



An Investigation into the Effect of Rainfall Variability on Farming Activities in Rural Area

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Authors' contributions

This work was carried out in collaboration between all authors. Author MIA designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Authors EFC and OAO wrote the protocol and managed the analyses of the study. Authors MIA and AOO managed the literature searches and managed the write up. All authors read and approved the final manuscript.

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ABSTRACT

Recently, rainfall anomalies have led to numerous incidences of droughts in many areas in Nigeria. Some of these anomalies have the potential to cause undesirable effects on farming activities and food security. This study analyzed the effect of rainfall on farming activities with particular reference to Ibarapa East Local Government Area of Oyo State. This work also examined the relationship between farming and rainfall. Questionnaire was used in collection of the data which were later analyzed using simple percentage and cross tabulation. Findings revealed that rainfall has significant effect on farming activities in the study area. It was also discovered that rainfall has significant effect on the price of agricultural products and on the purchasing power of the products. It was recommended that for the improvement of farming activities in the study area, the government at all levels should provide within its capacity modern farming tools at cheaper price. Education workshop and conference should be organized by the government or private individual so as to enhance their agricultural productivity.

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1. INTRODUCTION

It is clear that climate change is an inevitable phenomenon. As developing countries are highly dependent on agriculture, there are ever growing concerns that this change in weather variability will further threaten the welfare and food security of already highly vulnerable rural households in developing nations and pose a serious challenge to development efforts. In light of this impending threat, it is imperative that we have a deeper understanding of the impact of weather extremes on the poor and the effectiveness of current coping mechanisms.

Agriculture production remains the major source of livelihoods for most rural families in developing countries, including Nigeria. In Sub – Saharan Africa (SSA), agriculture provides employment to more than 70% of the population, contributing to about 26.5% of Gross Domestic Product (GDP) and export earnings of about 60% (Kandinkar and Risbey, 2000). Agriculture in this part of the world is rain-fed but unfortunately, the region has experienced unstable rainfall patterns as a result of climate change which ultimately result in uneven and declining yields with significant effects on household food insecurity (Juliana, [1]; Justus and Fletcher [2]).

Although shifts in rainfall and weather patterns are occurring worldwide, Barrios et al. [3] found that agricultural production in Sub-Saharan Africa is relative to other developing countries particularly sensitive to weather variability as the availability of water differs widely throughout the geographically diverse continent.

Extreme rainfall conditions characterized by droughts and floods can have devastating impacts on rural household's engaged in agricultural production, especially in low-income regions around the world. The absence of access to financial services by these households implies that they cannot mitigate the short-run effects of adverse weather conditions (Deschenes and Greenstone [4]).

In most cases, severe drought due to climate change and variability leads to severe food shortages, food insecurity and hunger. It is also believed that agriculture output may decrease by 20% in developing countries by 2020 and an average loss of 15% in cereal production as a result of climate change (Prabhakar and Shaw,

[5]; IFAD, [6]; Von Broun, [7]). Mostly at risk are people living in dry lands, along the coasts, in flood plains, mountains and the arctic region (FAO, [8]; Heltberg, [9]).

All governments, research bodies and international services are instituting a wide range of measures to modernize and increase agricultural production. This is because the farmers are consequently faced with new and sophisticated problems of the millions affected by these measures the great majority are individuals.

Agricultural and farming activities in any society are very important to its development potential. The place and direction of the society in overall economic development is being determined by their agricultural products which serves as mid-wife that brings to fruition the development of the much needed industrial activity as directed by the rate and volume of rainfall in the year in a particular place. Therefore, without the sufficient or much needed rainfall for farm crop, it will be hard to have good favourable yields.

Oyo state, which is rich in Guinea Savannah Grassland and which is of fertile soil made agricultural activities to be the major occupations of the people in the state because over 80 percent of the inhabitants engage in this work.

For better productivity of farm products there should be in depth study into the climate of the area, one has to examine the climatic factors which are relative humidity, temperature, rainfall, wind, air pressure and others. Rainfall is the most concerned to the agricultural activities because the annual rainfall of an area dictates life patterns of plants and animals of that particular area.

The good climate, favourable hydrology and rich soil allows for the cultivation of most Nigerian food and cash crops and still leaves ample scope for grazing, fishing and forestry. Majority of the crops that could be grown in Nigeria are usually found in the state (Oyo State) except cash crops like Kola and Coffee that are well grown in the forest region of the country.

However, in a developing nation like Nigeria nowadays, agricultural and farming activities have become a matter of importance because it plays the role of basic tools for the sustenance of

industrial growth which in turn will bring about improved economy for the nation and a higher standard of living for citizenry.

A desire for appreciable and systematic progress in industrial and economy in the country will be abortive without sound foundation in agricultural productivities. For example, Nigerians are needed to have textile and canned food industries at Lagos, Kano, Ilorin and other towns. It has been obviously known that they cannot survive without raw materials which agricultural products are the major raw materials. Therefore, it is based on this that the research work is to investigate into the effect of rainfall on farming activities in Ibarapa East Local Government Area of Oyo State.

1.1 The Effects of Climate on Agriculture

The whole of West Africa is situated within the tropics, that is, the area of the Tropic of Capricorn. The tropics are region of low pressure in one area and another cause wind, winds blow from the tropical high-pressure belts. These winds are called trade winds. These pressure belts swing North and south on the track of the overhead sun through usually with a time lag.

As the sun moves northward, the area south of this zone will be subjected to the influence of the south-west trade winds, which blow from the Atlantic ocean and are therefore laden with moisture. The release of the moisture will supply rain to such part.

The early part of the rain season is generally accompanied by lightning and thunderstorms, due to the wearing action at the meeting of the North-East and South-West trade winds.

As the sun moves southwards from the Tropic of cancer, as from late June towards the equator, the area under the influence of the North-East trade winds which are dry and dusty, blow from the Sahara desert and cause the harmattan of North and west Africa (FAO, [10]).

The main factors of climate which influence natural vegetation distribution in West Africa are winds, rainfall, relative humidity, temperature and cloud cover. Generally, these elements of climate are inter-related, for example, the prevailing winds will influences not only the amount of rainfall but also the seasonal variation.

Most coastal areas, being nearer the sea, receive more rain than the inland areas. The coasts of Guinea, Sierra Leone, Liberia, Nigeria and the South-West Trade Winds which cause conventional rainfall. The average annual rainfall in these areas is over 280mm/m², the annual temperature range is higher than the annual range of the interior. The relative humidity is always high thereby helping to check over is heavy for most of the year.

There is really no dry period in the coastal area of West Africa with the exception of these parts of Ghana, Togo and Senegal. Thus the average rainfall in the Lagos, Abidjan and Freetown area can vary from 2.2mm/m² to over 3.8mm/m² for this reason precipitation is never a limiting factor to crop production in this zone.

As one moves north of this belt, the sun passes overhead around April on, it's northward apparent movement. This account for the heavy rainfall in May-June- July from late July to August, the winds blowing across this zone do not rise up because the sun whose heat usually generates conventional currents is near the tropic of cancer, which is far away from this area. As a result there are little or no conventional rains during this period which is generally referred to as the August break.

2. MATERIALS AND METHODS

The study was carried out in Ibarapa East Local Government Area of Oyo State. East Local Government has an area of 838km² and a population of one hundred and eighteen thousand, two hundred and twenty six people (National Population Commissions, NPC, [11]). The major occupation of the people in the area is farming, some people engage in other occupation like trading, teaching and civil service as well as artisan. Ibarapa East Local Government is bounded in the south by Ibarapa Central Local Government, in the west by Ibarapa North Local Government, in the East by Ido Local Government and Odeda Local Government, Ogun State and in the north by Iseyin Local Government. The population of this study is all farmers in Ibarapa East Local Government. There are about fifty villages in the Local Government and ten villages were randomly selected for this study. The villages selected are Ajayi, Alabi, Akeete, Alapata, Abuleoba, Apata, Apooja, Araromi, Wasinmi and Alapinni. These villages have been inexistence for a period of over ten (10) years.

The instrument for data collecting was interview schedule designed by the researchers to collect data from the respondents.

The researcher, with the cooperation of the farmers in the study area administered the interview schedule to the farmers during the working hours in each selected village, and during the monthly meeting of the farmers' council in the area. The data collected were analysis, interpreted and summarized.

In analyzing the data, the socio economic characteristics of the respondents such as age, sex, primary occupation and years of farming experience were analyzed using frequencies and percentages while the hypotheses were analyzed with chi-square method of data analysis.

3. RESULTS

From Table 1, majority of the respondents (62%) are between the ages 21-40 years followed by those under 21 years with 25% while 13% of them were above 40 years of age. 64% of the respondents are male while 36% are female. This indicated that more male were interviewed than female. On primary occupation, most of the respondents (43%) identified farming as their primary occupation this indicates that farming is the major occupation of the inhabitants of the study area. 22% of them indicated that trading is their primary occupation followed by students with 20%, while 15% identified that their primary occupation is civil service. This indicated that almost every inhabitant of the study area engages in farming either as primary or secondary occupation. It is clear from Table 1 that most of the respondents (45%) have 11-20 year of farming experience, 25% of them have been engaging in farming for more than 20 years, 13% of them have less than 5 years of farming experience while those that have 1-10 years accounts for 12%.

3.1 Hypothesis Testing

Research hypothesis one (H₀₁). There is no significant difference between effect of rainfall and farming activities in the study area.

$$\text{Chi - square } (X^2) = \frac{E(0 - E)}{E}$$

where $E = \frac{CT \times RT}{GT}$

$$DF = (r - i) (c - i) = 2 \times 3 \times 3 = 6$$

The chi – square analysis gave $\chi^2 = 93 - 87$ the degree of freedom $\chi^2 (x - 1) (c - 1) = 9$ at 5% level of significance. The total value of χ^2 is 0.005, a = 16.91.

Table 1. Distribution of respondents according to their socio-economic characteristics

	Frequency	Percentage (%)
Age group		
Under 20 years	25	25
21 – 30 years	27	27
31 – 40 years	35	35
41 years and above	13	13
Sex		
Male	64	64
Female	36	36
Primary occupation		
Civil servant	15	15
Trading	22	22
Students	20	20
Farming	43	43
Years of farming experience		
Below 5 years	13	13
1 – 10 years	12	12
11 – 20 years	45	45
21 years and above	25	25

Since the calculated value of χ^2 is greater than the table value, the hypothesis is rejected indicating that there is significant difference between rainfall and farming activities in the study area.

Research hypothesis two (H₂): There is no significant difference between the effect of rainfall on the price of Agricultural production.

Table 3 shows the summary of the calculation using Chi-square at 5% level of significance.

Table 3 shows the price of agricultural products. The chi – square analysis (χ^2_{cal}) give $\chi^2 = 17.20$, the degree of freedom ($r - i) (c - i) = 9$ at 5% of significance and the table value of $\chi^2_{0.05, 9} = 16.91$.

Since the calculated value of χ^2_{cal} of 17.20 is greater than the table value of 16.91, we reject the hypothesis, indicating that rainfall has significant effect on price of Agricultural products in the study area.

Research hypothesis three (H₀₃); There is no significant difference between the effect of

rainfall and consumer purchasing in time of drought.

Table 4 shows the response of participants on the effect of rainfall on the consumer purchasing in time of drought. The chi-square analysis (X^2 Cal) gave $X^2 = 21.73$, the degree of freedom $(r - 1) (c - 1) = 6$ at 5% of significance and the table value of $X^2 = 12.59$.

Since the calculated value of X^2 Cal = 21.73 is greater than the table value of X^2 at 0.05, 6 = 12.59 the hypothesis is reject this indicates that rainfall has effect in the consumer purchasing of agricultural products.

Research hypothesis four (H_{04}). There is no significant difference between the effect of rainfall and socio-economic well-being of farmers.

Table 5 shows the responses of the respondents on the effects of rainfall on socio-economic well being of farmer. The chi-square analysis (X^2 cal) analysis gave $X^2 = 94.00$ the degree of freedom $(r - 1) (c - 1) = 9$ at 5% of significance level and since the calculated value of 94.00 is greater than the table value of 16.91, the I hypothesis is reject indicating that rainfall has significant effect in socio-economic well being of the farmers in the study area.

Table 2. Analysis of effect of rainfall on farming activities in the study area

Item	SA(4)	A(3)	D(2)	SD(1)	Total	X^2 cal	df	X^2 Tab
A	8	22	40	30	100			
B	49	21	23	7	100			
C	48	22	25	5	100	93.87	9	16.91
D	10	20	45	25	100			
Total	115	85	133	67	400			

Source: Field survey, 2016; df - Degrees of Freedom

Table 3. Analysis of rainfall and price of agricultural products

Item	SA(4)	A(3)	D(2)	SD(1)	Total	X^2 Cal	Df	X^2 Tab
A	46	24	25	5	100			
B	48	22	27	3	100			
C	42	28	25	5	100	17.20	9	16.91
D	39	31	29	10	100			
Total	175	105	97	23	400			

Source: Field survey, 2016; df - Degrees of Freedom

Table 4. Summary of the chi – square calculation at $\alpha = 0.05$ and period of drought

Item	Sa(4)	A(3)	D(2)	SD(1)	Total	X^2 Cal	Df	X^2 Tab
A	20	30	10	40	100			
B	30	25	15	30	100	21.73	6	12.59
C	15	25	40	20	100			
Total	65	80	65	90	300			

Source: Field Survey, 2016; df - Degrees of Freedom

Table 5. Analysis of rainfall and social-economic well being of farmers

Item	SA(4)	A (3)	D (2)	SD (1)	Total	X^2 Cal	df	X^2 Tab
A	10	20	45	25	100			
B	48	22	25	5	100			
C	49	21	23	7	100	94.00	9	16.91
D	8	22	40	30	100			
Total	115	85	133	67	400			

Source: Field Survey, 2016

4. DISCUSSION

It is important to note that the occurrence of a drought in a locality is most likely correlated with the likelihood of it occurring in the first place. This increased probability in itself may affect yields, the value of agricultural output and the level of consumption as households in drought prone areas have most likely taken some action to adapt to these conditions, such as accumulated asset loss at the household or community level (Thomas, et al. [12]).

From the table above it shows that an increase in the level of rainfall is the function of surplus yield in agricultural products for instance during the raining season, most of agricultural produce fall in price which makes the produce to be available and affordable for consumption. While the negative effect of rainfall can lead to erosion, flooding and leaching thereby reducing agricultural yield. Also there is outbreak of disease and pest because rainfall favours the breeding and multiplication of pathogenic organisms.

It shows that the effect of rainfall during the rainy season, reduces the income of agricultural product because there will be surplus of agricultural product during this season. Rainfall has significant effect on farming activities in the study area. In this case, when rainfall is heavy or sufficient in the area, farmers are actively engaged in farm works such as weeding, planting and others. However, in the time of light rainfall or irregular rainfall, the reverse is the case-farmers have less work to do in their farm, in which farming activities are usually dull without any visible works due to the lack or insufficient of rainfall.

The study also showed that rainfall has significant effect on the price of agricultural products. In this situation, when there is little rainfall or drought, the price of the products are very high because the productivity and harvest will generally be poor, hence, the far harvested crops will be costly.

Also it showed that rainfall has significant effect on consumer purchasing power of the products during the time of drought. In this case, the high price of agricultural products will adversely affect the purchasing power of the consumer because they will have to pay more for few goods purchased.

Finally, the study shows that rainfall has significant effect on the socio-economic well-being of farmers in the area. In this case, when rainfall is sufficient, the harvest will be normal, and it will enhance profit income of the farmers, which is the back-bone of the socio-economic well-being of the farmers, due to the high productivity. However, the reverse is the case when comes it to the shortage of rainfall in the area.

5. CONCLUSION

From the available data, one may infer that rainfall has effects on farming activities include enhancing farming productivity in the time of sufficient and regular rainfall. The price of agricultural products would also be cheaper and within the reach of the consumer. Under this situation, in the same vein, more consumers would be able to purchase the products at relatively cheap price, which the socio-economic well being of the farmer would be enhanced at that particular period of time when the rainfall is sufficient and regular.

Based on the findings and the analysis of this study, the following recommendation are suggested and if properly looked into by those concerned and adhere to, there will be an enhancement of farming activities in Ibarapa East Local Government Area, Oyo state. The suggested recommendations include:

- The assistance of Government [either local, state or federal] in terms of provision of modern farming tools/implements to farmers at cheaper price.
- It is also essential for the government to provide quality seedlings to farmers at relatively cheaper price.
- The provision of loan for agricultural activities by the farmers is highly essential to change agricultural development in the area to positive position.
- Adequate education and enlightenment should be provided to the farmers through seminar, workshop and conference by organized by the government or individual body to enhance agricultural development in the area.
- Planting of varieties should be encouraged by the farmers, the varieties that will be very resistant to drought when there is irregularity of rainfall.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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