International Journal of
Strategic Research in Education, Technology and Humanities
p-ISSN: 2465-731X | e-ISSN: 2467-818X
IJSRETH
September, 2023
Vol. 11, No. 1

Assessment of Rainfall Distribution and Implications for Rice Production: Effect of Climate Change

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Article DOI:
10.48028/iiprds/ijsreth.v11.i1.15

Abstract

This study examined the pattern and distribution of rainfall in the year, 2021 in Ikwuano local Government Area, of Abia State, Nigeria. Data were from secondary sources and analyzed with descriptive statistics. Results showed that the first four (4) months of the year recorded very poor amounts of rainfall. The highest peak of rainfall was recorded in the month of August. The result also showed absence of "August break". There was absence of double maxima in the months of July and August and heavy downpours were experienced between the months of July and September. Recommendations, among others, include that farmers should shift the planting period of some crops, crops that do not require much water to thrive well should not be cultivated between the months of July and September and farmers should cultivate "edible cover crops as must crops."

Keywords:
Climate change, Rainfall, Implications, Rice production

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Background to the Study

Rice (Oryza Sativa) is a major crop cultivated in Nigeria. It is ranked sixth most important crop after sorghum, millet, cowpea, cassava and yam, Adam, and Bashir (2019) Nigeria, is not only the largest producer of rice in West Africa, but also the second largest importer of rice in the world accounting for 25% of the continents import (central Bank of Nigeria (CBN), 2017). Rice Plays a major role in the economy of Nigeria, with local production done on approximately 2.8 million hectares of farmland by predominantly smallholder farmers using crude implements (CBN, 2017).

The cultivation of rice in West Africa has been established for a long period. It is the main cereal crop grown in many parts of the world, particularly in Asia, and it forms the main part of the diet of over one third of the world's population (Adam, *et al.,* 2019). It is one of the most valued cereal crops of west Africa. Apart from being an important source of food, it has become increasingly used as a constituent of animal feed. Rice is rice in carbohydrates and proteins; the outside layer of the rich grain which is removed during polishing is known as rice bran. Bran is rich in protein and vitamins and is widely used in the formulation of poultry foods.

Rice is typically a swamp plant which is well adapted to growing in natural flooded places such as riverbanks, valleys and the brackish and the freshwater managrove swamps. It can also be successfully cultivated using controlled irrigation. Many varieties also thrive under rain-fed conditions of fairly high attitudes. Rice can be said to be a water loving crop and its cultivation is usually rainfed. Rice needs about 5-6 months of rainfall for proper growth and development. Currently, the pattern of rainfall and its distribution is such that there is no guarantee of this duration of rainfall for rice production in that there has been deviation in the usual pattern of rainfall. Consequently, farmers do not understand the pattern of rain fall and this situation has affected the production planning of rice and has resulted in poor production and loses of the crop. To protect rice farmers from this unhealthy situation, there is need to provide them with current information on the present pattern or rainfall and it is on this basis that this research was embarked on.

Statement of the Problem

The environment plays of leading role in the adaptation of crops to a particular agricultural zone. The environmental factors mainly responsible are climatic, physical and biological. For any agricultural crop plant to survive in any environment, it must be adapted to all the conditions prevailing there. Among the main climators which affect crop husbandry is rainfall. The importance of rainfall in the growth of crops cannot be over-emphasized, as water plays a great role in metabolism and other vital processes of life. It has a significant role in determining where crops can live successfully. Agricultural crops vary in the amount of water they need for survival. This will help them plan better their rice production activities. With the foregoing, this study intends to address the following research questions. What is the time of commencement of rainfall, what is the frequency of rainfall, what is the amount of rainfall for the period covered. The main objective of the study was to generate data on rainfall pattern for the period covered.

Specifically, the study sought to; determine the time of commence of rainfall, determine the frequency of rainfall, determine the amount of rainfall for the period covered and discuss the implications for rice production.

Methodology

The materials used for this study were sourced from the Agromet Unit of the National Root Crops Research Institute (NRCRI) Umudike, Abia State. Umudike is located about 8km East of Umuahia town along Umuahia-Ikot Ekpene road with latitude 05^0 29^1 N, longitude $07^0 33^1$ East and at an altitude of 122m above the mean sea level (Emeka-Chris, 2011). Umudike is 140km North of Port Harcourt International Airport and 135Km South of Enugu Airport and only 80km east of Owerri Airport in Imo state. It is within the subequatorial climatic belt characterized by two major seasons; the wet dry seasons, the wet season starts in April and ends in September with a peak in June and July, while the dry season lasts from October to March. However, recent global climatic change has affected the durations of these seasons. Rainfall is high in the area, with an annual average of about 2,217.86mm. Relative humidity is also high and generally over 70%, while mean annual temperature is about 27^0C.

Data Collection and Analysis

The fundamental data required for this research were rainfall data for the year, 2021. The source of the data is the Agromet Unit of the National Root Crops Research Institute (NRCRI), Umudike. The data were analyzed using descriptive statistics.

Review of Some Environmental Factors Affecting Crop Production

(Excerpts from Akinyosoye, 1999).

The environment plays a leading role in the adaptation of crops to particular agricultural zones. The environmental factors mainly responsible can be divided into climatic, physical and biological factors. It should be borne in mind that, for any agricultural plant to survive in any environment, it must be adapted to all the conditions prevailing there. In most cases, one factor plays a major role in determining the degree of adaptation of a crop. This is why different agricultural crops are found in different parts of the world. Owing to the variation in environmental conditions, crops which are adopted to temperate zones are completely different from those of the tropics.

Climatic Factors

The climate of a place is the condition of weather over a long period. Weather is the average condition of rainfall, temperature, pressure, wind, humidity and sunlight over a relatively short period. The main climatic factors which affect crop husbandry in West Africa are rainfall, temperature, light and wind. The importance of rainfall in the growth of crops cannot be over-emphasized, as water plays a great role in metabolism and other vital processes of life. It has a significant role in determining where crops can live successfully. Agricultural crops vary in the amount of water they need for survival. Hence crops and farm animals adapted to dry savanna regions cannot survive in the wet forest regions of west Africa. Generally, there is an average of five (5) months of wet season and

seven (7) months of dry season in the savanna, and vice versa in the forest region which generally have five (5) months of dry season and seven months of rainy season. Crops which have a high-water requirement to thrive well in the forest regions and crops which need a relatively shorter duration of rainfall to complete their lifespan do well in the savanna.

Temperature is mainly important in determining which plants are found in the different ecological zones. Both the range of temperature in a region and the rate at which the temperature changes during the day and seasonally are important in determining whether a given agricultural crop can survive in a particular place. The soft, fleshy parts of most crops are killed by freezing temperatures. Other crops cannot exist in hot tropical climates because the temperature is too high.

Brief Excepts About the Rice Crop (Oryza Sativa)

The cultivation of rice in West Africa has been established for a long period. It is the main cereal crop grown in many parts of the world, particularly Asia, and if forms the main part of the diet of over one third of the world's population. It is one of the most valued cereal crops of West Africa. Apart from being an important source of food, it has become increasingly used as a constituent of animal feeds. Rice is rich in carbohydrates and protein, the outside layer of the rice grain which is removed during polishing is known as rice bran. Bran is rich in protein and vitamins and is widely used in the formulation of poultry foods.

Rice is typically a swamp plant which is well adapted to growing in naturally flooded places such as riverbanks, valleys and the brackish and freshwater mangrove swamps. It can also be successfully cultivated using controlled irrigation. Many varieties also thrive under rain-fed conditions at fairly high attitudes. In these conditions they are grown without irrigation, but they have a shorter growing period and also produce lower yields than the swamp varieties. These two types of rice, the swamp rice and the up-land rice, are widely grown in parts of west Africa where the rainfall is fairly high.

Many different varieties of rice are grown in West Africa. planting normally begins in Nigeria with the onset of the rains; this is usually in April or May. Nurseries have to be prepared on moist, water-retaining soils. The seeds are broadcasted at a fairly close spacing and germination begins after four or five days. At about the seventh or eighth week of growth, the Seedling are usually ready for transplanting. Seeds are normally sown in the nursery in May or June and transplanting begins in either July or August in most parts of Nigeria. The upland rice crop matures in five to seven (5-7) months depending on the variety sown, and upland rice normally matures earlier than swamp rice.

Results and Discussion

Time of Commencement of Rainfall (2021)

The month rains commenced in the year covered was noted and recorded. The results for period covered are shown in Table 1 for about 3-4 decades before now, available weather

records showed that the usual time of starting of rainfall in the South East Region was in the month of April. This position is in agreement with the position of (Oga, 2014). See figure 1, which was designed with available records and information in (Oga, 2014). This timing of rainfall and its pattern encouraged and guided farmers in the planning and implementation of farm activities plans. With this background information, the results of the field work for the period covered show a different scenario in relation to time i.e shift in the time of commencement of rainfall. These days, from available records, the rains now start early in the year, usually between the months of January and February contrary to what was previously obtained. See Figure 1 compared to figure 2.

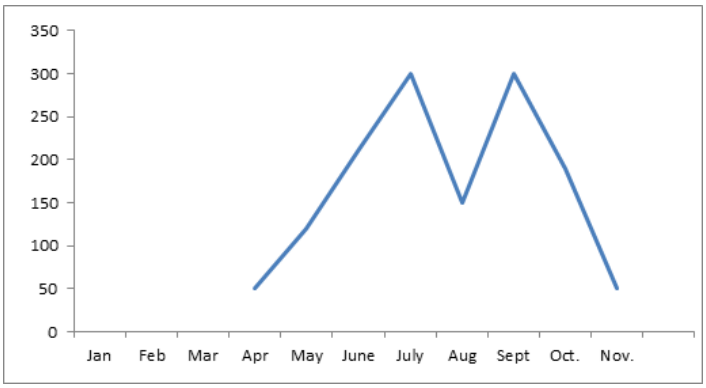

Figure 1: Showing hypothetical usual pattern of rainfall prior to the realities of global warming and climate change.
Source: Designed with information in (Oga, 2014, 2019)

Frequency of Rainfall
The number of times of rainy days in each of the month of the year covered was noted and recorded and the mean determined for each month. The results in Table 1 showed that rainfall was experienced ten (10) times with very poor frequencies in six (6) months. The lowest and high frequencies were recorded in the months of March and August respectively.

Amount of Rainfall
In each day of rainfall in each of the months for the period covered, amount of rainfall in millimeters were determined. The monthly mean of this was also determined. The result in Table 1 showed that there were increases in the amounts of rainfall from the month of June up to the month of October. The highest and lowest amounts were recorded in the months of August and March respectively. Generally, the result shows that there were heavy downpours in three (3) months-July, August and September. The heaviest downpour was recorded in the month of August.

Table 1: Showing rainfall frequencies, amount and temperature, its minimum, maximum and mean for the year, 2021.

Variables	Months											
Rainfall	**JAN**	**FEB**	**MAR**	**APR.**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
Frequencies	0	0	4	10	5	14	17	23	19	15	7	0
Amount (mm)	0	0	36.3	75.5	47.9	272	301.4	556.8	344.2	238	99	0
Temperature°C												
Min	22	21	22	21	21	22	23	22	21	22	23	34
Max	35	36	35	34	33	31	30	30	32	33	33	21
Mean	**28.5**	**28.5**	**28.5**	**27.5**	**27**	**26.5**	**26.5**	**26**	**26.5**	**27.5**	**28**	**27.5**

Sources: Agromet Unit of National Root crop Research Institute, Umudike, Abia State.

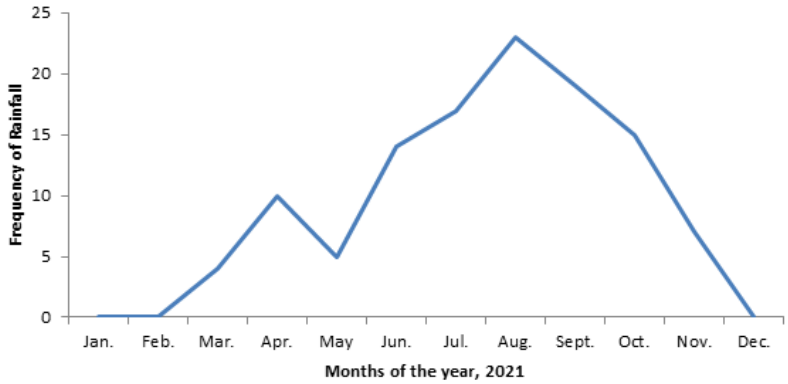

Figure 2: Frequency Distribution of Rainfall in the year 2021

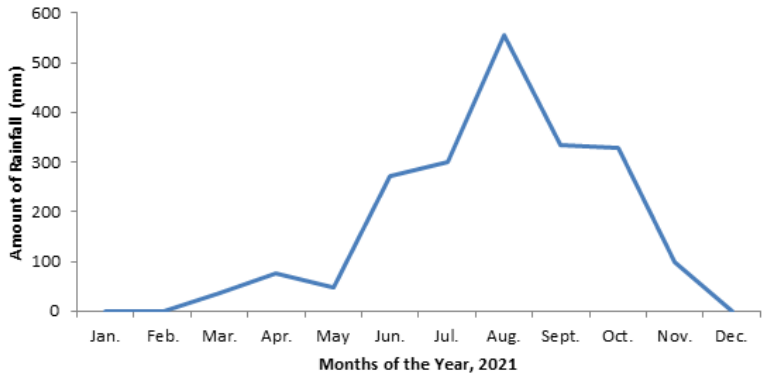

Figure 3: Distribution of Rainfall in Amount (mm) in the year 2021

Implications For Rice Production

Sequel to poor scenario of rainfall, especially between the months of April and May implies that the rice crop will probably start late in the nursery see figure. The cultivation of rice commenced in the nursery in the month of June, contrary to popular opinion when

the weather conditions were considered favourable. Seeds will therefore be sown in the nursery in the months of June/July and seedlings transplanted in August/September depending on the variety with this trend, the implications are that upland rice may suffer in the greater part of the year in the field due to poor rainfall while the swamp rice mill enjoy adequate water supply for about three (3) months instead of at least six (6) months required for proper growth and development of the crop. Also, the sharp drop in rainfall in the month of September when the rice crop needs water for the last lap of its life cycle may not augur well for the crop. Generally, the implications are that rice, no doubt, will not mature on time resulting in shortage in supply for both home consumption and the market. This will result in starvation and hunger. This position is in agreement with Chukwuone, Chukwuone and Amaechi (2018) who stated that poor rainfall distribution could lead to reduced output.

Conclusion

Climate change has caused some drastic changes in the patterns of rainfall and has equally impacted other weather elements and human livelihood among which is agriculture and this demands adaptation strategies. Consequently, the main objective of the study was to access data/information on rainfall distribution in the year, 2021 and accomplish some specific objectives. The practice of rice husbandry is influenced by various factor, especially, climate. The effect of climate in agriculture is felt through one of its potential elements, especially, rainfall. Currently, the nature of rainfall in relation to rice production has not been favourable due climate change. As a result of this, there is need to access data/information on the patterns of rainfall for some periods. For farmers use in order that agriculture may continue to support related human endeavors, there is need for adaptation strategies to the effect of climate change. Strategies to be employed in this regard, in the opinion of the study are, among others, shifting the planting dates of rice and use of irrigation facilities.

Recommendations

1. Creating awareness on the realities of global warming and climate change
2. Farmers to shift the planting dates of some crops.
3. Farmers groups or cooperatives to assist in constructing water channels to help in providing water during period of scarcity.
4. Government and non-governmental organizations and even Philanthropists should help establish local weather stations to help support Nigeria Meteorological Agency (NIMET) in their services.

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