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Temporal Variation of Rainfall Occurrence: The Effect on Tuber Crop Production In Niger Delta, South-South, Nigeria

Alexander Chinago Budnuka[1,] Bakpo Moses Tonubari[2,] Woke Chigozie[3,]
[1,2,] *Department of Social SciencesRivers State College of Arts and ScienceRumuola, Port Harcourt.*
[3,] *Department of Agricultural ScienceRivers State College of Arts and ScienceRumuola, Port Harcourt.*

Abstract: *The study temporal variation of rainfall occurrence: The effect on tuber crop production in Niger Delta, South-South Nigeria. Show the relationship between rainfall and tuber crop production. The study among other things reveals that annual rainfall has an insignificant effect on tuber crop production in the study area, where the amount of rainfall always exceeds the crop water requirement. It was observe that short storm of few months may influence the total annual rainfall .This storm could even miss the target (the planting season). It also show that rainfall parameters like onset, cessation and duration of rainfall is vital to production of the crops under review. A delay in onset of rainfall means a shift in farming calendar. Changing climate will certainly affect the production of the tuber crops negatively. A changing climate will usher increase rainfall which is inimical to the crops . Excessive water in the soil damages tuber crops.*

Keywords: *Climatic variable, Niger Delta, Nigeria, Rainfall variation, Tuber crops.*

I. Introduction

Agriculture is a key sector in the economy of Nigeria, and other developing countries, it accounts for over 60% of Nigeria Gross Domestic Product (GDP) in 2012 (Adejuwon, 2004). The sector is also the source of raw material used in the processing industries as well as a source of foreign exchange earnings for the country (Ajetomobi and Abiodun, 2010). Agriculture production is the main source of livelihood for most rural communities in developing countries and in sub-Saharan African in particular. This sector provides a source of employment for more than 60% of the population and contributes about 30-40% of the GDP (Kandinkar and Risbey, 2000).Agriculture is the basic activity by which human live and survives on earth (Rosenzwegi and Liver man, 2007).The importance of Agriculture in the world and inthe tropics in particular is undermined or under scrutiny due to its dependence on climate. It is very difficult to predict productivity with certainty due to variability of climatic elements. Climate variability and change have direct, often adverse influence on the quantity and quality of agricultural production (Sowunmi and Akintola, 2010). Climate affects crop yield directly because of alteration in rainfall and indirectly through changes in soil quality, pest and disease (Explores, 2005; Ayoade, 2003).

Agricultural productivity is strongly linked to rainfall variability, than any other element of climate in the tropics because farmers rely on rain fed agriculture. Therefore water scarcity is a major constrain to crop production. Rainfall determines not only where and when to plant crops but also whether crop will yield effectively or not.The amount of rainfall that is normally received determines which type of agriculture the can be carried out, and which crop that can be cultivated in a region. The seasonal rainfall occurrence regulates the agricultural calendar in the tropical region of Africa (Ayanlade, etal, 2009; Miller, 1971).

Rainfall provides most of the needed water for agriculture in the tropics. The role of moisture in agriculture is even more spectacular in tropics where because of relative high temperature throughout the year, the rate of evaporation is constantly high. On the other hand, rainfall is highly seasonal over most part of the tropics. Because temperature is high throughout the year, to ensure the growth of crops over most parts of the tropics with exception of few mountain areas, the growing season/harvest unlike in the temperate region is determined by availability of rainfall (Ayoade, 2003).

The climatic elements that affect crop production include solar radiation, temperature, precipitation, relative humidity, pressure, sunshine hours and wind. However, precipitation is the most important element affecting agriculture in the tropics and indeed Niger Delta region of Nigeria.

Variation in temperature over the study area in negligible or minimal, just like other climate elements with stable occurrence. But, rainfall fluctuations vary greatly in time, duration, amount, and intensity. This study focuses on the effect of rainfall variation on agriculture, since the other climatic element distribution is more reliable.Scholars have contributed on the impact of climate on agriculture both in Nigeria and abroad (Sorte, 1999; FAO, 1990, Mederski, 1983 and Alexander, 2012). Most of the aforementioned works cited deals with the effect of climate or climatic variable on crop production. No real attempt has been mad to study climatic effect on crop yield using rainfall parameter like onset, duration, and end of rainfall. This is necessary because a shift in time of planting, growing and harvest portend (i.e. will be) doom for unsuspected rural farmers.

Tuber crops like yam and cassava are staple food for majority of people within Niger Delta area. Yam is regarded as male crop, and as such traditionally the wealth of a man is measured on his numbers of yam barn or yam stead among Emohua community in Ikwerre nationality of River State and indeed the entire Niger Delta. Tuber crops depend very much on rainfall as the size of tubers are enhanced by availability of soil water.

The fact that Nigeria with a population of over 140 million, (Ukpong, 2009) of which 70 of the population were farmers still struggle to feed her citizen makes it important to study the effect of the most important climatic element in the tropics (Rainfall) on staple food crop production (cassava and yam) in Nigeria, especially in Niger Delta region in particular.

In the face of the mentioned challenges, the urge for self-reliance and sustenance is necessary. This work seeks to determine the effect of rainfall variations on tuber crop production within the study region. This is to be achieved through the following specific objectives.

(1) To determine the relationship between rainfall (Annual) and crop production. Note the crops are annual crops.

(2) To examines the effect of rainfallparameters onset, duration and end on the crop production.

H_0: For the work shows there is no relationship

H_1: Shows that there is relationship.

The study of temporal variation of rainfall occurrences: The effect on tuber crop production in Niger Delta is of special interest because, Niger Delta is assumed to have adequate rainfall due to its proximity to Atlantic Ocean. Could this mean good or bad for crop production?

II. The Study Area.

Niger Delta is a major geomorphic feature in coastal zone. It stretches from the Benin River Estuary for about 450km of twenty-one estuaries open and discharge into sea through the delta. The Niger Delta consist of major distinct ecological zones such as fresh water, swamp mangrove, creeks, estuaries and barrier island (Ukpong, 2009).The temperature is generally high. The relative humidity is about 80% in most of the months, but in July, and September it is over 95%, and about 75% in December and January.

The two dominant soil in Niger Delta are alluvial and ferrasol (Agbola, 1979).

Niger Delta is globally known for crude oil and gas production. Most of the sea ports in Nigeria are located in the zone under review. Agricultural and trading are also important sector. Figure 1 show the study area.

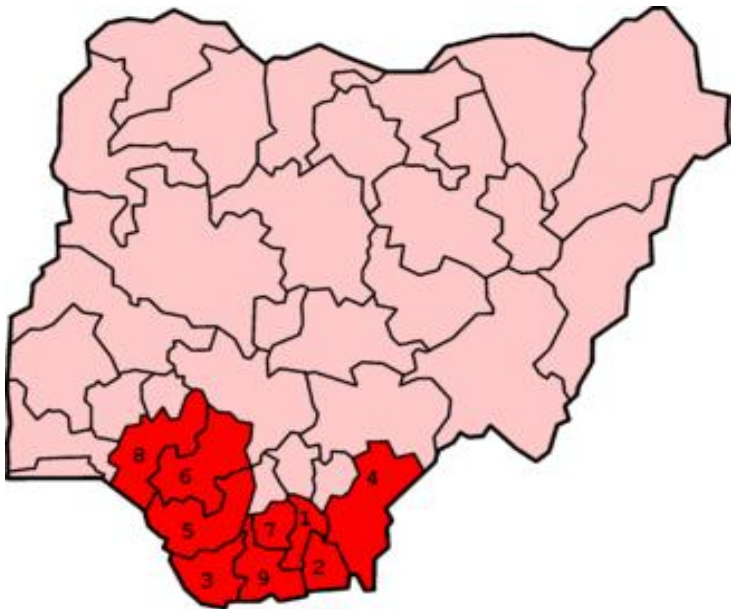

Figure 1: Map of Nigeria Showing political Niger Delta States.

III. Material And Method

Secondary data from Nigerian Meteorological Agency, Central Bank of Nigeria and the National Bureau of Statistics were collected for the period of twelve (12) years 1995-2006. Five states were selected from the region based on availability of data. The selected states include-AkwaIbom, Cross River, Delta, Edo and Rivers State.

Table, co-efficient of variation and percentage were descriptive statistics used, while spearman rank correlation and Friedman Test are the inferential statistics employed.

Friedman Test $X^2 = \frac{12}{Cr(r+1)}\left(R_1^2 + R_2^2 + R_3^2 \cdots R_1^2\right) - 3C(r+1)$ …… (1)

After (Hammond and McCullough, 1995; Easton et al, 1989).

Spearman rank correlation $r^1 - 1 - \frac{6\Sigma d^2}{n(n^2-1)}$ …….. (2)

The effect of annual rainfall on crop production were tested using spearman rank correlations while the effect of Onset, duration and end of rainfall on crop production was test using Fredman Test.

IV. Result And Discussion

Table 1 shows the distribution of Cassava production, yam production and rainfall distribution over the study period.

From the table, the highest rainfall occurred in 1996 followed by 2000 with a total of 14445mm and 13401mm respectively. The highest cassava yield was recorded in 2006, followed by 2001 with a total yield of 7069 and 6999 tones. Similarly the highest yam yield was recorded in 1997 with a total of 3976 tones, followed by 2001 with a yield of 3785 tones.

The co-efficient of variation (C.V) for cassava, yam and rainfall was calculated and recorded as 6.15%, 10.86% and 6.68% respectively. These show that the deviations from the mean are not much. This explains that rainfall is always available for crop production in the study area.

Table 1: Distribution of Rainfall, Cassava and Yam Production.

S/N	Year	Cassava production	Yam production	Rainfall
1	1995	6556	3205	12720
2	1996	5954	3074	14445
3	1997	6128	3976	12 435
4	1998	5935	2837	12,020
5	1999	5929	3011	11697
6	2000	6400	3257	13401
7	2001	6999	3785	11982
8	2002	6770	3601	12393
9	2003	6115	2926	12475
10	2004	6225	3012	11106
11	2005	6134	3269	11932
12	2006	7069	3268	11978
Total		76,218	39700	148 569
Mean		6,351.5	3308.3	12380.75
STD		390.68	359.12	826.62
C.V		6.15	10.86	6.88

Attempt is made to see the effect of temporal variation of rainfall over cassava and yam production.
Spearman rank correlation (r^1) is used.

The result shows that r^1=0.12. This relationship is too weak. Using coefficient of determination, it was observed that annual rainfall accounted or explained only 1.44% of cassava yield in Niger Delta over the study period. Further analysis using student't'-test (two tail test) at 95% shows that tcritical>$t_{calculated.}$ $t_{critical}$ value = 2.15 and $t_{calculated}$ =0.21. This implies that there is no relationship between annual rainfall and cassava production.

The explanation above means that rainfall is adequate for cassava production. The finding shows that the water requirement of cassava is always met. Rather than water scarcity, water availability may possess danger for cassava production. From table1, it was observed that cassava yield increase with decrease rainfall. This explains why cassava is cultivated outside the forest zone and even the Guinea Savanna zone.

A similar study in effect of annual rainfall on yam production shows that rainfall explains just 10% of yam production in the area. When tested for significance, the result show that $t_{critical}$ value = 2.15, $t_{calculate}$ value =1.07 meaning that no relationship exist between annual rainfall and yam production at 95% level of confidence. Rainfall can lead to excessive soil water which is inimical to yam production; findings show that rainfall has always been there in the study area.

Further analysis of rainfall parameters on cassava and yam production in the study area was carried out using Friedman Test. The study shows that at 5% level of confidence that the parameters, (onset, cessation, and duration) has effect on both cassava and yam production.

The onset of rainfall and cessation of rainfall for this work is regarded as a point in time when 51mm of rainfall or above is recorded and such could be sustained for the next 15days. Or the point at which rainfall recorded is below 51mm after rainy season and such is maintained for fifteen days.

$$\text{Onset/Cessation} = Dm\frac{(51 - PAR)}{RFM}$$

Table 2: Friedman Test of Variables.

S/N	Onset	Cessation	Duration	Cassava	Yam
1	1	3	2	5	4
2	1	3	2	5	4
3	1	3	2	5	4
4	1	3	2	5	4
5	1	3	2	5	4
6	1	3	2	5	4
7	1	3	2	5	4
8	1	3	2	5	4
9	1	3	2	5	4
10	1	3	2	5	4
11	1	3	2	5	4
12	1	3	2	5	4
Total	**C=12**	**C=36**	**C=24**	**C=60**	**C=48**

χ^2 =12/360(7920) - 216 =48

χ^2 critical $<\chi^2$ calculated. x critical value = 7.78 (Note –V=c-1=4). χ^2calculated= 48. Variation of the result implies that rainfall parameter (onset, duration and end) affects tuber crop yield over the study area.

Correlation between rainfall parameter and tuber crop production show that a shift in onset, duration or cessation of rainfall will affecttuber crop production for good or bad.

V. Conclusion

Agriculture is a very important sector within Niger Delta region, employing about 70% of the population. However agriculture in the Niger Delta area like in all the tropics depends absolutely on climatic variables. The study explains that the most unreliable element of climate in the tropics is rainfall.

The study pointed out that the annual rainfall does not affect tuber crop production (cassava and yam) which are staple food crops of the area under study.

Inadequate rainfall is no problem for the areas, because the crop water requirement is always met. Note that both crops are even cultivated outside the vegetation zone, even in areas having little rainfall.

In the study it was revealed that rainfall parameters like Onset, duration and end affects tuber crop production. This is because delay in onset of rainfall mean delay in planting of crops. Long duration will mean delay in harvest, which will lead to either rotten or dried produce. Early end in rainfall mean that the crop yield will be affected; Delayed end will result delayed harvest. This will also affect the farmers.

VI. Recommendation

Knowing that agriculture depend much on climate, we recommend that farmers should start planting from the Onset of rainfall.

Farmers should undermined weather and harvest their crop during extended duration of rainfall.

Farmers and policy makers should try to influence weather and climate. If the end is sudden, water can be sprayed to sustained growth. However, this situation is uncommon, and most likely will not occur in the study area. The normal situation is delayed end. In which case we suggest that farmers should defy rainfall and harvest their crops.

Farmers and agricultural administrators must learn and understand the rainfall characteristics in other to target when to plant their crops.

Farmers all over the world should understand that high annual rainfall does not guarantee sufficient water for cropping, because a few days, weeks or months storm can cause high annual rainfall.

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