ASSESSMENT OF EFFECTS OF CLIMATE CHANGE ON YAM PRODUCTION AMONG RURAL FARMERS IN BENUE STATE, NIGERIA

JOURNAL OF AGRICULTURAL ECONOMICS, EXTENSION AND SCIENCES (JAEES)
Volume 14 Number 1, June, 2026
ISSN 2545-5176
Page No. 39-45

Chia, J. I. and Anonguku, I.
Department of Agricultural Extension and Rural Development,
College of Agricultural Economics and Extension, Joseph
Sarwuan Tarka University Makurdi, Benue State , Nigeria.
chiajustinimoter@gmail.com

Abstract

The study assessed effects of climate change on yam production among rural farmers in Benue State, Nigeria. All yam farmers in Benue State formed the population of the study and due to the enormity of this population, a sample size of 150 respondents was selected using stratified, purposive and simple random sampling techniques. Primary data were collected using a structured questionnaire. However, out of the 150 copies of the questionnaire distributed, 144 copies were valid and used. Data collected were analyzed using both descriptive and inferential statistics. The study revealed that majority (59.7%) of the respondents were male, with the mean age of 40 years, Majority (56.3%) of the respondents were married with the mean household size of 10 persons, 90.3% of the respondents had formal education, with mean of 12 years spent in school. Farming (64.6%) was the major occupation of the respondents, with the mean of 20years of farming experience. Results further revealed that the mean farm size was 3 hectares, the mean annual income of the respondents stood N261,131.94 per annum. The result shows that bush burning ($\bar{x}$ =3.38), cutting down of trees ($\bar{x}$ = 3.22), burning of fossil fuel by industries/automobile ($\bar{x}$ = 3.24) and continuous cropping (3.03) were the major causes of climate change in the study area. The study found that the major effects of climate change on yam production were; low yield ($\bar{x}$=4.56), decay of yam tubers ($\bar{x}$=4.47), increase in weed infestation ($\bar{x}$=4.44), soil infertility ($\bar{x}$=4.29), increase in pest/diseases infestation ($\bar{x}$=4.27) and premature growth ($\bar{x}$=4.30). The result shows that there was a significant difference ($t = 14.034$, $p<0.01$) in the output of yam production before and after experiencing serious climate change in the study area. The study therefore, concludes that humans activities were the major causes of climate change in the study area. It is recommended that afforestation and reforestation should be practised by farmers so that plants will help to remove the high concentration of carbondioxide in the atmosphere.

Key words: *Assessment, Climate change, Effects, yam, Production.*

Introduction

Climate change is 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 that persist for an extended period typically decades or longer (Elijah, Osufor, and Amarah, 2018). Climate change is a change of climate (air, temperature, windfall, wind speed, rainfall) which is attributable directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparative time periods (Ugah and Agbo, 2016). In recent times, various countries have been threatened by changes in climatic conditions ranging from drought, delayed rainfall, continuous melting of the polar region causing severe flood in some countries and speculation about the acid rain (Food, Agriculture and Natural Resources Policy Network, 2016). Generally, Africa has been described as one of the most vulnerable continents to climate change and climate variability. [Intergovernmental panel on climate change (IPCC), 2021].

In Nigeria, the pattern of rainfall has altered, affecting the commencement of the planting season and resulting to poor harvest. Climate change presents significant threats to the achievement

of the sustainable development goals (SDGs) especially those related to eliminating poverty and hunger and promoting environmental sustainability (Udenezue and Nnabuite, 2017). Given the adverse effects of climate change, there is need to guard against this phenomenon by ways of mitigation and adaptation, particularly to farmers whose occupation heavily depends on climate for performance.

Yam is an annual tuber and monocot plant. It belong to the genus "Dioscorea" and the family dioscoreacea". The plant (yam) comprises of over 600 species out of which ten species produce edible tubers and only six are cultivated in Africa (Musa, Onu, Vosanka and Anonguku, 2011). According to Olorunsanya (2015), the edible species are Dioscorea rodundata (white yam), Dioscorea alata (water yam), Dioscorea bulbifera (aerial yam), Dioscorea dumentorum (rifoliate yam), Dioscorea Japoricca (Japanese yam) and Dioscorea esculent (Chinese yam). Out of these, Dioscorea rodundata (white yam) and Dioscorea alata (water yam) are species widely grown in the coastal region of rainforest, wood savanna and southern Savana habitats (Udemezue and Nnabuife, 2017).

According to Francis (2017), yam production in Nigeria is entirely dominated by small-scale farmers and major source of income for farmers particularly in Benue State, with majority of its population having their livelihood from agricultural sector. However, changing climatic conditions, including irregular rainfall patterns, rising temperature and increased incidences of extreme weather events, have raised concerns about their impact on yam production. Yam production seems to be most tuber crop vulnerable by the deleterious effects of climate change (Elijah *et al*. 2018). This leads to continue losses of yam by farmers which leads to food insecurity. Given the adverse effects of climate change on yam production, there is need to guard against the phenomenon by ways of mitigation and adaptation.

In spite of the efforts made by government to ensure that there is adequate dissemination of information on ways of mitigation and adaptation of climate change by establishment of meterological stations for weather forecast, research institutions and provision of extension services, climate change seems to be a serious environmental threat to agricultural production. This development is a worrisome issue for agricultural resource sustainability and food sufficiency.

Objectives of the Study

The broad objective of this study was to assess effects of climate change on yam production among rural farmers. The specific objectives of this study were to:

i. describe the socio-economic characteristics of the yam farmers in the study area,
ii. identify major causes of climate change in the study area,
iii. determine effect of climate change on yam production in the study area, and
iv. compare yam output before and after experiencing serious climate change in the study area.

Methodology

The Study Area

This study was conducted in Benue State, Nigeria. The State is located in the Middle Belt region of Nigeria, with Makurdi as its State capital. Geographically, Benue State lies between longitudes $7^0 47'$ and 10^o East of the Greenwich meridian and Latitudes $6^0 25'$ and $8^0 8'$ North of the equator. Benue State has a land mass of about 33,955Km^2 with 23 Local Government Areas. The State is agriculturally divided into three zones namely, Zone A (Katsina-Ala, Ukum, Logo, Ushongo, Kwande, Vandeikya and Konshisha Local Government Areas, Zone B (Gboko, Tarka, Buruku, Gwer-West, Gwer-East, Guma and Makurdi Local Government Areas) and Zone C (Ado, Apa, Otukpo, Ohimini, Okpokwu, Ogbadibo, Obi and Oju Local Government Areas). The State has a total population of 4,219,244 and a projected total population of 5,505,156 people at 3% growth rate on yearly basis (National Population Commission, 2006).

The State shares boundaries with five other States namely; Nasarawa to the North, Taraba to the East, Cross River to the South East, Enugu (South West) and Kogi to the West. The southern part of the state also shares small section of National boundary with the Republic of Cameroon. Benue State has favourable agro-climate ecologies for arable crops, tree crops and livestock production and enjoys two distinct seasons, raining season, beginning from April to October and dry season from November to March. Farming is the major occupation of the State populace. The major inhabitants or tribes in the State are Tiv, Idoma, Igede and Etulo (Benue State Agricultural and Rural Development Authority, BNARDA, 2021).

The population of this study consisted of all yam farmers in the three Agricultural Zones of Benue State, Nigeria. Due to the enormity of this population, a sample size of 150 respondents was selected using stratified, purposive and simple random sampling techniques. Firstly, the defined population of this study was stratified into three zones based on the existing agricultural zones in Benue State, namely Zones A, B and C. Secondly, one Local Government Area from each of the three zones was purposively selected based on their relative high level of yam production which gave a total of three Local Government Areas. The selected Local Government Areas were Ukum from zone A, Gboko from Zone B and Apa from Zone C. Thirdly, two yam farming communities were randomly selected from each of the farming communities to avoid biasness then, using a proportion of 5% (0.05) across board for convenience, a total sample size of 150 respondents was selected for the study.

Results and Discussion

Socio-economic Characteristics of Respondents

Table 1 reveals that majority (59.7%) of the respondents were males while 40.3% were females. This shows that men dominate in yam production, though the female farmers have their own roles to play, especially in the maintenance, harvesting, storage and marketing. The finding agrees with that of Olorunsanya (2015), that there are more males in farming than females due to land tenure system. The result also reveals that majority (63.2%) of the respondents fell within the ages of 21 - 40 years. The mean age of respondents was 40 years. This means that yam farmers in the study area are in the economically productive age and the respondents were old enough to give reasonable responses on climate change issues experienced over the years. This result agrees with Okoedo-Okojie (2015) that only those farmers within the productive age group of 20 - 50 years are likely to possess the necessary strength to carryout farming operations. The finding also agrees with that of Obinne (2016) that most active Nigerian farmers and agricultural extension agents were people within the age range of 24-40 years. With respect to marital status, the result showed that 56.3% of the respondents were married. This implies that married people are more involved in yam farming in the study area. The findings agrees with Francis (2017) who reported that majority of yam farmers were married. The reason for this is not farfetched, as family labour is a predominant source of labour in subsistence agriculture in Nigeria. The married farmers may receive assistance from their spouse and children in carrying out some activities on the farm. In terms of education, the study revealed that 9.7% of the respondents did not have formal education, while 90.3% of the respondents had formal education, with the mean of 12 years spent in school. This implies that the respondents were literate enough to be aware of climate change, adopt agricultural technologies and measures to mitigate the effects of climate change in the study area. Table 1 that the farmers have a mean household size of 10 persons. This indicates a fairly large household size, implying that more family labour will be readily available for use in yam production against short falls in supply of farm labour. Household size has a great role to play in family labour provision in the agricultural sector (Jiriko, 2019).

Table 1 also shows that majority (64.6%) of the respondents' occupation was farming. The result agrees with the finding of Ugah and Agbo (2016) that the main occupation of more than 70% of the population of the rural people in Nigeria is farming at subsistence level. The result further reveals that majority (63.1%) of the respondents had farm size of less than 2.6 hectares. The mean farm size stands at 3 hectares. This implies that the respondents were small-scale farmers. This result agrees

with the finding of Francis (2017) who reported that majority of yam farmers in Benue State were small-scale farmers. The mean years of farming experience was 20 years. This finding shows that the respondents in the study area had stayed long enough in farming enterprise and could therefore have noticed significant change in climate change as its affects their farming activities. Experienced farmers have more knowledge and information about climate change and agronomic practices that they can adopt in response (Ani, 2021). Table 1 reveals further that majority (79.2%) of the respondents earned between ₦50001 - N400,000 per-annum. The mean annual income of the respondents stood at ₦261,131.94 per Annum. The results show that the annual income of the respondents was low. This is in line with the findings of Zakari, Mohammed, Medugu and Sandra (2014) that annual farm income of rural farmers in Nigeria is low due to the primitive methods of farm management practices, low knowledge of improved technologies and low capital investment among other factors. These lead to low income generation and low living condition among rural farmers in Nigeria.

Table 1: Distribution of Respondents according to their socio-economic characteristics (n=144)

Variables	Frequency (f)	Percentage (%)	Mean (X)
Sex			
Male	86	59.7	
Female	58	40.3	
Age (years)			
≤ 20	2	1.4	40.4
21 – 40	91	63.2	
41 – 60	48	33.3	
>60	3	2.1	
Marital Status			
Single	40	27.8	
Married	81	56.3	
Divorce	10	6.9	
Widow/widower	13	9.0	
Level of Education			
Non Formal	14	9.7	
Primary	24	16.7	
Secondary	59	41.0	
Tertiary	47	34.6	
Years spent in School (years)			
≤ 6	40	27.8	
7 – 12	41	28.5	11.66
13 – 18	49	34.0	
> 18	14	9.7	
Household size (persons)			
≤ 10	110	76.4	
11 – 20	38	19.4	9.45
21 – 30	3	2.1	
> 30	3	2.1	
Major occupation			
Farming	93	64.6	
Civil service	17	11.8	
Trading	29	20.1	
Others	5	3.5	

Farm size (ha)			
≤ 2.5	91	63.1	
2.6 – 7.5	52	36.1	2.49
> 7.5	1	0.7	
Farming experience (years)			
≤ 5	18	12.5	
6 – 15	49	34.0	20.40
16 – 25	29	20.1	
> 25	48	33.3	
Annual income (Naira)			
≤ 50,000	13	9.0	
50001 – 400, 000	114	79.2	
400,001 – 750, 000	10	6.9	
> 750, 001	7	4.9	261,131.94

Source: Field Survey (2020)

Causes of climate change in the study area

Table 2 shows that causes of climate change in the study area were: emission of greenhouse gases ($\bar{x}$=3.38), bush burning ($\bar{x}$=3.38), burning of fossil fuel by industries and automobile ($\bar{x}$=3.24), cutting down of trees ($\bar{x}$=3.22), Continuous cropping ($\bar{x}$=3.03) and use of excess agro chemicals ($\bar{x}$ =3.01), The implication of this finding is that human activities are to a large extent the major causes of climate change as most of their industrial and agricultural activities lead to increase concentration of greenhouse gases in the atmosphere. This is in line with the findings of Ugah and Agbo (2016) that bush burning, burning of coal, oil and natural gas as well as deforestation and various agricultural and industrial practices are altering the composition of the atmosphere and contributing to climate change.

Table 2: Causes of climate change in the study area (n=144)

Variables	Mean(x)	Std. Deviation
Emission of greenhouse gases	3.38	0.982
Burning of Fossil fuel	3.24	0.830
Bush burning	3.38	0.836
Cutting down of trees	3.22	1.074
Use of excess agro chemicals	3.01	0.939
Continuous cropping	3.03	1.013

Sources: Field Survey (2020),
Cut-off mean ($\bar{x}$=>2.50)

Effects of Climate Change

Table 3: Shows that the variables that affect yam production were low yield ($\bar{x}$ =4.56), decay of yam tubers ($\bar{x}$ =4.47), increased weed infestation ($\bar{x}$ =4.44), soil infertility ($\bar{x}$ =4.29), soil becoming too sandy ($\bar{x}$ =4.27), increased pest/diseases infestation ($\bar{x}$ =4.27), premature growth. ($\bar{x}$=4.03), wilting of plant ($\bar{x}$=3.86), stunted growth of yam plant ($\bar{x}$=3.79) and agro chemicals no longer effective in yam farm ($\bar{x}$=3.60). The result agrees with the findings of Elijah *et al*. (2018) that climate change affects yam at all stages of production chain including land preparation, sowing, crop growth and management, harvesting, storage, transport and marketing. According to the researchers, climate change causes decay of yam tubers due to excess rainfall and high temperature, wilting of yam plans as a result of drought, increased weeds, pests and diseases. The implication of these findings is that agricultural production will suffer great losses as these effects of climate change will adversely affect yam production. This will lead to food insecurity and increase in poverty of the farmers, who depend mostly on income generated from the sale of their agricultural yam produce.

Table 3: Distribution of Respondents according to effects of climate change (n=144)

Varibales	Mean(x)	Std. Deviation
Low Yield	4.56	0.611
Increase in weed infestation	4.44	1.056
Increase in pests/diseases	4.27	1.207
Stunted growth of yam plants	3.79	1.170
Agro chemicals no longer effective	3.60	1.230
Soil becoming too sandy	4.27	1.213
Prematured growth	4.03	1.090
Wilting of plants	3.86	1.028
Decay of yam tubers	4.47	0.989
Soil infertility	4.29	1.102

Source: Field survey (2020)
Cut off mean (x=>2.50)

Yam production output before and after experiencing serious climate change in the study area

Table 4 Presents T-test of difference in yam production output before and after experiencing serious climate change by comparing yam output. The results show that there was a significant difference ($t=14.038$, $p<0.01$) in the output of yam production before and after experiencing serious effects of climate change. This shows that the output before experiencing serious climate change was significantly higher (1670. 35 metric tonns) than the output after experiencing serious climate change (856.11 metric tons). This result means that climate change had negative effect on yam production in the study area. The result agrees with Ani, Anyika and Mutambara (2021) whose findings showed that climate change has positive and negative impact on yam produce. This implies that yam production greatly depends on climate change for its productivity. Therefore, proper adapting measures should be adopted.

Table 4: Distribution of Respondents according to yam production output before and after experiencing serious climate change in the study area (n=144)

Variables	Mean difference	Std	t	Prob. Sign
Yam output before	1670.35	1282.571		
Yam output after	856.11	667.785		
Pair/Output BF-Output AF	928.890		14.038	0.00

Source: Field Survey (2020)
t-test Significant at 1% level

Conclusion and Recommendation

Conclusion

Based on the findings of this research, it was concluded that human activities were to a large extent the major causes of climate change in the study area as most of their industrial and agricultural activities lead to increase concentration of greenhouse gases in the atmosphere. The study found that climate change affects yam at all stages of production for example, yam tubers, low yield, premature growth, increased weeds, pest and diseases infestation.

Recommendations

Based on the findings of the study, the following recommendations were made;

i. Afforestation and reforestation should be practised by farmers so that plants will help to remove the high concentration of carbon dioxide in the atmosphere
ii. Development of climate resilient yam varieties by researchers. Breeding programs should focus on developing yam varieties that can withstand temperature fluctuations and irregular rainfall patterns.

iii. Yam production greatly depends on climate variability for its productivity. Therefore, proper adaptation should be measures adopted by all yam farmers.

References

Ani, J.K, Anyika, V.O. and Mutambara, E. (2021). The Impact of Climate Change on Food and Human Security in Nigeria. *International Journal of Climate Change Strategies and Management* 19(3), 134-143

Ani, K. J, (2021). The Impact of Climate Change on Food and Human Security in Nigeria. *International Journals of Climate Change Strategies and Management* 19(3), 42-67.

Benue State Agricultural and Rural Development Agency BNARDA (2021). BNARDA *Annual Report*, , Makurdi, Benue State. pp. 1-54

Elijah, S.T., Osufor, O.O. and Anarah, S. E (2018). Effects of Climate Change on Yam Production in Cross River State, Nigeria. *International Journal of Agriculture and Forestry*, 8(2), 104-111

Food, Agriculture and Natural Resources Policy network (2016). Climate Change and Food Challenges, 45-73

Francis, I. U. (2017). Impact of Climate Variability on Yam Production Benue State: An Empirical Analysis. *International Journal of Innovative Research in social Science and Strategic Management Techniques*, 4(2), 1-10

Intergovernmental Panel on Climate Change (IPCC) (2021). Summary for policy. Makers. In: Climate change 2021, Impacts, Adaptation and Vulnerability. Contribution of working Group II to the fourth Assessment report of the Intergovernmental Panel on Climate Change. Cambridge University press. Cambridge, UK, 7-22

Jiriko, R. K. (2019). Analysis of Adoption of Improved Soybean Varieties in Benue State, Nigeria. *Journal of Agricultural Economics, Extension and Science*, (51), 128-140

Musa, Onu, Vosanka. and Anonguku (2011). Production Efficiency of Yam in Zing Local Government Area of Taraba State, Nigeria. *Journal of Horticulture and Forestry*, 3(12), 372-380

National Population Commission (2006). Nigerian Population Census report. A blue print on 2006 National Census of Nigeria Pp 206-210.

Obinne, O. P. O. (2016). Local Knowledge Approach to Climate Change and Mitigation/Adaptation Strategies in Nigeria. Lead paper, presented at AESON Conference, held at Ogafemi Awolowo University, Ille-Ife, May 10th, 2016. 1-18

Okoedo-Okojie, D. U. (2015). Determinants of Constraints to Information Sources Utilization among Maize Farmers in Edo State, Nigeria. British *Journal of Applied Science and Technology*, 1(2), 182-190

Olorunsanya, E. O. (2015). A Gender Base Economic Analysis of Yam Production Among Resources Poor Household in Kwara State, Nigeria. *Journal of Mendel University in Brno Czech Republic*, 3(4), 25-45

Udemenzue, J. C. and Nnabuife, E. L. C. (2017). Challenges of Yam production in Awka North Local Government Area of Anambra State, Nigeria. *British Journal of Research,* 6(1), 31-42

Ugah, A. A. and Agbo, A. A. (2016). Climate Change and its Impact on Agricultural Sustainability in Nigeria. *Journal of Agricultural Economics, Extension and Science,* 2(1), 81-90

Zakari, D. M, Mohammed, A. B, Medugu, N. I. and Sandra, I. (2014). Impact of Climate Change on Yam Production in Abuja, Nigeria. *International Journal of Science, Environment and Technology*, 3(2), 458-472