THE IMPACT OF CLIMATE VARIABILITY ON AGRICULTURAL OUTPUT IN NIGERIA

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Abstract

The study examined how climate variability could impact Nigerian agricultural output. Specifically, the study determined how annual rainfall changes, changes in wind patterns, and temperature fluctuations have impacted agricultural output in Nigeria. The study used secondary data from 1995 to 2024 and sourced from the Central Bank of Nigeria (CBN) statistical bulletin, the National Bureau of Statistics, and the Nigerian Meteorological database. The sourced data were analyzed using multiple regression analyses. Findings showed that annual rainfall changes, changes in wind patterns, and temperature fluctuations all positively and significantly impact agricultural output with probability values of 0.0000, 0.0190, and 0.0013, respectively. The study therefore recommended that the Nigerian government should make provision for water irrigation and also invest in artificial lakes and rivers to provide water for crops in the case of low rainfall.

Keywords: Agricultural Output; Climate Variability; Rainfall; Temperature; Windfall

1.1 Introduction

Agriculture is the backbone of economic growth and a source of income for the majority of developing countries. In Nigeria, it is one of the major sectors of the economy that plays an essential role in employment generation, food security, and poverty eradication. A large number of the Nigerian populace depend directly or indirectly on agricultural activities for their livelihood. The Food and Agriculture Organization (2022) highlights that agriculture is the primary livelihood of a large number of rural households in developing countries and is fundamental to food security and economic stability. In the case of Nigeria, agriculture also plays a major role in the economy and a large percentage of the population are employed in this sector (National Bureau of Statistics, 2023).

Without doubt, agriculture is one of the pillars of the Nigerian economy. However, agricultural production in the country is still quite susceptible to environmental and climatic conditions. One of the main problems

hurting agricultural productivity in Nigeria is the issue of climate variability. Climate variability is defined as the variations in the weather patterns over a period of time, which are usually short-term changes in rainfall, temperature, humidity, and seasonality (Intergovernmental Panel on Climate Change, 2021). Such changes could have an impact on agricultural production as the growth of crops, soil fertility, and the availability of water are to a large extent, dependent on the climatic conditions.

Farming in Nigeria is still mostly rain-fed agriculture, which implies that farmers primarily depend on natural rain for their crop production rather than employing irrigation systems. Hence, any change in rainfall pattern and temperature can have a major impact on the growth of the crops and agricultural production. According to the Food and Agriculture Organization (2022), alteration of rainfall patterns, rise in temperature levels, and extreme weather events have a detrimental impact on agricultural production, especially in developing countries and sub-Saharan Africa in particular. Due to these climatic changes, agricultural activities are affected, resulting in decreased crop harvests, total loss of crops, and higher exposure of smallholder farmers to risks.

Over the last decades, Nigeria has undergone deep alterations in weather patterns. These alterations have included temperature increases, erratic rainfall distribution, and more frequent occurrence of extreme weather events such as floods and droughts, among others. Research evidences demonstrate that these weather alterations have been majorly responsible for dwindling agricultural outputs in many areas of the country (Ajiere et al., 2021). For example, due to the changing rainfall patterns, the traditional planting schedules have been thrown into confusion and farmers are finding it hard to figure out the right times for planting and harvesting their crops.

Rainfall variability is one of the most prominent climatic factors influencing the level of agricultural production in Nigeria. The availability of sufficient rainfall is a critical prerequisite for crop growth as it influences the moisture content of the soil and plant development. On the other hand, rainfall irregularities such as late arrival of rains, early withdrawal of rains, or long dry periods can disrupt crop production. Studies reveal that fluctuating rainfall patterns have resulted in lower agricultural production in a number of farming communities in Nigeria (Ibrahim et al., 2025). Lack of rainwater can also result in water deficiency of plants, which in turn negatively affects the growth of the plants and their productivity.

Changes in temperature are a very important factor for deciding agricultural productiveness. Higher temperatures can harm crop growth through higher evapotranspiration levels, lessening soil moisture, and causing early crop maturation so the development does not reach the best stage. The Intergovernmental Panel on Climate Change (2021) states that changes in the global temperature have already started to influence agricultural systems around the world, especially in the areas where farm activities rely mostly on a stable weather. In Nigeria, temperature increases have been linked to lower yields of maize, rice, and yam (Giweze et al., 2024).

Along with changes in how often it rains and in temperatures, severe weather events like floods and droughts have also been occurring more often in Nigeria. Flooding is capable of ruining farms, washing away plants, and even destroying agricultural facilities. On the other hand, drought may cause a lack of water and failure in crops. Extreme weather events of this kind bring very serious problems to farming and

food security in Nigeria. According to the Food and Agriculture Organization (2022), climate-related calamities have been a major cause for the disruption of farming production systems in many developing countries in recent years.

The impacts of climate variability on agriculture in general, go far beyond just crop output to include socio-economic problems on a larger scale. A decline in agricultural production means less food availability, higher prices for food, and an increase in the poverty level of rural others. As farming provides jobs for a significant number of Nigerian workers, changes in the level of farm production might also lead to problems concerning employment and source of making money. So, in addition to influencing farm output, climate variation poses a danger to economic stability and rural area development as well.

Smallholder farmers in Nigeria are among those who are most affected by the consequences of climate changes. This is because generally, they do not have access to modern agricultural technologies, irrigation methods, or climate information services. Also, they base their farming on old methods that have a very high dependency on environmental conditions. Besides that, almost no access to financial means and extension services leaves these farmers with very few options for changing and adopting climate resilient farming methods. In this way, climate changes remain a major threat to the sustainability of agriculture in Nigeria.

Researchers and policymakers have in fact responded to such difficulties by highlighting the critical role of understanding the link between climate change and agricultural productivity. There have been empirical investigations aimed at assessing the effects of changes in rainfall and temperature on crop yields and agricultural production in Nigeria. For instance, Effiong (2024) discovered that variations in climate factors play a major role in the changing productivity of food crops in the country. The research showed that rainfall and temperature variability impact crop yields in a quantifiable way.

Understanding the influence of climate changes on agricultural output is very important for creating successful adaptation strategies and policies. Once the climatic factors that trigger the changes in agricultural production are found out, policymakers can come up with appropriate measures to support farmers in the face of climate-related risks. These measures can be, for instance, modernized irrigation infrastructure, drought-tolerant varieties of crops, and enhanced provision of weather information services.

There is a need for a new study on the effect of climate change on Nigerian agriculture given the increasing proof of climate-related problems impacting agriculture in Nigeria. This paper seeks to determine the effects of climate change on agricultural productivity in Nigeria. The study intends to offer data-driven findings that can help formulate efficient policies and methods to increase agricultural resilience and production in Nigeria by examining the link between weather factors such as precipitation and temperature and farming performance.

1.2 Objectives of the Study

The major aim of this research is to assess how changing climate affects agricultural production in Nigeria. The specific objectives included to:

i. analyse how annual rainfall changes has impacted agricultural output in Nigeria.

ii. study how changes in wind pattern has impacted agricultural output in Nigeria.

iii. evaluate the impact of temperature fluctuations on agricultural output in Nigeria.

2.1 Conceptual Framework

Climate Variability

Changes in climate over short periods such as changes in rainfall temperature humidity, and wind patterns are what we call climate variability. It refers to the climatic features at a specific time and location which could range from a single day to a few months or years. On the other hand, long-term or global climate change refers to large-scale and persistent changes in climate over decades or longer. These changes are often, but not always, drastic enough to result in the establishment of a different climate type at a location. Climate variability may occur due to internal natural climate system processes or external environmental impacts (Intergovernmental Panel on Climate Change, 2021).

Climate variability is raising considerable alarm for the agriculture sector worldwide but especially in the context of developing countries where agriculture is mostly dependent on natural climatic factors. For instance, the Food and Agricultural Organization (2022) has found that changes in rain patterns, temperature variations, and extreme weather conditions are some of the stressors that have interrupted agricultural systems in various parts of the world. Sub-Saharan Africa's farming sector is heavily dependent on rainfall which makes the region more susceptible to changes in climate as other factors like limited advancements in technology and insufficient irrigation facilities also contribute to the vulnerability of the sector.

Climate variability in Nigeria is characterized by irregular rainfall, rising temperatures, drought, and flood occurrences among other manifestations. These changes in climate have had an impact on agricultural production in different parts of the country. Delayed rains, for example, can interfere with famers' planting schedules while flood caused by heavy rains can destroy crops and farmland. Farmers thus remain in a state of doubt about the periods of planting and harvesting.

Rainfall variability is one of the key factors of climate change impacting agriculture. Besides rainfall is the main source for soil moisture, without which plants will not be able to grow and yields will be diminished. When rainfall patterns are uncertain, a farmer is most likely to suffer either from lack of water or over-abundance, both scenarios leading to crop loss. In the same way, crop growth may be impacted by temperature fluctuations through the effects on photosynthesis, respiration, and transpiration.

Agricultural Productivity

Agricultural productivity measures how efficiently agricultural inputs like land labor capital, and technology are transformed into agricultural outputs. It is typically gauged by the quantity of agricultural output generated per unit of input. Agricultural productivity is very important for food security, raising rural incomes, and fostering economic development, especially in the case of developing countries.

In Nigeria, agriculture is still one of the main sectors of the economy. The sector is responsible for a large part of employment and national income while also being the main source of livelihood to many rural households. According to the National Bureau of Statistics (2023), the agricultural sector in Nigeria has a high impact in aiding the reduction of unemployment rate in the nation as well as making a significant contribution to the nation's gross domestic product.

However, the agricultural potential of Nigeria has been somewhat limited by factors like insufficient exposure to modern farming techniques, dilapidated infrastructure, lack of easy accessibility to credit, and environmental issues like climate change. Among these determinants, climate change has been identified as one of the largest challenges facing food production since plant growth relies heavily on consistent weather conditions.

The productivity of agriculture depends on the environment, economy, and technology. Environmental factors like soil quality, water availability, and temperature are the basic conditions where crops can grow naturally. Economic factors like the availability of loans and agricultural inputs influence the farmers' capability to introduce better farming methods. Technological factors like advances in seed technology, fertilizers, and irrigation systems can significantly improve crop production by root yield enhancement.

Agricultural productivity can be severely affected when weather conditions become unstable because of the fluctuations in rainfall and temperature. Besides, crops might not develop adequately, soil moisture levels could fall below the minimum needed, and more pest attacks might be witnessed. Therefore, changes in climate patterns represent a major hindrance to the continued existence of agriculture in Nigeria.

2.2 Theoretical Review

Different theoretical frameworks account for the link between climatic variability and farm productivity. Ricardian Theory of Land Productivity is one of the most popular theoretical frameworks in environmental and agricultural research.

The Ricardian theory of Land Productivity

This theory, which the classical economist David Ricardo first laid down, is a framework for understanding the influence of environmental factors on land value and agricultural productivity. It argues that the main causes of differences in land productivity are natural factors like soil quality, rainfall, and temperature. In this framework, agriculture output is a function of the interaction of environmental factors and farmers' capacity for changing their farming methods.

An important application of the Ricardian method in the field of climate change studies is its usage for understanding the impacts of climatic conditions on agricultural output. This model considers that farmers' production decisions are influenced by climatic conditions. If the weather changes, the farmers will react by choosing different crops, building irrigation systems, or changing planting periods, for instance, depending on changes in rainfall or temperature.

The Ricardian theory, in relation to climate variability, implies that changing climate conditions have the potential to greatly affect agricultural productivity as they change the natural environment where crops

grow. If the climate turns unfavorable, farm production might suffer unless farmers respond with adaptive measures to counter the effects of climate variability.

A different theoretical take on the link between climate and agriculture is the Theory of Agricultural Adaptation.

The Theory of Agricultural Adaptation

The theory of agricultural adaptation highlights the capability of farmers to alter their farming methods as a response to environmental changes.

Farm communities, according to this theory, are capable of dealing with climate variability through methods such as changing crop types, modifying planting times, crop diversification and irrigation use.

Agricultural adaptation measures could serve as a buffer against the adverse effects of climate change on farm production. But, a farmer's decision to embark on an adaptive measure normally hinges on the availability of resources, technology, and information. It is a well-known fact that in most developing countries, small-scale farmers are financially handicapped and are technologically not empowered to make use of viable adaptation measures. Due to the above, climate variability continues to be a major source of threat to the agricultural sector in these areas.

2.3 Empirical Review

Many empirical pieces of research have focused on the link between climate variability and agricultural productivity in Nigeria and other developing countries. These works mainly conclude that variations in climatic factors such as rainfall and temperature have a considerable impact on agricultural production.

Ajiere et al. (2021) examined the impact of climate variability on agricultural sustainability by analyzing rainfall and temperature patterns in Imo State, South Eastern Nigeria. The study utilized 30 years (1988–2017) of rainfall and temperature data obtained from the Nigerian Meteorological Agency (NiMet). The data were analyzed using descriptive statistics, decadal distribution, trend analysis, anomaly analysis, and a five-year moving average. The findings revealed an increasing trend in annual maximum and minimum temperatures and a declining trend in annual rainfall. Specifically, the third-order polynomial trend indicated a decrease in the annual mean rainfall anomaly alongside a persistent increase in the mean temperature anomaly, particularly during the second decade (1996–2007). The study concluded that significant variability in rainfall and temperature poses a threat to agricultural sustainability, especially in regions that rely heavily on rain-fed agriculture. Consequently, the authors recommended government intervention through the provision of irrigation facilities, mechanized farming systems, and awareness programs on climate change adaptation to enhance sustainable agricultural production.

On the other hand, Effiong (2024) carried out an in-depth analytical inquiry into the causal link between climate parameters and food crop productivity in Nigeria using granger causality econometric test. The research concluded that changes in rainfall and temperature had a considerable causal influence on crop yields from 2010 to 2023. More specifically, the results showed that heavy rainfall and very high temperature levels caused a decrease in the yield of particular crops.

Another research by Ibrahim et al. (2025) looked into the impact of climate change along with other productivity factors on the agricultural output of maize in Nigeria. By applying an autoregressive distributed lag (ARDL) technique, the authors revealed that changes in rainfall and a rise in temperature both had a statistically significant effect on maize production in Nigeria. Ibrahim et al. (2025) suggested that changing climate is still one of the main drivers of the variation in farming productivity in Nigeria.

Giweze et al. (2024) explored the consequences of weather changes on yam farming among Delta State farmers, Nigeria. The study used primary data through the use of questionnaires that were shared with farmers in Delta State, Nigeria. The retrieved questionnaires were analyzed using the Analysis of Variance (ANOVA) and regression. The results showed that rising temperatures adversely affected yam production levels. Besides, the publication highlighted that rainfall variability led to different stages of yam cultivation as well as overall farm productivity changes.

Opeyemi (2021) investigated the Nigeria incentive-based risk-sharing system for agricultural lending (NIRSAL) credit for infrastructural development in the Nigerian agricultural sector. The study used primary data through a questionnaire that was shared with NIRSAL employees and farmers in Ogun State who were beneficiaries of the NIRSAL loans. The method of data analysis was simple linear regression. The author stated that despite the positive and vital relationship between NIRSAL loans and agricultural infrastructural development, NIRSAL should fund infrastructure like water irrigation to supply water for local farms during dry season and drought periods to boost farm productivity.

Umar, et al. (2020) examined the factors that enhanced rice production in Kebbi State, Nigeria. The study used qualitative interview technique by interviewing farmers in Kebbi state. The findings showed that good weather conditions and normal temperature were vital factors that boost rice production in Kebbi State.

Omankhanlen (2020) assessed how agricultural investment would enhance agricultural output growth in Nigeria using the ARDL econometric technique. The result showed that investment in climate-related infrastructure and alternatives like windmill and artificial lakes positively and significantly impact agricultural output growth in Nigeria.

Okoh et al. (2025) studied the impact of environmental conflict between farmers and herdsman on agricultural productivity in Tafawa Balewa Local Government, Bauchi State, Nigeria. The authors used observation and interview technique and found that conflicts between farmers and herders cause environmental degradation issues like erosion and this hampers productivity.

Okafor and Isibor (2021) examined how macroeconomic variables of exchange rate, inflation, and money supply would impact the Nigerian agricultural sector development. The research utilized the ordinary least square regression and found that money supply mostly would increase funding to the agricultural sector and boost the level of agricultural output growth through provision of infrastructure.

Besides research in Nigeria, investigations from other sub-Saharan Africa regions also point out that climate variability has a very strong influence on agricultural production. In fact, the Food and Agriculture Organization (2022) stated that climate-related shocks such as droughts and floods have led to large

agricultural losses in numerous African countries. These types of climate-related events usually disrupt farming operations and cause food insecurity.

Equally, the Intergovernmental Panel on Climate Change (2021) observed that global warming and erratic rainfall have already started to negatively impact agricultural production in many parts of the world. They further noted that, owing to their limited ability to adapt, agricultural sectors of the developing countries are the most susceptible to climate variability.

Although the literature on climate variability and agricultural productivity is rapidly expanding, targeted research on Nigeria in this regard is still lacking. Most of the published articles concentrate on one or two regions or even a single type of crop and are therefore not valid or sufficient to make generalizations at the national level. Hence, there is a need for thorough investigations to better analyze the interrelationships between climate variability and agricultural productivity in various regions of the country. This research intends to add to the literature on climate variability and agricultural productivity in Nigeria.

The purpose of this paper is to track how output of agriculture is affected by climatic changes focusing on rainfall and temperature. Thus, the paper will be based on actual data with the ultimate intention of feeding the policymakers as well as the agricultural sector strategists.

3.0 Methodology

3.1 Model Specification

The study adapted and modified the model of the research of Ibrahim et al. (2025) and the model's functional form was:

$AGRIC_t = f\ (RAIN_t, WIND_t, TEMP_t)$……..(1)

Where

$AGRIC_t$ = Agricultural output of Nigeria in time t

$RAIN_t$ = Annual rainfall in Nigeria in time t

$WIND_t$ = Annual windfall pattern in Nigeria in time t

$TEMP_t$ = Annual temperature changes in Nigeria in time t

The model econometric form is:

$AGRIC_t = \alpha_0 + \beta_1\ RAIN_t + \beta_2\ WIND_t + \beta_3\ TEMP_t + \mu_t$……..(2)

The model log-linearized form was:

$LAGRIC_t = \alpha_0 + \beta_1\ LRAIN_t + \beta_2\ LWIND_t + \beta_3\ LTEMP_t + \mu_t$……..(3)

The study used secondary data from 1995 to 2024 due to data availability for those years. The data was sourced from the Central Bank of Nigeria (CBN) statistical bulletin, the National Bureau of Statistics, and the Nigerian Meteorology database. The study used the descriptive analysis, correlation analysis, and the multiple regression analysis to assess the subject matter.

4.0 Analyses and Discussion of Findings

4.1 Descriptive Statistics

Table 4.1: Descriptive Statistics Result

	Lwind	Lrain	Lagric	Ltemp
Mean	16.80284	11.06463	36.01160	18.29370
Median	10.92717	10.2125.1	22.36700	11.3828.2
Maximum	17.63724	16.4936.8	28.72895	20.34162
Minimum	9.105123	7.016900	14.55489	10.87788
Std. Dev.	6.164651	2.906589	12.94126	8.172032
Skewness	-0.407389	0.513500	1.276202	0.345763
Kurtosis	3.859188	3.536658	3.915943	3.339627
Jarque-Bera	2.456646	1.586769	12.11359	8.741945
Probability	0.092783	0.062311	0.173928	0.090063
Sum	504.0851	3.493900	10.83480	548.8109
Sum Sq. Dev.	12.81124	0.125936	4.938009	15.04707
Observations	**36**	**36**	**36**	**36**

Source: Authors compilation using E-views 9 (2026)

Mean and median are central tendency measurements and from table 4.1, Lagric had the highest mean and median values of 36.01160 and 22.36700 respectively. This showed the importance of the variable in the model. Also, Lagric had the highest maximum value of 28.72895 while Lrain had the minimum figure of 7.016900. The standard deviation measured the variations in a dataset. From table 4.1, Lagric had the highest figure of 12.94126. The skewness measured the data distribution from the mean and must be between 0 and 1 to show a normal distribution of the dataset. Therefore, all the variables, from the result in table 4.1 were normally distributed with Skewness values from 0 and 1. Kurtosis shows the flatness or peakness of the dataset around the mean. A Kurtosis of 3 or exceeds 3 shows a normal distribution. From the table 4.1, the kurtosis of all the variables were 3 and above respectively to prove that all the variables were normally distributed.

4.2 Correlation Analyses

This was used to test the type of relationship between Lagric and all the independent variables including Lrain, Lwind, and Ltemp. The relationship type could be positive or negative. From table 4.2, all the independent variables have a positive correlation with Lagric. This was because their values of 0.423701, 0.240116, and 0.169937 respectively carry positive signs. This also means that Lrain has a 42% (0.423701) correlation with Lagric. Also, Lwind had a 24% (0.240116) correlation with Lagric, while Ltemp further

had a 16% (0.169937) correlation with Lagric.

Table 4.2 Correlation Result

	Lagric	Lrain	Lwind	Ltemp
Lagric	1.000000	0.423701	0.240116	0.169937
Lrain	0.423701	1.000000	0.020729	-0.095646
Lwind	0.240116	0.020729	1.000000	0.544521
Ltemp	0.169937	-0.095646	0.544521	1.000000

Source: Researchers Compilation using E-views 9 (2026)

4.3 Augmented Dickey-Fuller (ADF) Unit Root Test

Table 4.3: ADF Result

Variable	ADF @ Level	5% Critical value	Probability Value	Order of Integration	Remark
Lagric	-6.481209	-3.527431	0.0000	I(0)	Stationary
Lrain	-5.375822	-3.527431	0.0000	I(0)	Stationary
Lwind	-3.942065	-3.527431	0.0435	I(0)	Stationary
Ltemp	-3.617284	-3.097495	0.0442	I(0)	Stationary

Source: Author Computation (2026)

The study used Augmented Dickey-Fuller unit root test to check for data stationarity. The null hypothesis was unit root absence and non-stationary data. From table 4.1, the probability figures of all the variables were stationary at level as they were all significant at 5% significant level to confirm the stationarity of all the data.

4.4 Multiple Regression

Table 4.4: Regression Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Lrain	0.261738	0.085244	3.070456	0.0000
Lwind	0.199682	0.061995	3.220937	0.0000
Ltemp	0.073995	0.030247	2.446358	0.0243
C	0.105362	0.177083	0.594986	0.1027

R-Squared = 0.59	Adjusted R-Squared = 0.47	Prob(F-statistic) = 0.000000	Durbin-Watson stat = 1.961758

Source: Author's Computation (2026)

From table 4.4, Lrain, Lwind, and Ltemp had a positive relationship with Lagric with positive coefficient figures of 0.261738, 0.199682, and 0.073995 respectively. Hence, any increment in them would enhance Lagric by 26%, 19%, and 7% respectively. Also, the probability values of Lrain, Lwind, and Ltemp of 0.0000, 0.0000, and 0.0243 were all significant at 5% significant values (lower than 0.05). Therefore Lrain, Lwind, and Ltemp have positive and significant relationship with Lagric.

The R-squared value of 0.59 proved that all the independent variables explained 59% changes in Lagric. The F-statistic probability value of 0.000000 and prove that all the independent variables together jointly impact Lagric.

4.2 Result Discussion

Rainfall variations were positively significant in impacting Nigerian agricultural output performance and were affirmed by Ajiere et al. (2021), who opined that changes in rainfall had a highly significant effect on crop production output in Nigeria. They further stated that low rainfall would cause low agricultural output. Windfall was positively significant in impacting Nigerian agricultural output performance and was affirmed by the Food and Agriculture Organization (2022), who stated that quality rainfall is needed by crops for growth. Hence, drought, including lack of rainfall, would stunt crop growth and adversely affect agricultural output.

Temperature variations were positively significant in impacting Nigerian agricultural output and were corroborated by Ibrahim et al. (2025), who revealed that a temperature rise has a statistically significant effect on maize production in Nigeria.

5.0 Conclusion

The study examined how annual rainfall, annual rainfall pattern, and annual temperature changes would impact agricultural output in Nigeria. The unit root test showed that all the variables were stationary at levels; hence, the use of the multiple regression technique as a technique of analysis. The multiple regression result showed that, first, rainfall variations were positively significant in impacting Nigerian agricultural output performance. Also, the study found that windfall was positively significant in impacting Nigerian agricultural output performance. Finally, the research proved that temperature variations were positively significant in impacting Nigerian agricultural output. Based on these results, the study concluded that the relevance of climate behavior to improving Nigerian agricultural output cannot be overemphasized. Adequate rainfall, windfall, and moderate temperatures ultimately impact agricultural output growth. Hence, the government should focus on climate improvement measures to enhance the agricultural sector. The study thus recommended that there should be the provision of water irrigation to provide water for crops during periods of low rainfall by the farmers. Also, the study recommended an adequate investment in windmills to provide artificial wind for crops and this would boost agricultural crop production output. Moreover, Nigerian farmers should be taught how to take advantage of different temperature changes to aid their crop growth by agricultural extension workers and local government representatives.

References

Ajiere, S., Diagi, B. E., & Edokpa, D. O. (2021). Impacts of climate variability on sustainable agriculture in Imo State, Nigeria. *Journal of Geographical Research, 4*(3), 1–10.

Effiong, M. O. (2024). Variability of climate parameters and food crop yields in Nigeria: A statistical analysis (2010–2023). *Journal of Infrastructure Policy and Development, 8*(4), 1–12.

Food and Agriculture Organization. (2022). *The state of food and agriculture 2022*. https://www.fao.org/

Giweze, E. A., Oyita, G. E., Ofuoku, A. U., & Ebewore, S. O. (2024). Effects of weather variability on yam productivity among farmers in Delta State, Nigeria. *FUDMA Journal of Agriculture and Agricultural Technology, 10*(1), 45–55.

Ibrahim, I. M., Yahaya, U., Alhassan, M. T., & Adeyemi, O. O. (2025). Climate change and productivity factors affecting maize production in Nigeria. *African Journal of Agricultural Science and Food Research, 12*(2), 60–74.

Intergovernmental Panel on Climate Change. (2021). *Climate change 2021: The physical science basis*. Cambridge University Press. https://www.ipcc.ch/

Mbutor, O. M., Ochu, R. E., & Okafor, I. I. (2022). The contribution of finance to agricultural production in Nigeria, *Economic and Financial Review*, 5(2), 1 – 9

National Bureau of Statistics. (2023). *Nigerian gross domestic product report.* https://nigerianstat.gov.ng/

Okafor O. & Isibor A. A. (2021). Macroeconomic variables and Nigerian agricultural sector development, *British Journal of Management and Marketing Studies*, 4(4), 9 – 20, DOI: 10.52589/BJMMSTTLY6KLR.

Okeke, A.M., Mbanasor, J.A., & Nto, P.O., (2020). Effect of anchor borrowers' programme access among rice farmers in Benue State, Nigeria: Application of Endogenous Switching Regression Model, *International Journal of Agriculture and Earth Science*, 5(3): 31- 47.

Okoh, J. I., Isibor, A. A., & Udume, M. (2025). Impact of environmental conflict between farmers and herdsman on solid economic development in Tafawa Balewa Local Government, Bauchi State, Nigeria. *International Journal of Social Sciences Research and Development (IJSSRD)*, 7(1), 13 – 33, DOI: https://doi.org/10.34218/IJSSRD_07_01_002

Omankhanlen, A. E. (2020). Agricultural investment risk relationship to national domestic production, *International Journal of Risk and Contingency Management (IJRCM)*, 2(2), 80 – 98

Umar, S., Hali, M. R., &Bunza, F. S. (2020). Factors influencing adoption of improved rice production technology (IRPT) under anchor borrowers programme (ABP) in Kebbi State. *IOSR Journal of Agriculture and Veterinary Science*, 12(7), 19 – 26