

Effect of Climate Change on Rainfall Pattern and Agricultural Production in Afikpo North Local Government Area of Ebonyi State, Nigeria

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This research was carried out to generate information/data on rainfall distribution in the study area in the year, 2019. Prior to the issues of realities of global warming and subsequently climate change, farmers had substantial knowledge of the weather conditions of their immediate environment and with this planned their farming activities effectively with reduced losses of produce and other farm resources. But nowadays, this knowledge appears to have been eroded consequent on the influence of global warming and climate change. The field work was carried out in Afikpo North Local Government Area (LGA) of Ebonyi State. The LGA comprises of 12 Autonomous Communities (ACs) and out of these, ten (10) were randomly selected. Field Assistants (FAs) were needed for the field work and two (2) FAs were purposively selected from each of the selected ACs to assist in the field work. The data generated were analyzed using tables and descriptive statistics. The result of the field work, among others, showed that the rains now commence early in the year between the months of February and March and thereafter cease and start again in the month of May. The result also showed the absence of the usual double peaks of rainfall "double maxima". The recommendations, among others, include establishment of weather stations in the localities to help in the generation of information on weather conditions for farmers use and farmers' to construct water channels on the farms as source of irrigation.

Background to the Study

In Nigeria, like other developing countries, agriculture remains the most viable economic sector and considerably contributes towards production and employment (Yusuf, Suleiman, Yakubu and Yusuf, 2018). Nigeria produces variety of agricultural crops, vegetables and fruits to feed her/or its population and earns foreign exchange through exports due to the favourable factors (suitable agro-climatic conditions, water supply and rich fertile soils) before discovery of oil (Eboh, 2015; Thursday, 2016). In Nigeria, agriculture engages about 70% of the labour force and contributes about 40% of her Gross Domestic production (GDP). The Central Intelligence Agency (CIA), 2013).

In effort to achieve the desired level and targets in agriculture, in terms of adequate food production and provision of substantial support for the local industries, the practices of agriculture requires adequate availability of land and supply of vital inputs such as 'improved seeds, fertilizer, agro-chemicals, among others. The farmers, according to Olaniyan and Ogunkunle (2018) should be assisted by Extension Organizations to have current knowledge of improved sources of information and have access to all inputs needed for effective production. There is equally the need, among others, to provide relevant infrastructure such as storage facilities and other assistance to include provision of credit facilities, education, training and extension services, research and appropriate technology (Oladele, 2015). There is also the need for a favourable climate as an all important ingredient or input in agriculture (Oga, 2014). Climate, a major requirement in agricultural production is very essential. This is in consideration of the crucial roles of its various elements, especially rainfall, a major source of water resource use in agriculture by farming households. Other sources include streams, rivers, lakes and ponds. Water is used for various agricultural activities such as testing seed viability washing of produce, implements, mixing agro-chemicals for use on the farm, for feeding livestock operate and maintain farm machines, process farm products, etc (Oladele, 2015).

Rainfall, a very essential element of climate has numerous implications for agricultural production of a place (Oga, 2014). This is because its nature (time of commencement in a given period, frequency, amount, duration, intensity and distribution) to a very large extent determines the types of and level of agricultural practices and production of a place. According to Nwaiwu et al, (2014), much of the water for agricultural production comes from rainfall. Where rainfall is well distributed and in adequate amount, growth and productivity of crops like yam, cocoyam, cassava, plantain, corn, rice and tree crops like rubber, kola-nut, oil palm, citrus, among others, is guaranteed.

According to Nwajiuba (2013), the most important element of climate is rainfall, the amount that falls, how it falls e.g. steadily over several days or suddenly in torrential downpours, hence its effectiveness i.e. how much of it is available for use by plants. Currently, it has been observed, and even available records have shown that the nature (time of commencement, frequency, amount, duration, intensity, etc) of rainfall has not been encouraging. There has been a deviation from the natural pattern of rainfall (Nigeria Meteorological Agency (NIMET), 2016). An encouraging nature of rainfall in terms of

commencement at the right time, moderate or adequate in amount, duration and intensity, no doubt, is desired and generally accepted as the “best nature” of rainfall for any desired level of agricultural production. Consequent upon this best nature of rainfall, it is the utmost desire of places substantially involved in agricultural production, of which Afikpo North Local Government Area (LGA) of Ebonyi State is among, to have and appreciate this nature of rainfall. The current unfavourable nature of rainfall widely experience is due to global warming and subsequently climate change: this situation does not augur well for agriculture and agricultural productions, and this, no doubt, has multiplier effects.

Often, it has been observed and recorded that the rains do not come when expected. This is in agreement with Anam and Antai (2015). When it is eventually experienced, may be fair, moderate or torrential and in the process may not be adequate for agricultural production or may even be very destructive to physical structures as well as agricultural products (Radio Nigeria (RN), 2012). As a result of Global warming and subsequently climate change, there is rise in sea level and increased flooding (Moore, 2013). This position was corroborated by UNESCAP (2011). There is equally, reduction in the area of cultivable land and decreased food supply. According to (Danielou, 2012), records have shown reduction, relocation or even extinction of some plants and animal species e.g butterflies, polar bear, walrus, caribou, mistletoe, etc. sequel to the above discouraging scenario of rainfall as a result of Global warming and climate change, there is need to chart a path to assisting in suggesting adaptation strategies against their negative effects and this informed the study.

Objective of the Study

The general objective of this research was to generate data on rainfall pattern and distribution in Afikpo North Local Government Area (LGA) of Ebonyi State in the year, 2019.

Specific Objectives

- i. To determine the time of commencement of rainfall in each day of rainfall in the months of the year covered.
- ii. To determine the frequency of rainfall in each day of the months of the year covered
- iii. To determine the duration of rainfall in hours in each day of rainfall in the months of the year covered
- iv. To make recommendations

Statement of the Problem

Among the global issues, currently, is global warming and climate change. These have impacted among others, agriculture due to their influence on weather elements especially, rainfall. Long before now, farmers carried out their farming activities with good background knowledge of the weather conditions of their immediate environment, especially, in relation to the pattern and distribution of rainfall. With this knowledge,

they considerably understood their immediate environment and on this premise planned their farming activities effectively with minimal losses on the farms. But nowadays, this knowledge seems to be a mirage as a result of Global warming and Climate change. This has caused considerable changes in the trend and distribution of rainfall. Consequently, farmers can no longer understand the current weather conditions of their immediate environment and this has affected the planning of their farming activities and has resulted to some huge losses of their farm produce and other resources. Sequel to this, farmers need assistance in this regard and to help them achieve this, there is need to provide them with current basic information/data on these changes, among which are current changes in the pattern and distribution of rainfall and also suggest adaptation or mitigation strategies. These will provide guidance for the farmers and enable them to effectively plan their farming activities and subsequently minimize the effects of the present vagaries of weather conditions as they concern their farming activities and water management.

Materials and Methods

The Study Area

The work was conducted in Afikpo North Local Government Area (LGA) of Ebonyi State of Nigeria in the year, 2019.

Afikpo North Local Government Area of Ebonyi State is an agrarian LGA with a good number of the populace engaged in one form of agricultural production or the other mainly at subsistence level. The crops cultivated in the LGA include: maize, rice, yam, cassava, cocoyam, potatoes, and vegetables, among others. Besides cultivation of crops, animals are reared especially the small ruminants (sheep and goat and fishing is also practiced by the people. The keeping of poultry is also practiced. The pattern of agricultural production is mainly affected or defined by the influence of the annual weather condition of the LGA based on two distinct seasons: the dry and wet seasons. The dry season starts about the month of November and terminates around the month of March, while the wet season starts in the month of April and ends in the month of October with the average annual rainfall of about 134mm (Ebonyi State Agricultural Development Programme (EBADEP), 2011).

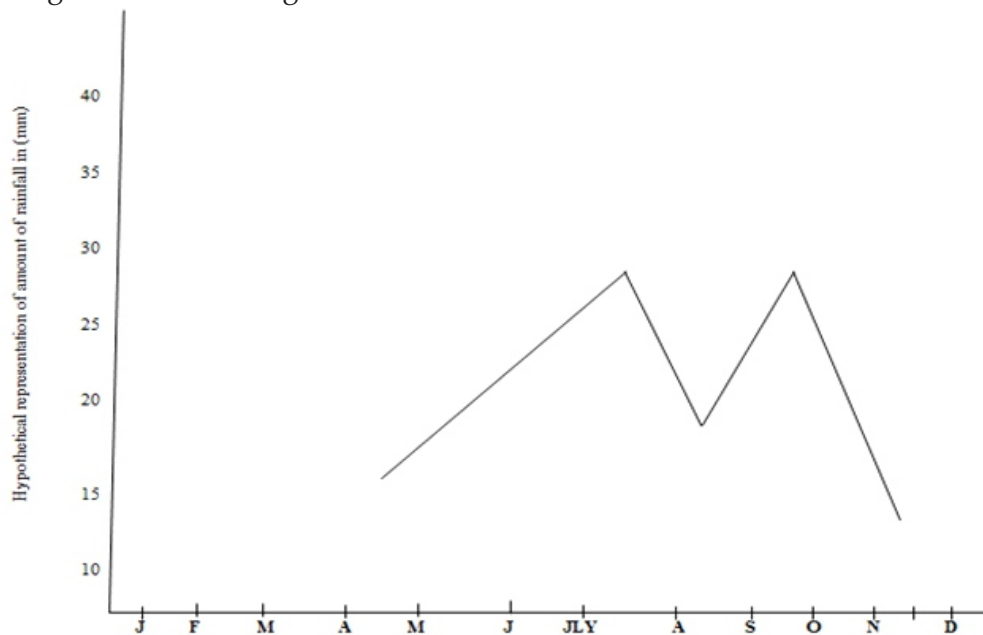
Method of Data Collections

Afikpo North Local Government Area (LGA) is made up of twelve (12) Autonomous Communities (ACs). Ten (10) ACs were randomly selected for the field work and Field Assistants (FAs) were needed to assist in the work. Two FAs were purposively selected from each of the 10 randomly selected ACs to give a total number of 20 FAs who assisted in examining and recording the parameters considered relevant to the field work.

Result and Discussions

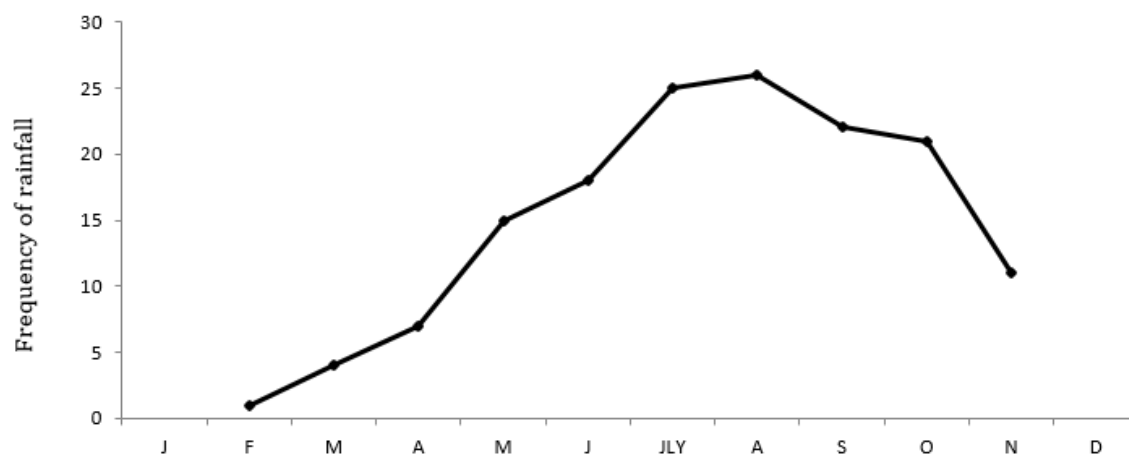
Time of commencement of rainfall

Fig. 1: Showing the usual pattern and distribution of rainfall before the incidence of global warming and climate change



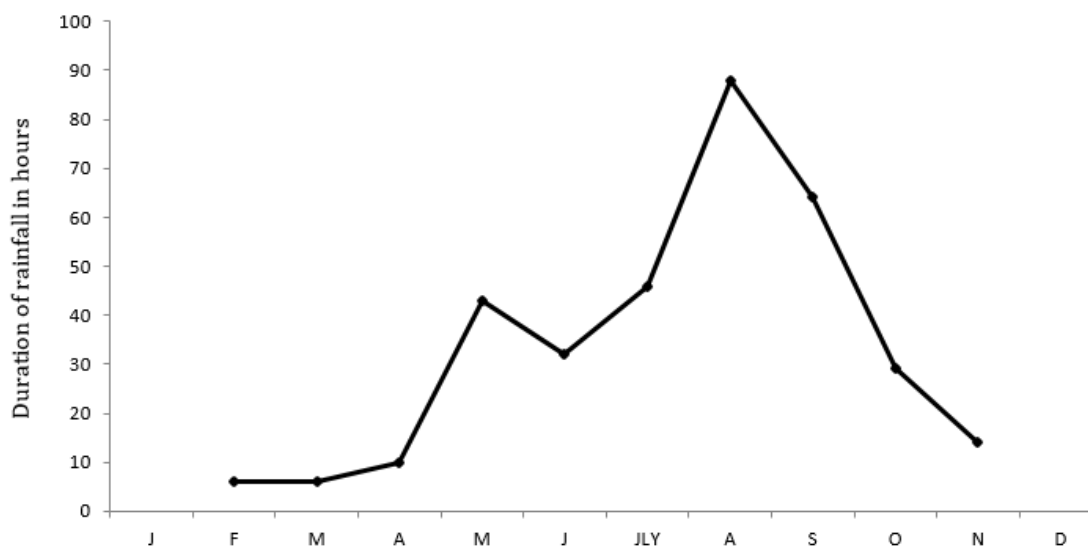
Source: Oguntola and Nwite et al. 2008 and Oga, 2014

Fig. 2: Frequency of rainfall in 2019.



Source: Field work, 2019.

Fig. 3: Rainfall distribution in hours in the year, 2019.



Source: Field work, 2019.

The result of the field work showed that rainfall was experienced in all the months of the year except for the months of January and December, see Table 1. There was much heat due to high level of temperature between the months of February and April. Focus Group Discussions (FGDs), 2019) and this situation is in agreement with the opinion of Roudier et al, (2014), who asserted that much heat is usually experienced more in the month of February.

Rainfall started early in the year in the month of February and between the month and April. The rain was not much, recording frequencies of 1,4 and 7 in the months of February, March and April respectively. After the month of April, rainfall increased gradually from the month of May and was poorly distributed between the months of April and July. This situation was in agreement with (NIMET, 2016). After the month of July, there was high increase in rainfall reaching a peak in the month of August, contrary to popular opinion, see Figures 2 and 3. There was usually the experience of “August break” in the month of August, see Figure 1, this was absent in the period covered, see Figures 2 and 3. The rains dropped sharply after the month of August which is also contrary to popular opinion. See Figure 3. This condition is in agreement with Oga and Oga (2011 and 2012). The months of July and September under normal circumstances were supposed to have recorded two peaks of rainfall i.e. “double maxima”, see Figure 1, but this was also absent in the period covered, contrary to popular opinion, see Figure 3.

Table 1: Monthly summary of weather elements' conditions in the study area in the year, 2019

S/No.	Months of the year, 2019	Rainfall		Frequency of rainfall in each month	Duration of rainfall in hours in each month	Intensity	
		Yes	No			Frequency of moderate rainfall in each month	Frequency of heavy rainfall in each month
1	Jan	-	-	-	-	-	-
2	Feb	√	-	1	1	-	1
3	Mar	√	-	4	6	2	2
4	Apr	√	-	7	13	4	3
5	May	√	-	15	43	8	7
6	June	√	-	18	32	7	11
7	July	√	-	25	46	17	8
8	Aug	√	-	26	88	15	11
9	Sept.	√	-	22	64	15	7
10	Oct	√	-	21	29	13	8
11	Nov.	√	-	11	14	7	4
12	Dec	-	√	-	-	-	-

Source: Field work, 2019

Frequency of rainfall for the period covered

In terms of frequency of rainfall, there was an upward trend from the month of May and declined a little between the months of May and July and increased to the month of September and then dropped sharply. See Figures 2 and 3.

Duration of rainfall in hours for the period covered

In relation to duration of rainfall in hours, this was experienced more between the months of May and September and recorded duration in hours of 88 in the month of August, see column 4 and between rows 5 and 9. The highest level of rainfall both in frequency and duration in hours was recorded in the month of August, see column 4 row 8. In terms of moderate and heavy rainfall, the months of July and August recorded highest moderate rainfall and highest number of heavy rainfall was recorded in the month of August.

Effect on Agricultural production

The rainfall pattern and distribution was poor in the area of study for the period covered. This position was supported by (Medugu, 2009). It is pertinent to note here that between the months of February and March high temperature was experienced as evidenced in Figures 2 and 3. This resulted in heat stress in livestock and caused death of some poultry birds. This situation was supported by Focus Group Discussions (FDGs, 2019) poultry farmers. Maize cultivated with the early rains experienced high temperature in the month of March and were scotched by heat (FGD, 2019) and this situation is in agreement with Thomas and Sanyaolu (2019).

In the months of May and June, crops like rice suffered in the nursery due to absence of rainfall resulting in near drought situation. Vegetable crops also suffered from heat due to high temperature causing huge wilting condition for most of the crops. See Figures 2 and 3. Information available from the field work., see Figures 2 and 3, (FGDs, 2019), and personal experiences showed that there was great flood in the month of August due to heavy rainfall which lasted for long hours. This situation is in agreement with the position of Moore (2013), see also Figures 2 and 3.

During this period, farmers experienced a very unfavourable situation in the month due to great flood on the farmland which reached the kneel level and made it difficult for farmers to transplant rice from the nursery to rice farms. Crops such as cassava and yam had to be harvested immaturely due to heavy flood which lasted for some days and which even caused the rotting of these crops in the soil. This situation also made it difficult to cultivate late maize which is usually cultivated between the months of July and August. After the month of August, rainfall dropped drastically, see Figures 2 and 3. This situation may not guarantee sufficient water (rainfall) to support rice that succeeded in reaching the permanent site. This situation may have resulted in shortage in the production of rice and most other crops resulting in hunger, starvation, etc. This situation, no doubt, may culminate in food insecurity and probably causing stagnation in rice production. This position is supported by Akinbile (2010) and is in agreement with the opinion of Vander Zaag (2010).

Conclusion

The practice of agriculture is affected by various factors especially climate. The effect of climate is felt through one of its potential elements, rainfall. The rainfall of a place, to a large extent determines the scenario of agricultural production. Currently, the nature of rainfall in relation to agricultural production in Afikpo North Local Government Area(LGA) of Ebonyi State is not encouraging due to the influence of Global warming and Climate change. In order that agriculture continues to play its role as the backbone of a nation's economy, there is need for adaptation/mitigation strategies. Strategies to be employed in this regard include, among others, adoption of sustainable agriculture and land management practices and water management practices. Farmers to delay cultivation of crops to about 4-5 weeks after the first set of rains which now occur early in the year and there is need to shift planting dates of some crops and farmers to cultivate cover crops etc.

Recommendations

1. Sufficient awareness should be created on the realities of Global warming and climate change both for the farmers and public consumption
2. Farmers should be advised not to plant with the coming of the first rains but to delay or shift planting dates and probably commence planting after about 4-5 weeks after the first set of rains.

3. Farmers should be advised to cultivate crops that may not require much water during the early rains in the year.
4. Farmers should be advised as a matter of necessity to cultivate edible cover crops as “must crops” during each cropping season.
5. Farmers should cultivate crops that are resilient to climate change eg. Resistant varieties.
6. Government as a matter of urgency should revitalize relevant Agencies such as NIMET and equip them with appropriate technologies in order for them to improve on their services and personnel trained in this regard.
7. There should be establishment of Meteorological stations in some localities where necessary to help provide information on weather conditions to enable farmers plan their farming activities.
8. There is need to construct water channels on the farms to serve as source of irrigation.

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