Technical Education, Faculty of Education, and the other from Department of Crop Science, Faculty of Agriculture, University of Benin. The reliability of the instrument was done using Spearman-Brown reliability computation which yielded a co-efficient of 0.78. The data collected was analyzed using frequency count, simple percentage, mean and standard deviation. The findings of this study revealed that there is sufficient knowledge of arable crop farming on climate change and variability in Edo State, the impact of climate change which includes decrease in the production of food crops, changes in planting and harvest time, reduction in crop yield and income of farmers, increase in the rate of disease during the excess rainfall. This study also revealed various adaptation strategies available to arable crop farmers, which are; the use of improved and resistant crop varieties, the use of alternatives fallow/tillage practices, the varying planting dates and times. Lastly, this study reveals the implications and prospects of these adaptation strategies to food production in Edo State which includes; continuous food production by arable food farmers, improved nutrients use efficiency of arable crops, reduced green-house gas emission, among others. This study recommended among others that government should make improved and resistant crop varieties available to arable crop farmers so as to increase their agricultural productivity.

Keywords: Arable Crop, Climate Change, Variability, Food Production and Farmers

Introduction

Arable crops are very important crops as they are the chief sources of dietary food energy for the majority of humans and livestock, especially in the lowland tropics, much of the sub-humid tropics of West Africa and Central Africa. Examples of these arable crops are *Zea mays* (maize), *Triticum aestivum* (wheat), *Oryza sativa* (rice), *Hordeum vulgare* (barley), *Pennisetum glaucum* (millet), *Cajanus cajan* (pigeon pea), *Vigna unguiculata* (cowpea), *Pisum sativum* (green peas), *Sorghum bicolor* (sorghum), *Glycine max* (soybean), *Ipomoea batatas* (sweet potato), *Dioscorea SPP* (yam), *Manihot esculenta* (cassava), *Colocasia esculenta* (cocoyam). Climate change and variability affect the production of these crops in Sub-Saharan African countries especially Nigeria because agricultural production in these countries is partly or dependent on rain-fed production. The numerous adverse effects of climate change and variabilities have made farmers, agricultural experts, and the government look for favorable adaptation strategies that will ensure the continuity of agricultural activities and food production in the nation.

Climate change according to the Intergovernmental Panel on Climate Change (IPCC, 2007) refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Arable crop production is highly sensitive to climate. It is affected by long-term trends in average rainfall

and temperature, inter-annual climate variability, shocks during specific phenological stages, and extreme weather events (IPCC, 2012).

In the view of Deuter (2008) who summarized the impacts of climate change on arable crop production as follows; Increased temperatures could reduce crop yields by shortening growing seasons and accelerating grain sterility in crops, shifts in rainfall patterns could disrupt flows in rivers used for irrigation, accelerate erosion and desertification and reduce crop production and livestock yields, damages resulting from an increase in the intensity or frequency of severe weather events (rainfall, hail, wind and heat stress), changes in time of harvest for some crops and in some locations, changes in suitability and availability of cultivars for present and future production, reduced availability of water and increased cost of irrigation water in most localities and different seasons (dry seasons), greater seasonal variability, heightened pest and diseases incidence, increased emergence of weeds and negative impacts on soils and crops due to extreme temperature, rainfall, erosion and flooding. The major problem of arable crop farmers now is how to adapt food systems and livelihoods to the expected climate change and variability, especially in Sub Sahara Africa where crop production is highly dependent on the intra-seasonal and inter-annual variations in rainfall. It is in this light that arable crop farmers and the government in various countries continue to develop adaptive strategies to curb the challenges and damages of climate change.

Adaptation to climate change refers to actions that reduce the negative impact of climate change while taking advantage of potential new opportunities (Gregory, 2010). This involves adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. These adjustments can be done by the arable crop farmers themselves or the government through the implementation of agricultural policies aimed at promoting appropriate and effective adaptation measures. The common strategies to be adopted by farmers are; the use of drought-resistant and improved varieties of crops, crop diversification, changes in cropping pattern and calendar of planting, conserving soil moisture through appropriate tillage methods, improving irrigation efficiency, afforestation, treatment of livestock faeces to reduce methane and increased use of organic manure rather than inorganic fertilizers, especially the nitrogenous ones. These strategies focus on managing risks, reducing vulnerability, enhancing food production and general agricultural productivity, protecting the environment, and ensuring sustainable development under the changing climate.

Statement of the Problem

Most farmers do not know about climate change and variability and how it is a challenge to crop production. This lack of knowledge of the adverse effects of climate change and variability restricts them from looking for ways to improve arable crop production. To a local farmer series of these variations are classified as a bad farming year, improper cultural practices, or the handiwork of the evil world. How can one look for solutions to a problem he has not defined? Different strategies can be adopted by arable crop farmers to curb the adverse effects of climate change and variability, these include; the use of drought-resistant varieties of crops, crop diversification, changes in cropping pattern and calendar of planting, conserving soil moisture through appropriate tillage methods, improving irrigation efficiency, and afforestation and agro-forestry and these strategies are not available to the local farmer in terms of knowledge and application. Numerous factors influence farmers' choice of these adaptation strategies such as climate change awareness, knowledge of adaptation strategies, finance, manpower, environmental concern, socio-demographic characteristics of a farmer, perceived risks, etc. These factors can affect the success or failure of the adaptation strategies. What are the challenges faced by farmers in the application of their chosen strategies? What are the implications and prospects of these adaptation strategies to food production in Edo State?

Purpose of Study

The main purpose of this study is to gather information on the adaptation strategies of arable crop farmers to climate change and variability, its implication, and prospect for food security in Edo State, Nigeria.

The specific purposes of this study are;

- To determine the knowledge of arable crop farmers on climate change and variability in Edo State.

- To identify the various ways in which climate change and variability affect arable crop production amongst farmers in Edo State.
- 5. To determine the various adaptation strategies available to arable crop farmers for climate change and variability.
- 4. To specify the challenges encountered by arable crop farmers in the application of the adaptation strategies to climate change and variability.
- To ascertain the implications and prospects of these adaptation strategies to food security in Edo State.

Research Questions

8. What is the knowledge of arable crop farmers on climate change and variability in Edo State?
- What are the various ways climate change and variability affect arable crop production amongst farmers in Edo State?
 - What are the various strategies available to arable crop farmers for adapting to climate change and variability?
 - What are the challenges encountered by arable crop farmers in the application of adaptation strategies to climate change and variability?
 - What are the implications and prospects of these adaptation strategies of arable crop farmers to food security in Edo State?

Significance of the Study

The adaptation strategies available to arable crop farmers to climate change and variability will be of benefit to arable crop farmers, livestock farmers, and other agriculturists in making food production easily possible in and off seasons for the growing populace.

- The results of this study are expected to give direction for policymakers in designing appropriate public policies to increase agricultural productivity and mitigate the effects of climate change on food crop production in Nigeria, especially in the Southwestern zone.
- It will provide a useful guide to international and local donor agencies interested in climate change mitigation and adaptation in their provision of grants and funds for environmental and resource management studies.
- The results of this study will also help agricultural planners in the Agricultural Development Programmes (ADPs) and Ministries of Agriculture, Science and Technology; and the Environment in the southwestern region and Nigeria as a whole and those states in the zone with Agro-climatological and Ecological zone study Units in their planning activities and providing useful weather data that will guide in planning public (or planned) adaptations to complement the farm-level (or autonomous) adaptation strategies.
- Farmers are also going to benefit by knowing the adaptation strategies to climate change that are more productive and efficient.

Methodology

Survey research was used in the study, while the study population comprise students in Faculty of Agriculture, University of Benin, Benin City, Edo State. This population comprised of the 400 level students in the six Departments of Faculty of Agriculture; Departments of Animal Science (ANS), Crop Science (CRS), Soil Science and Land Management (SLM), Agricultural Economics and Extension (AEE), Aquaculture and Fisheries Management (AFM), Forestry and Wildlife Management (FWM). The sample size used for this study is 207 (48.14%) of the total population (430). The size of the sample was reached using confidence level of 95% based on the population as stated by Uzoagulu (2011). The study utilized proportionate stratified random technique in selecting respondents to adequately represent the 400 level students in Faculty of Agriculture. This is to ensure representativeness of the sample relative to the population and guarantees that minor constituents of the population are represented in the sample. Proportionate stratified random sampling technique ensuring representativeness of the sample relative to the

population (ANS-39, CRS-43, SLM-43, AEE-34, AFM-29, and FWM-19). This gives a total number of (207) 400 level agricultural science students.

Using administered questionnaire formulated for data collection. The questionnaire has two sections (A & B). Section A focused on the demographic or personal data of the respondents such as age, sex, marital status, etc.; while section B contains five (5) research questions. These include: What is your knowledge of arable crop farming on climate change and variability in Edo State? (containing eight research items), What are the various ways climate change and variability affects arable crop production amongst farmers in Edo State? (containing six research questions), What are the various adaptation strategies available to arable crop farmers for climate change and variability? (containing eight research questions), What are the Challenges Encountered by Arable Crop Farmers in the Application of the Adaptation Strategies to Climate Change and Variability? (containing eight research items) and What are the Implication and Prospect of these Adaptation Strategies of Arable Crop Farmers to Food Production in Edo State? (containing nine research questions). The options were presented in four point scale ranging from: Strongly agree (SA), Agree (A), Disagree (D) and strongly Disagree (SA) for all the research items. Correspondingly each of those options attracts the following: SA (4), A (3), D (2) and SA (1).

The validity of the Instrument was determined by the researcher adopting expert judgment approach. By this, the instrument was given to experts in the department. This includes my supervisor and other lecturers in the Department of Crop Science (CRS), Faculty of Agriculture, University of Benin. Split half method was used to determine the reliability of the instrument. After the administration of the instrument, Spearman- Brown reliability computation was carried out. A reliability coefficient of 0.78 was generated, indicating that the instrument is highly consistent and reliable. The questionnaire was distributed personally by the researcher to the respondents. She explained the nature and purpose of the study to the respondents and collected the questionnaires immediately after the respondent responded to the questions. Data collected were inputted into the computer and analyzed using frequency count, simple percentage, mean (\bar{x}) and standard deviation were employed to analyze the data collected from the answered research questions. While the mean was used to determine the degree of responses, the standard deviation was used to determine the extent at which the respondents' responses cluster or deviate around the mean. The mean rating of 2.0 was used for decision point such that only items less than 2.0 was regarded as disagree while mean rating equals or above 2.0 was regarded as agree.

Results

Research Question 1: What is your knowledge of arable crop farming on climate change and variability in Edo State?

Table 1: Knowledge of arable crop farming on climate change and variability in Edo State.

| SN | ITEMS | SA | A | D | SD | \bar{X} | Standard Deviation | Decision |
|----|--|----------------|---------------|---------------|--------------|-----------|--------------------|----------|
| 1 | Are you aware of climate change | 153 (76.5%) | 34 (17%) | 5 (2.5%) | 8 (4%) | 1.34 | 0.719 | Disagree |
| 2 | I became aware of climate change through social media | 74 (37%) | 93 (46.5) | 25 (12.5%) | 8 (4%) | 1.84 | 0.794 | Disagree |
| 3 | I became aware of climate change through fellow farmers | 49 (24.5%) | 89 (44.5%) | 53 (26.5%) | 9 (4.5%) | 2.11 | 0.825 | Agree |
| 4 | I became aware of climate change through television/radio and newspaper/magazine | 46 (23%) | 81 (40.5%) | 69 (34.5%) | 4 (2%) | 2.16 | 0.796 | Agree |
| 5 | Higher and lower temperature is form of climate change | 25 (12.5%) | 98 (49%) | 69 (34.5%) | 8 (4%) | 2.30 | 0.737 | Agree |
| 6 | Increased and decrease temperature is a form of climate change | 31 (15.5%) | 93 (46.5%) | 72 (36%) | 4 (2%) | 2.25 | 0.733 | Agree |
| 7 | Variations in season is a form of climate change | 42 (21%) | 91 (45.5%) | 54 (27%) | 13 (6.5%) | 2.19 | 0.841 | Agree |

From table 1 above, knowledge of arable crop farming on climate change and variability, it shows that most of the respondent are aware of climate change, most of the respondent are aware of the climate change through the help of the social media, most of them became aware through the fellow farmers in the field, some of them became aware of it through the television programme, through radio and through newspaper they read, the various temperature of higher and lower are as a result of the climate change. The increase and decrease of temperature are from the climate change. The variation in season is a form of climate change.

Research Question 2: What are the various ways climate change and variability affects arable crop production amongst farmers in Edo State?

Table 2: Ways climate change and variability affects arable crop production amongst farmers in Edo State.

| SN | ITEMS | SA | A | D | SD | (X) | Standard Deviation | Decision |
|----|---|---------------|---------------|---------------|---------------|------|--------------------|----------|
| 1 | Leads to variability in agricultural production | 93 (46.5%) | 77 (38.5%) | 30 (15%) | | 1.69 | 0.720 | Disagree |
| 2 | Decreases the production of food crops | 16 (8%) | 134 (67%) | 50 (25%) | | 2.17 | 0.550 | Agree |
| 3 | Causes changes in planting and harvest time, making it difficult for farmers to predict the times | 26 (13%) | 89 (44.5%) | 81 (40.5%) | 4 (2%) | 2.32 | 0.720 | Agree |
| 4 | Reduces crop yield | 18 (9%) | 85 (42.5%) | 89 (55.5%) | 8 (4%) | 2.44 | 0.713 | Agree |
| 5 | Lack of uniformity in natural precipitation (rainfall) | 20 (10%) | 100 (50%) | 63 (31.5%) | 17 (8.5%) | 2.39 | 0.781 | Agree |
| 6 | Increase rate of disease attack during excess rainfall | 32 (16%) | 71 (35.5%) | 76 (38%) | 21 (10.5%) | 2.43 | 0.883 | Agree |

The climate change and variability affects arable crop production amongst farmers in Edo state. Looking at the table above it shows that the leads to variability in agricultural production affect the arable crop production. The climate change decrease the production of food crops, the climate change causes changes in planting and harvest time, making it difficult for farmers to predict the times and season. It reduces the crop yield of the farmers, it also increase the rate of disease during the excess rainfall

Research Question 3: What are the various adaptation strategies available to arable crop farmers for climate change and variability?

Table 3: Adaptation strategies available to arable crop farmers for climate change and Variability

| SN | ITEMS | SA | A | D | SD | (X) | Standard Deviation | Decision |
|----|---|----------------|----------------|---------------|--------------|------|--------------------|----------|
| 1 | Use of improved and resistant crop variables | 133 (66.5%) | 38 (19%) | 25 (12.5%) | 4 (2%) | 1.50 | 0.789 | Disagree |
| 2 | Use of alternative fallow/tillage practices | 28 (14%) | 139 (69.5%) | 29 (14.5%) | 4 (2%) | 2.05 | 0.604 | Agree |
| 3 | Varying planting dates and time | 16 (8%) | 118 (59%) | 58 (29%) | 8 (4%) | 2.29 | 0.669 | Agree |
| 4 | Effective irrigation and tillage practices | 4 (2%) | 92 (46%) | 91 (45.5%) | 13 (6.5%) | 2.57 | 0.646 | Agree |
| 5 | Fertilizers and organic manure application | 22 (11%) | 65 (32.5%) | 100 (50%) | 13 (6.5%) | 2.52 | 0.776 | Agree |
| 6 | Discouraging deforestation and encouraging afforestation and regeneration | 34 (17%) | 57 (28.5%) | 96 (48%) | 13 (6.5%) | 2.44 | 0.846 | Agree |
| 7 | Crop diversification | 29 (14.5%) | 90 (45%) | 68 (34%) | 13 (6.5%) | 2.33 | 0.802 | Agree |
| 8 | Discouraging the practice of bush burning | 66 (33%) | 70 (35%) | 47 (23.5%) | 17 (8.5%) | 2.08 | 0.951 | Agree |

The various adaptation strategies available to arable crop farmers are the use of improved and resistant crop variables, the use of alternatives fallow/tillage practices, the varying planting dates and times. But it was not so with some respondent who disagreed about the adaptation strategies, it shows that irrigation and tillage practice is not an adaptation strategies, fertilizers and organic manure application is not an adaptation strategies, deforestation and encouraging afforestation and regeneration is not an adaptation strategies, but totally discouraging the practice of bush burning is an adaptation strategies.

Research Question 4: What are the challenges encountered by arable crop farmers in the application of the adaptation strategies to climate change and variability?

Table 4: Challenges encountered by arable crop farmers in the application of the Adaptation strategies to climate change and variability.

| SN | ITEMS | SA | A | D | SD | (X) | Standard Deviation | Decision |
|----|---|---------------|----------------|---------------|---------------|------|--------------------|----------|
| 1 | Illiteracy of the food crop farmer | 122 (61%) | 70 (35%) | 4 (2%) | 4 (2%) | 1.45 | 0.640 | Disagree |
| 2 | Lack of inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production | 61 (30.5%) | 131 (65.5%) | 4 (2%) | 4 (2%) | 1.76 | 0.589 | Disagree |
| 3 | Poor access to climate change adaptation strategies information by food crop farmers | 37 (18.5%) | 123 (61.5%) | 31 (15.5%) | 9 (4.5%) | 2.06 | 0.720 | Agree |
| 4 | Government irresponsiveness to climate risk management | 33 (16.5%) | 113 (56.5%) | 45 (22.5%) | 9 (4.6%) | 2.15 | 0.742 | Agree |
| 5 | High cost of improved crop varieties | 37 (18.5%) | 69 (34.5%) | 77 (38.5%) | 17 (8.5%) | 2.37 | 0.881 | Agree |
| 6 | Lack of/ or inadequate access to weather forecast technologies | 50 (25%) | 51 (25.5%) | 74 (37%) | 25 (12.5%) | 2.37 | 0.994 | Agree |
| 7 | Traditional beliefs/practice e.g. some farmers do not use fertilizers in crop production, waiting for first rain etc. | 136 (68%) | 55 (27.5%) | 5 (2.5%) | 4 (2%) | 1.39 | 0.639 | Disagree |
| 8 | High cost of fertilizers and other input | 57 (28.5%) | 130 (65%) | 13 (6.5%) | | 1.78 | 0.551 | Disagree |

Some of the challenges encountered by arable crop farmers in the adaptation strategies to climate

change and variability include, poor information that was given to the crop farmers, limited government irresponsiveness to climate risk management, lack of access to weather forecast technologies, high cost of fertilizer and other input, high cost of improved crop varieties, traditional beliefs, lack of extension programmes directed to meet the climate change adaptation in food crop production.

Research Question 5: What are the implication and prospect of these adaptation strategies of arable crop farmers on food production in Edo State?

Table 5: Implication and prospect of these adaptation strategies of arable crop Farmerson food production in Edo State

| SN | ITEMS | SA | A | D | SD | (X) | Standard Deviation | Decision |
|----|--|---------------|----------------|----------------|-------------|------|--------------------|----------|
| 1 | It ensures continuous food production for arable food farmers | 73 (36.5%) | 109 (54.5%) | 18 (9%) | | 1.73 | 0.617 | Disagree |
| 2 | Improves nutrients use efficiency of arable crops | 24 (12%) | 119 (59.5%) | 47 (23.5%) | 10 (5%) | 2.22 | 0.715 | Agree |
| 3 | Protect the soil from breakdown, thus ensuring good crop yield | 33 (16.5%) | 85 (42.5%) | 77 (38.5%) | 5 (2.5%) | 2.27 | 0.762 | Agree |
| 4 | Reduces green-house gas emissions | 34 (17%) | 80 (40%) | 81 (40.5%) | 5 (2.5%) | 2.29 | 0.773 | Agree |
| 5 | Increase agricultural productivity and development | 26 (13%) | 83 (41.5%) | 86 (43%) | 5 (2.5%) | 2.35 | 0.736 | Agree |
| 6 | Provision of better living conditions for farmers | 31 (15.5%) | 61 (30.5%) | 103 (51.5%) | 5 (2.5%) | 2.41 | 0.778 | Agree |
| 7 | Provision of raw material for industries for the manufacture of foods and other products | 30 (15%) | 66 (33%) | 94 (47%) | 10 (5%) | 2.42 | 0.804 | Agree |
| 8 | Increase the level of income of farmer in rural settlements | 30 (15%) | 99 (44%) | 72 (36%) | 10 (5%) | 2.31 | 0.785 | Agree |
| 9 | Ensures continuous use of agricultural land by arable crop farmers. | 24 (12%) | 94 (47%) | 72 (36%) | 10 (5%) | 2.34 | 0.753 | Agree |

Some of the implication and prospect include it ensures continuous food production for arable food farmers, improves nutrients use efficiency of arable crops, reduces green-house gas emission, increase agricultural productivity and development, provision of better living conditions for farmers, provision of raw materials for industries for the manufacture of food and other products, increase the level of income of farmer in rural settlements, and ensures continuous use of agricultural land by arable crop farmers.

Discussion of Findings

In research question 1, response from the respondents reveals that there is sufficient knowledge of arable crop farming on climate change and variability in Edo State. This is indicated by high mean values ranging from 2.11 to 2.30. This is in consonance with Tunde (2011), the author posited that delayed rainfall accounts for climate variability based on farmers' perception of climate variability on agriculture in Nigeria. In another vein, Abaje et. al., (2014) reported that impacts of an increase in temperature, high rainfall variability, and high incidence of flood occurrences also account for climate change and variability which is a common knowledge to farmers.

In research question 2, response from the respondents reveals that climate change and variability affects arable crop production amongst farmers in Edo State. This is indicated by high mean values ranging from 2.17 to 2.44. To a significant extent, this finding is in accordance with the study of Abaje et al. (2014) which

states that climate variability and change causes decline in crop yield due to the impacts of an increase in temperature, high rainfall variability, and high incidence of flood occurrences. Similarly, Ogalleh et al. (2012) reported that local perception and response to the variability and changes in climate reveal that smallholder farmers in Nigeria perceived increased incidence of crop disease and livestock diseases as some of the major impacts of climate variability.

There are various adaptation strategies available to arable crop farmers for climate change and variability as seen in research question 3; some of which include: use of improved and resistant crop variables, use of alternative fallow/tillage practices, varying planting dates and time, effective irrigation and tillage practices, fertilizers and organic manure application, discouraging deforestation and encouraging afforestation and regeneration, crop diversification and discouraging the practice of bush burning. This was indicated by high mean values ranging from 2.05 to 2.57. This finding is supported by the study of Hassan and Nhemachena (2008) who reported that some farmers in Africa use agro chemicals and fertilizer application as a means of adapting to the effects of the changed climate. Similarly (but with particular focus on tomato), Tshiala and Olwoch (2010) identified irrigation as an effective strategy that enhances the improvement of tomato yield.

The challenges encountered by arable crop farmers in the application of the adaptation strategies to climate change and variability as revealed in research question 4. This is indicated by high mean values ranging from 2.09 to 2.37. This findings is supported by the study of Deressa et al. (2009) which stated that some challenges and factors faced by farmers in adapting to climate change such as socio-economic factors: education, wealth, status and availability of resources (such as land, credit and water storage adaptation practices of farmers.

In research question 5, response from the respondents reveals that there is implication and prospect of these adaptation strategies of arable crop farmers to food production in Edo State. This is indicated by high mean values ranging from 2.22 to 2.42. Some of the implication and prospect include but not limited to the fact that it ensures continuous food production for arable food farmers, improves nutrients use efficiency of arable crops, reduces green-house gas emission, increase agricultural productivity and development, provision of better living conditions for farmers, provision of raw materials for industries for the manufacture of food and other products, increase the level of income of farmer in rural settlements, and ensures continuous use of agricultural land by arable crop farmers. This is in accordance with the study of Singh et al. (2022) which posits that farmers adaptation strategies identified in this study are useful to mitigate the negative impacts of climate change in the agricultural sector.

Conclusion and Recommendations

In conclusion, arable crops are very important crops as they are the chief sources of dietary food energy for the majority of humans and livestock, especially in the lowland tropics, much of the sub-humid tropics of West Africa and Central Africa. Climate change and variability affect the production of these crops in Sub-Saharan African countries especially Nigeria because agricultural production in these countries is partly or dependent on rain-fed production. The numerous adverse effects of climate change and variability have made farmers, agricultural experts, and the government to look for favorable adaptation strategies that will ensure the continuity of agricultural activities and food production in the nation.

On recommendation, government should provide improved and resistant crop varieties available to arable crop farmers so as to increase their agricultural productivity; discourage bush burning and deforestation and encourage afforestation and regeneration; executives of farmers' associations should organize workshops that would enlighten and sensitize their members on climate change and the various adaptation strategies to cope with the attendant challenges; farmers should embark on adequate extension programmes directed at meeting the climate change adaptation strategies in food crop production. In addition, government should make fertilizers and improved crop varieties available to arable crop farmers at a subsidized rate.

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