

IMPACT OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTIVITY ON SCHOOL FARMS IN NIGERIA

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Abstract

The paper reviewed the causes, consequences and impacts of climate change in the Nigerian agricultural sector. The paper found out that, notwithstanding the existence of modern agricultural technologies, climate change which occurs with different weather varieties hamper productivity levels of both crops and animals in recent time in the country. Although there is information about the negative impacts of climate change in the country, much of this information are not on the doorsteps of the rural agricultural producers due to minimal existence of adequately trained change agents. As Nigeria is currently experiencing increasing incidence of disease, declining agricultural productivity, increasing number of heat waves, unreliable weather patterns, declining rainfall in already desert-prone areas, these gave ways to paradigm shift in the agricultural sector especially in the rural communities. Due to these increases, there is decline in production of agricultural produce/products which is consequence of climate change. This paper recommends among other things that there is need for a systematic collaborative approach involving all the stakeholders - science experts and researchers, governments at all levels, policy makers, farmers associations, youths and women groups, private sectors: non-governmental and civil society organizations to work together in turning the critical challenges posed by climate change into opportunity/opportunities.

Keywords: Climate Change, Agricultural Productivity, Causes, Adaptation

Introduction

Climate change is one of the prevailing environmental problems in the world and has gained universal discourse in recent time because its effects are multi – faceted. It is a single problem which has given birth to numerous known issues such as sea level rise, ocean warming, increasing temperature, rainfall variability, increasing evaporation and increasing tropical storms among others. These effects have also metamorphosed into some impacts such as the decline in agricultural activities, drought, migration, health problems, crises among farmers and herds - men, flooding, erosion, hunger and poverty

among others and other numerous problems yet to manifest.

Concept of Climate Change

Weather is a key factor in carrying out agricultural productions, in spite of technological approaches and development such as use of inorganic fertilizers, modern land preparation and planting of early season crops, mechanization in farming, effective usage of agrochemicals, improved seed varieties, expansion of irrigation systems, genetically modified organism, among others. Weather is the short-term state of the atmosphere at a specific time and place in terms of

precipitation, temperature, wind, humidity, among others. The weather condition changes according to the weather of each location. The long-term manifestation of weather and other atmospheric conditions in a given area is called climate.

Climate is the general weather conditions in an area over a long period and one of the major influential factors in agriculture (Ani et al., 2022). It influences the type of crops cultivated at any specific location on earth, livestock farming and determines what types of land use are possible. Precipitation, temperature and sunlight have been noted as some influential climate factors that have direct effect on plants and animals farming and determine the spread of pests and diseases among other effects (Agbola and Fayiga, 2016; Osuji et al, 2023). Thus, climate is critical in agricultural crop cultivation and productivity.

The survival of agriculture is dependent on good climate, and both agriculture and climate are both inter-related because they both take place globally as recorded by Adejuwon, (2006). Nigeria is experiencing adverse climate conditions with negative impacts on the welfare of millions of people. Climate fluctuation is putting Nigeria's agricultural system under serious threat and stress. Nigeria's agriculture is mostly rain-fed, therefore changes in climate affects productivity. In Nigeria, varieties of food crops are produced and are all dependent on rainfall, so that where rainfall is abundant, rain-fed crops are planted and in drier parts of the country, crops that do not require much rainfall are planted.

According to Ngigi (2009) defined climate change as a change in climate that is attributable directly or indirectly to human activities, that alters the atmospheric composition of

the earth which leads to global warming. An Intergovernmental Panel on Climate Change (IPCC) in (2007) reported that climate change is a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period typically decades longer.

Climate change had been attributed to severity to changes in global warming. Climate change is considered as the most pressing environmental problem facing the globe today, affecting patterns of life and general living conditions. Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods (that may range from decades to millions of years). It is usually caused by factors such as: biotic processes (such as humans, animals, etc.), variations in solar radiations received by earth, volcanic eruptions etc. Climate change has repercussions such as upsetting seasonal cycles, harming ecosystems and water supply, affecting agricultural farming systems and food production, causing sea-levels to rise etc.

Nonetheless, agriculture is very sensitive to weather and climate and depends heavily on water, land, and other natural resources affected by climate (Gowda et al., 2018; Anabaraonye et al., 2022). Climate change has both positive and negative effects. For instance, while it could lengthen the growing season or encourage multiple cropping in some regions due to increase in rainfall, it could also make agricultural practices more difficult in others due to high temperatures (Odenkule, 2014; Adamaagashi et al, 2023). Thus, a significant cost of the damage caused by climate change impacts is mostly felt in the areas of agriculture.

According to Mba et al. (2020), the combined effect of food crisis and the global financial downturn has forestalled progress in rural development as a result, leading to high hunger and malnutrition trends.

Studies have revealed that high rainfall, desertification and flooding are extreme climatic conditions that adversely affect food production (Enize and Agala, 2023). In addition, productive agriculture is important to feed the increasing population and for sustainability of modern civilization, but it has been affected by climate change. Given the impacts of climate change in agriculture, its study is important, because the livelihood patterns of millions of people are dependent on agriculture and it is on this record that agriculture is the mainstay of the Nigerian economy.

Major Forms and Causes of Climate Change

According to Botkin and Keller (2010), the phenomenon of climate change is linked to both natural and human causes' i.e., natural events and human activities are believed to contribute to the increasing climate change. Primarily, climate change is caused by increase in greenhouse gases and even changes in ocean currents among others. Due to nature of science, not every single detail is ever totally certain and not all questions are yet to be answered. Below, are some of the causes of climate change and they include: -

- i. **Changes in the earth orbits:** changes in the shape of the earth's orbit and precession affects the amount of sunlight received on the earth surface.
- ii. **Changes in the sun's intensity:** changes occurring within or inside the sun can affect the intensity of sunlight that reaches the earth's surface.

The intensity of the sunlight can cause either warming (for stronger solar intensity) or cooling (for weaker solar intensity).

iii. **Volcanic eruption:**

Volcanoes can affect the climate because they can emit aerosols and carbon dioxide into the atmosphere.

- **Aerosol emissions:** volcanic aerosols tend to block sunlight and contribute to short term cooling. They do not produce long term changes because they leave the atmosphere not long after they are emitted.
- **Carbon oxide emission:** Volcanoes also emit carbon dioxide (CO₂), a greenhouse gas which has a warming effect. The level of carbon dioxide (CO₂) has risen since the last past millions of years.

The human factors that emit large amounts of greenhouse gases includes: industrialization, burning of fossil fuel, gas flaring, urbanization, changes in global patterns of land use and agriculture. Furthermore, human activities that reduce the amount of carbon sinks as reported by (IPCC, 2007, and Nzeh, 2008) are deforestation, alterations in land use, water pollution and agricultural practices. These human activities have been proven to contribute to the ongoing climate change in Nigeria.

Effects and Consequences of Climate Change

These identified are the major effects according to Nzeh et. al. (2016):

- a) Effect of climate on Farm Operations
- b) Effect of climate on Farmers
- c) Effect of climate on Farm Productivity

- d) Climate change and its effects on Crop Production
- e) Climate change impacts on Animals

a) Effect of climate on Farm Operations

Farming operations mean plowing, cultivating, planting, harvesting, and similar operations routine to most farms and that are performed on a farm. Climate change affects planting and harvesting periods. Due to this, there are occasional shifting seasonal rainfall patterns and severe precipitation events and flooding, delay planting and harvesting of plants. Climate change has effects on soil water balance which leads to changes of soil evaporation and plant transpiration; consequently, the crop growth period may shorten in the future, causing crops yields to decrease according to Nzeh et al, (2016). Climate change also decreases the crop rotation period, so farmers` needs to consider varieties sowing dates, fertilization levels when planting crops. Challenges when harvesting due to excessive moisture on the farm, farm output is affected when crops that are ready to be harvested or about to ripen, get soaked in excessive rainfall (Adams 2019).

b) Effect of climate on Farmers

Majority of the rural population in Nigeria survive through the production of agricultural products. Drying up of lakes, streams among others affect fishing. Also crops that are dependent on rainfall are affected. Climate change is a big threat to Nigerian food security, affecting both subsistence and commercial farming. Climate change causes an increase of diseases and pests, thereby declining agricultural production. Declining rainfall in northern areas of Nigeria is causing increasing desertification. This is supported by (Nzeh et al, 2016) that

the former food basket of the nation is now empty and people in the coastal areas who used to depend on fishing have their livelihoods destroyed by the climatic changes. As reported by Ikpi (2010), the increasing effects of climate change in agricultural production have led to the migration of people from rural areas to urban areas. This is so because, people who used to depend on agricultural production have been disappointed and so they have to look for better jobs or means to survive.

c) Effect of climate on Farm Productivity

Climate change has significant effects on farm productivity, influencing crop yields, livestock health and overall agricultural output. As reported by Ikeme (2009), Nigeria is currently experiencing increasing incidence of disease, declining agricultural productivity, increasing number of heat waves, unreliable weather patterns, declining rainfall in already desert prone areas, in the north causing increasing desertification decreasing food production in central regions and destruction of livelihoods by rising water in coastal areas where people depend on fishing and farming. Climate change may change the types, frequencies and intensities of various crops and livestock pests, also the availability and timing of irrigation water supplies and the severity of soil erosion, Challinor and Wheeler (2008). The qualities of grasses are affected by higher temperatures, which may lead to drying up of grasses, thereby reducing the nutritional values of livestock feeds.

d) Climate change and its effects on Crop Production

The most immediate consequence of drought is a fall in crop production, due to inadequate and

poorly distributed rainfall. Farmers are faced with harvests that are too small to both feed their families and fulfil their other commitments. A lack of rainfall can cause entire crops to fail or result in a very small crop, even for farmers who irrigate their fields (Adams, 2019). In turn, low crop production leads to losses in other industries that rely on agricultural products in order to stay in business. The drought has led to increased prices for hay, feeds and even grocery produce.

e) Climate change impacts on Animals

There have been some notable and significant impacts of climate changes on livestock production. According to Nzeh et al, (2016) there are two types of effects which are; Direct and Indirect effect. Direct effect is the constant exposure of animals to high temperatures, which causes reduction in growth and productivity, decline in feed intake, weight loss, etc. For instance, when cattle are under heat stress, they are subjected to the following conditions: Reduced grazing time (because animals may be seeking shade). Reduced feed intake. Indirect effects the quantity and quality of forage available to the animals is determined by climate. In high rainfall areas, plants grow faster. In arid regions or areas, lack of rainfall limits plant growth. High temperature and humidity provide a favorable breeding environment for external and internal parasites, fungi and bacteria.

Climate Change Adaptation Issues

Climate change adaptation refers to adjustment in ecological, social, or economic systems to reduce the negative or enhance the positive impacts of climate change. Numerous and various conditions will dictate the extent of adaptation. According to

Nzeh et al, (2016), climate change adaptation aims at mitigating and developing appropriate coping measures to address the negative impacts of climate change on agriculture. An important limitation to the effective adoption of climate change information in Nigeria's agricultural sector is the lack of a comprehensive baseline. Given the different interests, risk and resources faced by various stakeholders in agriculture, there is likely to be an extensive typology of adaptive responses that may be appropriate for different agricultural zones. The different types of farming systems, tenure system, access to financial resources, level of skills, extent of support (i.e., from extension agents) etc. also can affect adaptations to climate change.

Climate change adaptation is increasing on the agenda of researchers, policy makers and program developers who are aware that climate change is real and threatens to undermine social and ecological sustainability.

Measures to address the negative impacts of Climate Change in Nigeria

The following are the major solutions to the challenge of agriculture due to climate change as reported by Adams (2019):

- i. Provision of a plentiful supply of clean and cool drinking water for livestock during drought and excessive heat
- ii. Water management during drought is also necessary for some crops such as rice and vegetables to thrive well
- iii. Adequacy and accuracy of weather forecast to enable proper preparedness of farmers towards the next season

- iv. Suitable shade or shelter is required for livestock during the period of high rainfall
- v. Agricultural funding for research and technology development
- vi. Provide access to high quality forage
- vii. Trade Liberalization and Market
- viii. Development Funding and infrastructure development
- ix. Consistency in government policy

Conclusion

It has been discussed that farmers (mostly in the urban areas) that their awareness on weather patterns is changing as manifested in increasing flooding and changes in rainfall patterns. Others are on increase in temperature, high incidence of pests, diseases and weeds and even decrease in crop yields among other incidence. Meanwhile, their understanding of the concept of global climate change with regard to greenhouse emissions, ozone layer depletion etc. is still limited. It is therefore necessary that they have full knowledge of what climate change really is as it is perhaps the most serious threat to the fight against hunger, malnutrition, diseases and poverty in especially in Nigeria where its negative effects on agricultural production lead to more increase in the poverty level of the farmers at both urban and rural areas. It is therefore necessary for us to understand the knowledge of climate change and the best way to adapt to climate change depending on agricultural zones. However, some solutions have been proffering to these negative effects of climate change on agricultural production, this includes: Preparedness of farmers towards the next season, Adequacy and accuracy of

weather forecast, Availability of veterinary doctors, Agricultural funding for research and technology development, Trade Liberalization and Market Development, Funding and infrastructure development and Consistency in government policy.

Recommendations

Based on the issue discussed in this presentation, the following are recommended;

1. Mainstream climate change adaptation considerations into national agricultural policies and strategies.
2. Agricultural productivity can be increased and sustained by developing agricultural technologies that are environmentally sensitive.
3. Strengthen agricultural extension services to support farmers in adapting to climate change.
4. Farmers' access to loans and grants to enable them scale up their land holding as well as engage in mechanized farming or use new agricultural technologies to boost their productivity.
5. Involvement in Climate Smart Agriculture (CSA) such as small-scale irrigation, conservation agriculture, agroforestry, integrated pest management and integrated crop-livestock systems, that enhance resilience to climate change while improving productivity and sustainability.
6. Subsidies in the areas of improved climate change-resistant plants/fertilizers by the government. These plants can withstand the shock caused by prolonged dry season or delayed rainy season.
7. Collaborate with international organizations to access climate change funding and expertise.

8. Provide farmers training on climate-resilient agricultural practices.
9. Establish climate information services to provide farmers with accurate climate data.

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