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Determination of Growing Season Duration of Cassava in Akure, Ondo State, Nigeria

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ABSTRACT

This study examines the duration of growing seasons of cassava in Akure, Ondo State, Nigeria. The main objective of the study is to know the changes occurring in the characteristics of rainfall like variations in the amount of rainfall, rainy days and its distribution. The rainfall data used was obtained from Agro-climatology and Ecological project, Ministry of Agriculture, Fisheries and Forestry Resources, Akure, Ondo State; synoptic stations in Akure, Ado-Ekiti and Osogbo for a decade (2006 to 2015). The length of the growing season for a number of food crops in Akure with particular emphasis on cassava (manihot spp.) was determined. The data collected was also analyzed using the measure of central tendency. The results obtained showed that the rainfall onset and retreat of rainfall varies from year to year but the average onset could be put between the month of April and May while the retreat is in November.

Keywords: Cassava (Manihot spp.), Growing season, Rainfall onset, Rainfall retreat and Variation.

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INTRODUCTION

Agricultural development and food security should be simultaneously handled if food sustainability must be upheld and enough food to go around for serving the Nigerian citizen. Agriculture is the preparation of plants and animals for man's use, it is perhaps the most weather-sensitive of all human economic activities (Ayoade, 2004; Adebayo and Owolabi, 2009; Adegboyega, 2019). Crops are most sensitive to weather conditions particularly in the agricultural calendar. In the tropics, rainfall assumes significance in nearly every phase of agricultural activity, from the time of land clearing, preparation of planting and harvesting operations to the time of fertilizer application, selection of varieties of crops, harvesting, storage, transportation and marketing of such agricultural products in rain-fed agriculture. Variation in the growing season occasioned by a variation in the onset and retreat of rains is critical to ultimate crop yield (Beniot, 1997). Ayoade (2004) opined that agriculture largely depends on climate to function, hence, precipitation, solar radiation, wind, temperature, relative humidity and other climate parameters effect are solely determinant of the global distribution of crops and livestock as well as its productivity. Mostly rainwater is used in agriculture for crop production. Rainfall among other factors has always dictated how land is used in one way or the other and it also affects the humidity condition of the atmosphere. Rainfall determines the vegetation cover of a particular geological zone and crop distribution some of the attributes of the rainfall trend are time of onset of the raining season, total amount of rainfall, distribution, number of rainy day and duration of rainfall as well as its time of cessation/ retreat (Bello, 1997). One of the major limiting factors to agricultural production after soil fertility is, therefore, water supply deficiencies, onset length and retreat of the rainfall as well as water movement over the land and within the soil and on soil evaporation (Hagreaves and Zamani, 1982; Forest and Lidon, 1984). The dates of onset and cessation of the rains vary from year to year in most parts of the tropics. Thus, farmers especially in Nigeria and particularly in Akure, find it extremely difficult to accurately determine the reliable beginning, duration and end of the growing season. Consequently, in most parts of the study area are inappropriately determined. It, therefore, results into the incidence of crop failure or low yield which is becoming a

recurring issue in agricultural and food productivity in this part of the country (Bello, 1997; Oluwakemi et al., 2014). In an inter-tropical country like Nigeria, rainfall commences, reaches its peak and retreats on different months of the year at different places. This results from the northward and southward sun-synchronous movements of the inter-tropical Discontinuity (ITD) and the associated rain belt (Adebayo and Owolabi, 2009). Rainfall onset and retreat is the beginning of rainfall and the end of rainfall, respectively. Rainfall onset and retreat periods appear to be of paramount importance in West Africa and particularly in Nigeria since they affect regional economies (Olaniran, 1983; Adejuwon et al., 1990). The most notorious seasonal component, in this regard in Nigeria, appears to be the rainfall onset as it is usually fore-shadowed by a succession of isolated showers of uncertain intensity with intervening dry periods of varying duration (Owolabi and Adebayo,2013). A failure in the early establishment of rainfall onset usually indicates a drought in the early part of the rainy season. This affects farmers negatively since it is essential that; after a given date, the rain will become fairly continuous and sufficient to ensure adequate soil moisture after planting commences and that such moisture levels will be maintained or surpassed as the season advances.

Rainfall influences and affects many aspects of human activities. It is of maximum importance when it occurs in the right proportion, intensity and amounts, also at proper time; but if the rainfall is in excess it becomes a threat and it may cause havoc to man and his environment when it comes or falls in high intensity and longer duration, they become catastrophic rather than good. It causes flooding, erosion, including risk to human life, damage to buildings and infrastructure, and loss of crops and livestock (Adegboyega, 2019). Therefore, the rainfall onset is the beginning of the season of germinations, productivities and harvesting in the agricultural sector of the country and also might improve the economies of the country in the sales of exported cash crops, and also the cessation or retreat of rainfall might leads to drought, famine, food shortage in the area or part of the country where there are no irrigation practices in that part of the country (UNECA, 2014). Taking Akure, Ondo State as a case study, we need to study the rainfall onset and retreat of rainfall to determine the growing season for farmers especially, farmers growing cassava. Cassava *(Manihot specie*) is an important food crop in Nigeria and most especially in Akure, the study area. It is of two varieties namely sweet cassava (*manihot palmata*) and the bitter cassava (*manihot utilissima*). Cassava tuber is processed into garri, cassava flour for human consumption, while starch and ethanol are processed from it for industrial usage. Cassava could be planted any time from March to October every year in the study area and it matures from twelve (12) months for the early maturing species while the late-maturing species take a period of between twenty-four (24) to thirty (30) months before one can have bumper harvest from it (Adegbola et al.,1976; Rebecca et al., 2018).

Adiku and Kuatsinu (1992) opine that rainfall is a major determinant of agricultural prediction in any agro-ecological zone anywhere in the world; therefore studying onset and retreat of rainfall is very important in the whole world today, its seasonal and annual characteristics such as the onset and intra-seasonal rainfall distribution that promote good crop yield are, however, characterized by market fluctuations. The onset or knowing the onset that is, the beginning of rainfall is very important to cassava farmers in the study area because it answers the vital questions, “when to plant the crop” and “where to plant (which site will be favourably suitable for the crops)?” Adiku and Kuatsinu (1992) observed that the most variable component of rainfall in West African countries is the onset date and that rainfall variability is higher at the onset than at the end of the rainy season. Also, the study of the rainfall onset and retreat of rainfall enables one to know the time and the season water will be available for domestic uses (Olaniran,1983b; Iheke and Agodike, 2016). Rainwater seeps into the ground in a process called infiltration, some of the water seeps deep beneath the top layers of soil where it fills up the space between subsurface rocks. It becomes groundwater also called table water. It is noteworthy, that less than 2% of the earth’s water is groundwater, and it provides 30 percent of our freshwater, rainwater continued to replenish the water, without which the portable water would have become a mirage than it is today (UNSCD, 2001). According to the National Climatic Data Centre (2010), the wettest place in the world with highest average amount of yearly rainfall is Iloro in Colombia; in addition, appropriate decision with regard to irrigation needs and their timing as water conservation strategies for dams and hydro-electric power utilization are all in reliable estimates of monthly knowledge of rainfall cessation or amounts. Furthermore, a reasonable knowledge of rainfall cessation enables the prediction of the length of the growing or rainy season which is most useful for the section of crop activities. Crop matching and cropping sequences (Khanal, 2009). Therefore, in order to ensure maximum and sustainable agricultural productivity, as well as efficient water resources management practices, reliable prediction of the monthly and annual precipitation, the cessation date and retreat of the rainfall are equally very important. The heavy dependence of agriculture on the seasonal characteristics of rainfall in this region, and the increasing evidence of decreasing rainfall in the West African region (Anyadike, 1992; Hass et al., 1995; Olaniran1983a) means that it is essential that these characteristics are predicated effectively on time that is, for the direct forthcoming on ongoing season. According to Khanal (2009), agriculturist is only interested in high portability at a certain point in time. The rains will become fairly continuous and sufficient to ensure enough moisture in the soil at the time of planting. This level will be maintained or even increased as the season advances.

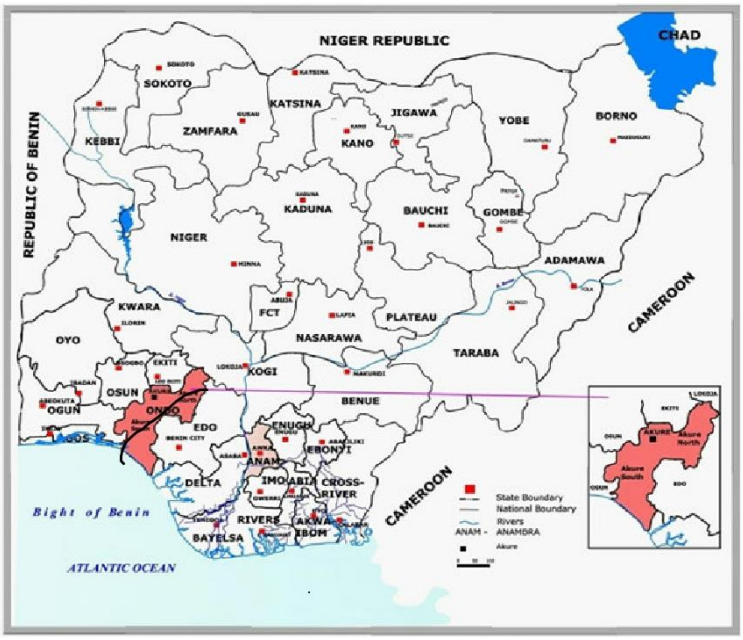

Figure 1. Map of Nigeria showing Ondo State. Source: Google Map, 2019.

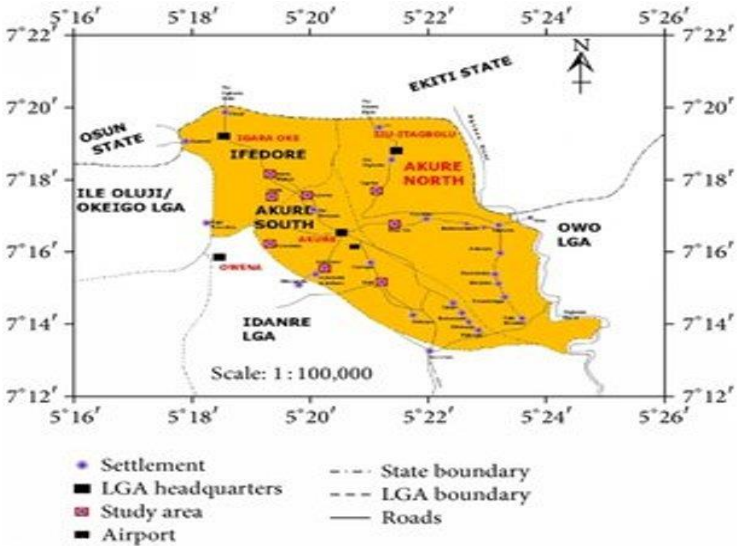

Figure 2. Map of Akure region showing Akure, the study area. Source: Google map, 2019.

MATERIALS AND METHODS

The Study Area

The study area is Akure, capital of Ondo State, Nigeria. Akure is located between latitude 7^0 15'and 7^0 17' North of the Equator and between Longitude 5^0 14' and 5^0 16' east of the Greenwich meridian. It is about 204km east of Ibadan and 311km northeast of Lagos State. Population of Akure rose from 239,124 (NPC, 2006) to the present population on 3.15% to read 360,260. Figure 1 shows the map of Nigeria and the location of Ondo State, while Figure 2 shows the map of Akure region and the location of Akure, the study area.

Method of Data Collection

Data collected and used for this study was from secondary data sources only. Rainfall data only was adopted for this research work, for temperature and other climatic parameters their variability's are so infinitesimal and were almost constant in the study area; the data were obtained from rain-gauge measurement from two types of weather station; synoptic station and Agro-climatological and Ecological Project, Ministry of

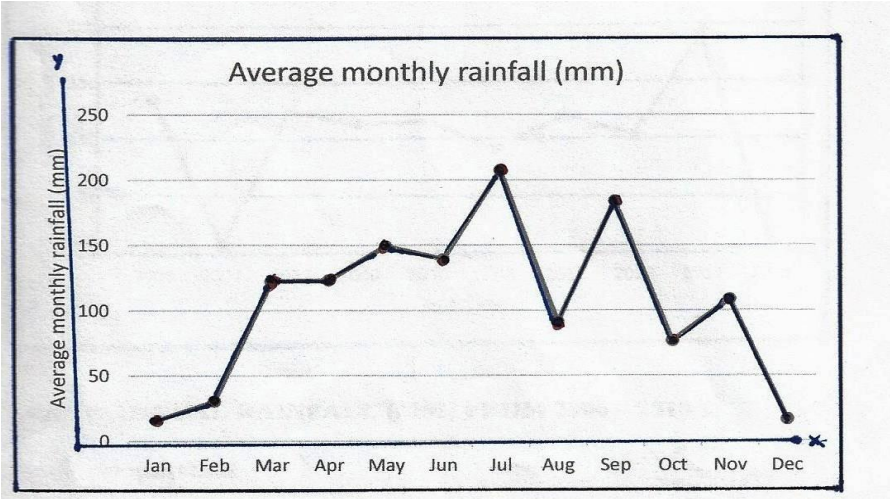

Figure 3. Average monthly rainfall. Source: Authors' field work,2017.

Agriculture, Fisheries and Forest Resource, all in Akure. The data covered a period of ten years that is from 2006 to 2015. This period was considered to be sufficient enough for the determination of the growing season for cassava over a small study site, as the study area.

Data Analysis

The cassava growing season was determined using Joliffe and Dodd (1994) techniques with some modifications that stated the end of the crop's growing season. Joliffe and Dodd (1994) techniques for prediction of wet season in tropical climate, submitted that the rainy season has started when a period of five days with at least 25mm of rainfall occurs, the start day and at least two other days in this period are wet (that is with >0.1mm rainfall received) and no dry period of 7days or more occurs in the following 30 days. The use of 5 days period with at least 3 wet days is to preclude the chance of a false start defined as early rainfall followed by long dry spells. Therefore, in order to reliably state the end of the cassava growing season, the following modifications were added to the technique: (I) When a period of 5 days starts having less than 25mm of rainfall (II) 3 days of this period are dry (<0.1mm rainfall received) and (III) This is followed by a dry period of 7days or more.

RESULTS AND DISCUSSION

Pattern of Rainfall Distribution in Akure Between 2006 And 2015

Figure 3 shows the amount of average monthly rainfall (mm) from 2006 to 2015. The highest amount of rainfall occurred in July with (207.65mm) and the lowest monthly rainfall occurred in January with (15.875mm). The rainfall pattern across the months followed seasonal fluctuation, with more rainfall between March and September than the other months. Rainfall generally increased from March. Figure 4 indicates the amount of average annual rainfall (mm) from 2006 to 2015. The highest rainfall occurred in 2014 (193.358mm) and the lowest rainfall occurred in 2007 (4.525mm). From 2008, there was a fairly regular amount of rainfall till 2013, then in 2014 the amount of rainfall greatly increased and then 2015 witnessed a big drop in the amount of rainfall from 2014. Figure 5 shows the rainy days in a month from 2006 to 2015. The highest rainfall occurred in July with 14.5 times and the lowest monthly rain day occurred in January with just 0.5 time. However, it could be understood that the rainfall occurrence was not stable in all months but with a steady increase from March to July before it eventually fell in August, rose slightly in September and dropped gradually till December. Similarly, the rainy seasons recorded an increase in the daily rainfall than that of the dry season. This was for the crop understudy as the growing of cassava is evidently seen in Akure. Figure 6 shows the daily rainfall per year from 2006 to 2015 where the year with the highest rainy day occurred in 2006 with 114 times rainfall and the year with the lowest rainy day occurred in 2011 with 79-time rainfall. The pattern, however, shows that rainy days rainfall pattern fell gradually from 2006 to 2009, 2010 witnessed a slight increase in the rainy days and then and a continuous rise and fall was witnessed year between successive years from 2010 to 2015.

Tables 1 and 2 show that there are variations in both the yearly rainfall and that of the rainy days in the study area.The highest mean annual rainfall was in 2014 with 193.36mm with a small standard deviation of 117.05 followed by year 2006 with 135.11mm with standard deviation of 102.91mm and the least annual rainfall in 2011 was 91mm with a standard deviation of 85.40.

The total number of rainy days also varies throughout the

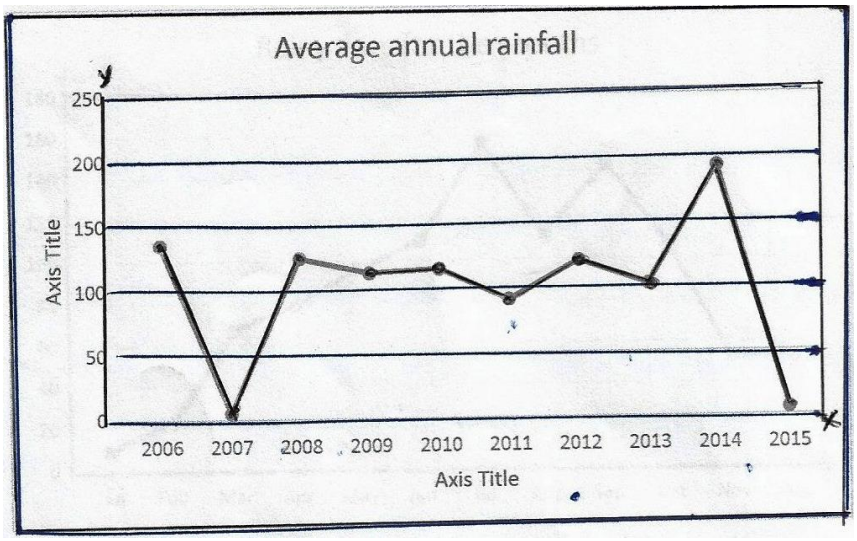

Figure 4. Average annual rainfall. Source: Authors' field work,2017.

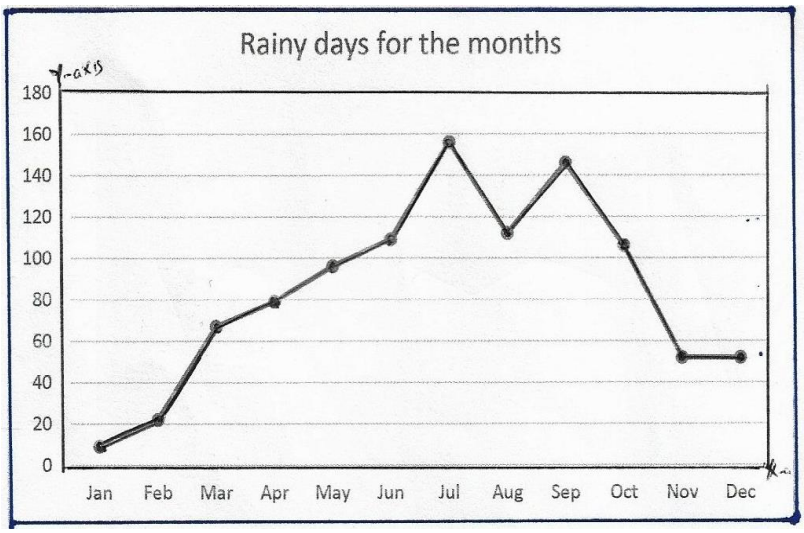

Figure 5. Rainy days for the Months. Source: Authors' field work, 2017.

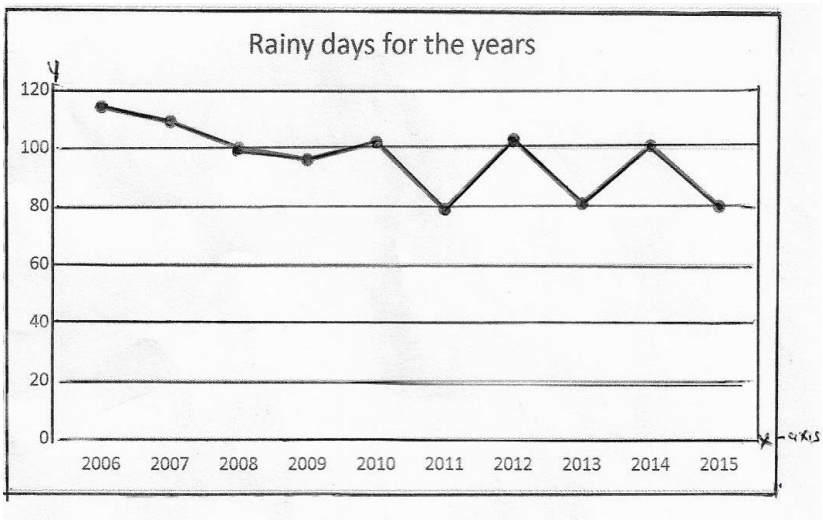

Figure 6. Rainy days for the year. Source: Authors' field work, 2017.

Table 1. Variation in yearly rainfall and rainy days from 2006 to 2015.

Years	Mean Annual Rainfall	Maximum and Months (Mm)	Minimum and Months (Mm)	Standard Deviation	Total Rainy Days	Total Annual Rainfall
2006	135.1058333	352.5 (SEPT)	0 (Dec)	102.907204	114	1621.27
2007	4.525	13.9 (JUL)	0 (JAN And DEC)	3.97557648	109	54.3
2008	124.23	344.6 (JUL)	0 (JAN And FEB)	120.458388	100	1490.76
2009	112.5416667	331.5 (JUL)	0 (JAN And DEC)	93.1382079	96	1350.5
2010	115.2125	251.6 (SEPT)	26.25 (Feb)	73.1728038	102	1382.55
2011	91	229.5 (SEPT)	0 (JAN And DEC)	85.4004001	79	1092
2012	120.7916667	214.6 (MAY)	17.9 (Jan)	92.1390838	103	1449.5
2013	102.5333333	259.2 (SEPT)	15.2 (Feb)	80.3102544	81	1230.4
2014	193.3583333	355 (NOV)	0(Dec)	117.047259	101	2320.3
2015	5.233333333	28.7 (SEPT)	0 (JAN, NOV And DEC)	7.95022393	80	62.8

Source: authors' computation, 2017.

Table 2. Variation in monthly rainfall and rainy days from 2006 to 2015.

Months	Mean Monthly Rainfall	Maximum and Year (Mm)	Minimum and Year (Mm)	Standard Deviation	Mean Monthly Rainy Day	Total Monthly Rainfall
January	5.791666667	2 (2012)	0 (2013,2014,2015)	1	0.5	15.875
February	11.48594167	4 (2012)	0 (2015)	1.707825	2.25	30.5
March	43.77524733	9 (2013)	5 (2015)	1.825742	7	122.5
April	44.99025243	11 (2014)	2 (2015)	3.9457573	7.75	123.275
May	53.36024733	11 (2012)	7 (2014)	1.825742	9	149.255
June	49.889738	10 (2012,2013)	7 (2014)	1.414214	9	139.255
July	75.282282	20 (2015)	12 (2013)	3.696846	14.5	207.65
August	35.462435	14 (2014)	1 (2013)	5.737305	9.25	91.4
September	67.04301267	17 (2012)	10 (2014)	3.304038	13.75	184.075
October	29.97909267	13 (2012)	6 (2015)	3.162278	10	76.775
November	40.24134	14 (2014)	2 (2015)	5.09902	7	108.625
December	6.589323	4 (2013)	0 (2014,2015)	1.892969	1.25	16.625

Source: authors' computation, 2017.

Table 3. Rainfall onset and ceasation of growing season.

Years	Onset	Ceasation
2006	March 26	Oct 10
2007	April 14	Nov 2
2008	May 18	Oct 27
2009	April 2	Nov 1
2010	April 12	Nov 12
2011	April 20	Nov 2
2012	March 25	Nov 7
2013	March 10	Nov 5
2014	March 15	Nov 15
2015	May 2	Oct 25

Source: author's computation, 2017.

years around the years covered in this study. The highest number of rainy days was found in 2006 with 114 days and total rainfall of 1621. 27mm.The least rainy days was in 2011 with 79days and a total rainfall of 1092mm.These show that the number of rainy days did not mean that the year would have the highest annual rainfall. For instance, year 2014 had a total of 101 rainy days with highest total annual rainfall of 2320.3mm while 2006 recorded the highest number of rainy days as 114 days with total rainfall of 1621.27mm.

Table 3 shows the onset and the cessation of cassava growing over a period of ten years. This implies that there are variations in both onset and cessation of growing season over the years.

CONCLUSION

The study has revealed that there is a significant variation in the length of the growing season for cassava crop production over the years in the study area. There

are no two years where the rainfall onset of the growing seasons is the same. Cassava should be planted between May and July every year so as to meet with rainfall onset and the rainfall retreat pattern for good yield, bumper harvest, food security and sustainability in Akure. This type of study should be carried out yearly or every two years in order to help the cassava farmers determine their growing season so that they will not fall victim of false start of rainfall.

RECOMMENDATIONS

Every farmer should bear in mind the rainfall onset and the retreat of rainfall sessions for different types of crops through the extension workers in the Ministry of Agriculture, especially as it is prominent for them to have a bumper harvest. Excess rainfall due to ignorance, improper timing of rainfall could lead to havoc due to flooding, land degradation, damping of tubers and destruction of cash crops and Automatic weather stations should be installed in different parts of the country for appropriate and accurate forecast of rainfall.

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