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EXPLORING THE RELATIONSHIP BETWEEN RAINFALL CHARACTERISTIC AND THE YIELD OF IRISH POTATO ON THE JOS PLATEAU NIGERIA

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ABSTRACT

The research analyses rainfall characteristics on the yield of Irish potato on the Jos Plateau. Secondary data on climatic elements was obtained from Nigerian Meteorological Agency Abuja while crop yield data was abstracted from the official records of Federal Ministry of Agricultural and Rural Development, Abuja. Both climatic and crop data were obtained for the period of 30years (1988 – 2017). The research made use of correlation and regression analysis to establish the relationship between rainfall characteristics and yield of irish potatoe. Mean annual rainfall of 1245mm, length of raining season of 173days, seasonality index of 0.94, onset date of rains 14th April and cessation of 3rd October are established mean rainfall values established in the study. Results obtain shows that length of raining season exhibit a strong positive relationship with the

yield of Irish potato with a correlation coefficient = 0.727 with a significant level at 0.01% confidence level. The Onset date also exhibited a negative and strong relationship with the yield of Irish potato with r value of -0.521. The combined effect of rainfall was found to be significantly strong on the yield of Irish with a correlation coefficient of 0.791 and a coefficient of determinant r^2 = 62.5%,the research therefore concludes that the final yield of crops is not entirely dependent on total annual rainfall, rather on the overall characteristic of the rainfall. It is therefore recommended that further researches be conducted with respect to phenological growth stages of crops and their climatic requirements at the growth stages.

INTRODUCTION

In the tropics, rainfall, more than temperature, determines the season, the amount and timing of rainfall is the chief criteria for distinguishing various climatic characteristics. Contrary to the popular belief that climate is uniform in the tropical region, only a very small portion of the tropics has a year round rainy season. Rainfall is the major source of water available for agriculture and human consumption. Rainfall is an important aspect in both climatic and geomorphological studies. The amount of rainfall in a given region or location is influenced by many factors including relief, wind speed and direction (relative to costal orientation) as well as distance from the ocean. For instance when humid air masses moving across the region are forced to rise over highlands it tends to bring heavy rainfall (Usman, 2013). Similarly, sub-Saharan African is ravaged by hunger and starvation following shortage in food production due to high reliance on rain fed agriculture which is characterized by a high degree of rainfall variability due to climate changes (Emeghara, (2015).

Rainfall characteristics in terms of amount, distribution (spatial, seasonal and diumal), intensity and frequency of rainy days influence agricultural production and

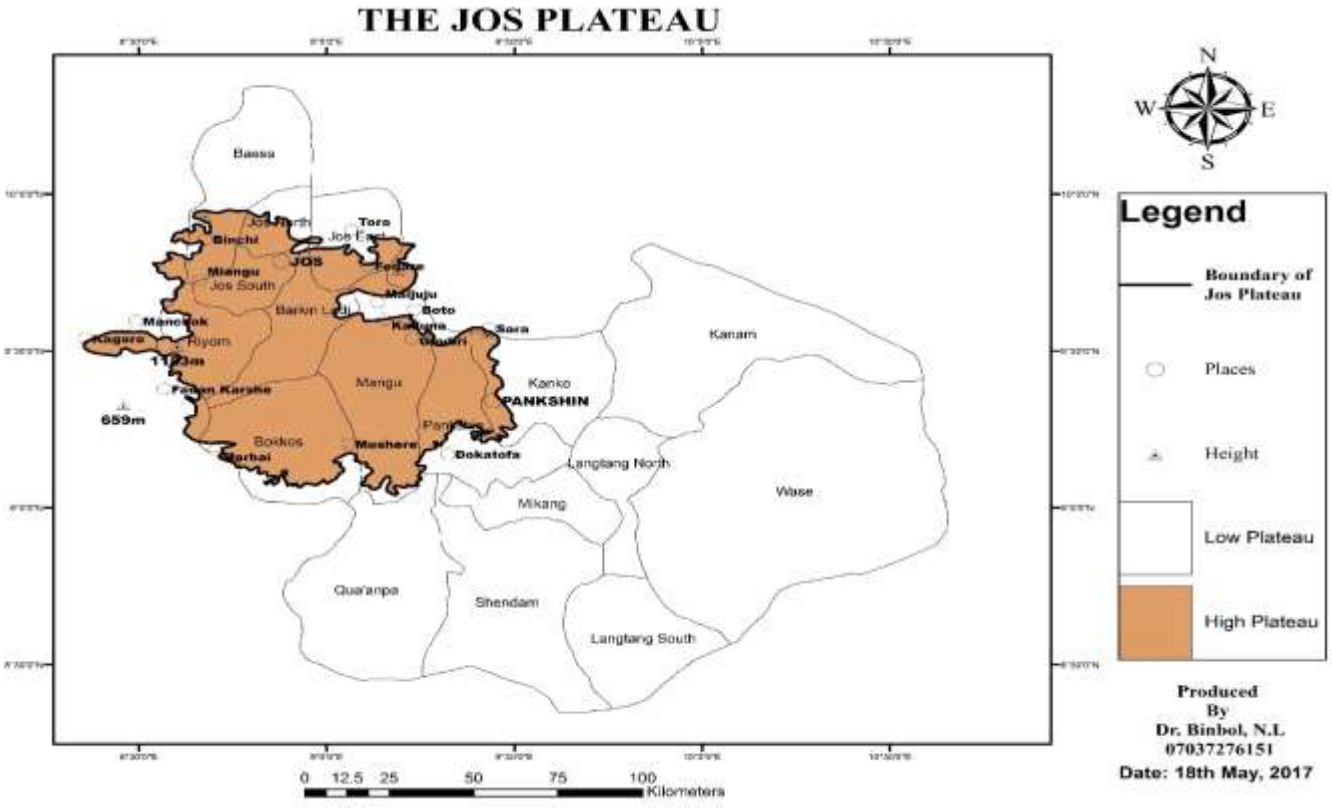
crop field. Rainfall uncertainty remains a critical challenge confronting small holder farmers in Sub-sharan Africa, particular in Jos Nigeria, Rainfall is the major climatic parameter which has a major influence for crop production (Haques, 2009, Kabir and Golder, 2017). Crop production and agricultural practices in general usually vary across regions as this is dependent of a particular region as this dependent on the precipitation pattern of that area. Moreover since the 1950's, warming of the climate system is unequivocal and many observed changes are unprecedented from decades to millennia (IPCC, 2007). Rainfall is a climatic parameter that affects the way and manner man lives. It affects every facet of the ecological system, flora and fauna inclusive (Obot and Onyenkhu, 2011 and Ojoy and Sulaiman, 2018). It has always been captivating when suddenly the bare surface of the earth begins to wear a green look at the onset of wet /rainy season with grasses springing up as well as plants, shrubs and trees-budding and flourish with green leaves all over. All of these are in response of the earth to the rains it receives as rainfall is the most variable climatic factor of the tropics determines vulnerability level of crop production (ayoade, 2004).

Agriculture a main contributor Nigerian economy employing 70% of the rural population and contributing 23% to the nation GDP (Binbol and Zemba, 2007). Majority of agricultural practices in Nigeria depends on rainfall which is characterized by high amount variability both seasonally and annually. The seasonal rainfall variation in rainfall affects cropping calendar the timings of farm clearing, planting, on farm activities and even post-harvest activities related to storage are often characterized by irregularities. Annual rainfall variability on the other hand affects agriculture more in terms of frequency and intensity of fall. While agriculture is generally considered highly climate sensitive, climate change is projected to further exacerbate this sensitivity either positively or negatively. This is because analyses of rainfall trend in the recent past over Nigeria suggests a downward trend in most northern locations, while the southern stations demonstrate an upward trend (NiMet, 2018). Similarly the effects of rainfall variability on some studied

crops have been documented and there abound a strong argument that is not the amount of rainfall available for crop that determines its final yield, but rather, the timing of the rains that matter (Beyers et al, 2014; Bekele et al, 2017; Sawa and Adebayo, 2018).

Description of The Study Area

The Jos Plateau region is located within geographical coordinates of latitude 8^0 to 10^0N and longitude 7^0 to 11^0E. It is bounded in the north by Kaduna state, west by Nasarawa State, to the east by Bauchi state and to the south by Quan Pan, Mikang, Langtang north and Kanke local government areas of the state (fig 1). The climate is characterized by two distinct seasons, wet and dry. The wet season spans a period of 6 months (May – October), while the dry season covers November to April. Mean annual rainfall total stands at about 1200mm, with a mean temperature of about 22^0C (Binbol et al, 2016).



Study Design

The research made use of secondary data particularly data on rainfall and crop yields. Data on rainfall in millimeters collected for period of 30 years (1988 to 2017) was obtained from the achievers office of the Nigerian Meteorological; Agency (NIMET) from heipang Airport jos and utilized for the study. Rainfall data collected existed in a raw form of daily rain-guage record as such monthly and annual Values were derived, the rainfall data was collected from rain-gauge records. According to World Meteorological Organization defines a rainy day as a period where the amount of precipitation exceeds 0.25mm, (W.M.O 2000), Annual crop yield on Irish potatoes measured (in kilograms/hectare) and rainfall (in millimeters), constitute the bulk data for the study spanning a period of 30years. Alongside the crop yield data on irish potatoes collected total land area under cultivation of the crop was obtained. Following this the yield per hectare was calculated by dividing total annual yield of each crop by the land area cultivated over the selected 30 years period.

Analytical Method

The rainfall data collected was subjected to simple descriptive statistical analysis of mean, standard deviation and coefficient of variation.

The mean is expressed as $\bar{x} = \frac{\sum X}{N}$

……..…….

(1)

Where mean is the summation of the distribution (X) divides by the distribution (N).

The standard deviation measures the dispersion about the mean of the variable, it is simply the

Square root of the variance expressed as $\sigma = \frac{\sum(X-\bar{X})^2}{N}$ …..……..

(2)

While the coefficient of variation measures the percentage deviation from the mean, and it is expressed as CV= σ/X x 100%

…… …….. (3)

Furthermore analysis of rainfall characteristics will include annual rainfall amount, onset and Cessation of rainfall, Hydrologic growing season (HGS) or Length of Raining Season (LRS), Seasonality Index, Hydrologic ratio and Dry spell occurrences.

Annual Rainfall Amount: In calculating the annual rainfall amount, data on rainfall in millimeter collected for a period of 30 years was subjected to analysis to establish the years with the lowest and highest amounts of rainfall, the average rainfall over the entire period and the standard deviation for rainfall variability. Furthermore, to establish the annual pattern of annual rainfall variability, Microsoft excel was used to plot a regression trend line for the 30-year time period.

Onset, Cessation Dates and Length of Rainy Season: Onset date of rain refers to the time a place receives an accumulated amount of rainfall sufficient for plant grow. It does not actually refer to the first day rain falls. Cessation of rain means the termination of the effective rainy season. Also is not the last day rain falls, but when rainfall can no longer be assured. The onset and cessation of rains are controlling factors of the calendar of agricultural activities. Length of Rainy Season (LRS) also referred to as hydrological growing season (HGS) is the difference between the cessation date and onset date. Walter (1967), Griffith (1972), Ilesanmi (1972), Adefolalu (1989) and (Binbol *et.,al*, 2016) employed several statistical methods such as mean, media, percentages and standard in order to determine the onset, cessation and length of rainy season. In this present work, Walters (1967) method was adopted due to its accuracy and simplicity. Walter's formula for computing the onset and cessation dates of rains is as follows:

Days in the month

$$\left\{\frac{(51-accumulated\ rainfall\ of\ previous\ months)}{Total\ rainfall\ for\ the\ month}\right\}$$

…… (4)

Where the month in reference is that in which the accumulated total rainfall is in excess of 51mm. For the cessation dates, the formula is applied in the reverse order from December.

Seasonality Index of Rainfall

The rainfall seasonality index measures the spread and steadiness of rainfall during the wet season. It is the sum of absolute deviations of mean monthly rainfall from the overall monthly mean divided by the mean rainfall. The rainfall seasonality index measures the spread and steadiness of rainfall during the wet season. According to Walsh and Lawler (1981), the seasonality index is computed as follows:

$SI = l/R\sum|Xn - R/12]$, - - - - - - - - - - (5)

Where:

SI = Seasonality Index

Xn = Mean rainfall of month n

R = Mean annual rainfall.

In order to establish the relationship between rainfall characteristics and crop yield, the research employs inferential statistical technique of Pearson Product Moment correlation analysis and regression technique. Rainfall characteristic is considered as the independent variable while crop yield is the dependable variable, the equation is expressed as:

$Y= a +b_1 X_1 + b_2 X_2$ e…… (1)

Where:

$X_1X_2X_3$ = rainfall

Y = crop yields

b1, b2 n …… bn = regression coefficient (each b determines the amount and nature of change in Y (irish potatoe yield /ha) for one unit of change in the corresponding x-value when the other x value are held constant.

x1,x2,…. xn = The independent variables (that is annual rainfall).

e = the error of estimate or residual of the regression. Apart from the coefficients of the independent variables (rainfall characteristics), coefficient of determination (R^2) was used to determine the percentage explanation achieved jointly by the rainfall characteristics. This method was found preferable since it gave the linear and unbiased estimate among other estimators. It has been used by several authors to study rainfall characteristics on crop yield (Akintola, 1983) and (Tyubee, and Odekunle *et al*, 2007). To study rainfall and crop yield.

Presentation of Results and Findings

Annual Variation of Rainfall on the Jos Plateau

Findings on variables under investigation , annual rainfall, length of rainy season (LRS), seasonality index, onset of rain, cessation of rain, and yield of potato are presented in descriptive statistics of minimum, maximum, mean and standard deviation (refer to Table1)

Table 1: Descriptive Statistics for variables under study

Rainfall Xtics	N	**Minimum**	**Maximum**	**Mean**	**Std Deviation**
Ann. RF	30	814.7	1582.7	1245.020	139.2816
LRS	30	129	203	173.17	18.934
S. Index	30	.082	1.10	.9447	.07500
Onset	30	70	138	103.77	14.383
Cessation	30	232	294	273.27	13.539
Irish potatoe Yield	30	1003	9950	6617.07	2508.137
Valid N (listwise)	30				

Source: Authors computation

Out of the 30 years rainfall analyzed, the lowest annual amount recorded was 814.7 mm in the year 1995, while the highest amount of annual rainfall of 1582.7mm recorded in the year 2001. Average rainfall for the entire period is put at 1245.020 mm with a standard deviation of 139.28 mm. This means that the variability of rainfall in Jos is not too pronounce and it is within acceptable standard. this means that the variability of rainfall on the Jos plateau is unnoticeable and it is within the acceptable standard. Further to this, a regression trend line was fitted on the plot and findings shows that in spite of the variable nature of rainfall on the Jos Plateau rainfall seems to be on the increase (refer to Fig.2).

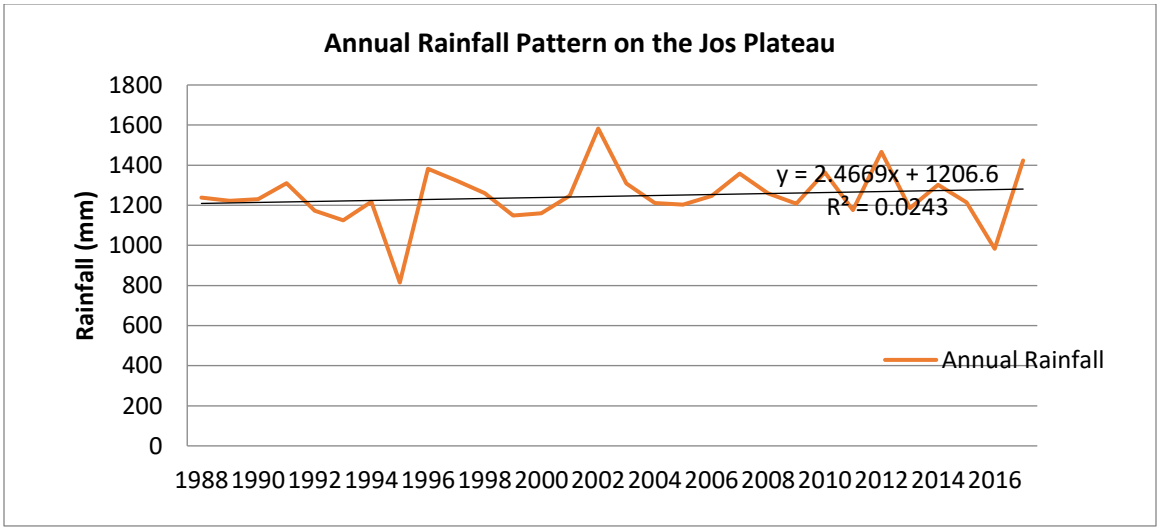


Figure 2. Annual Rainfall pattern on the Jos Plateau.

From the regression equation generated Y= 2.4669X + 1206.6, the correlation coefficient shows that rainfall the X v ariable generally increased from the mean annual of 1206.6 mm with about 2.5mm. The coefficient of determination r^2 confirm the increased in the mean of annual rainfall by about 2.4%. This findings confirm Oruonye *et.al*, (2014) where they discovered that annual rainfall is on the increase in a similar study conducted in

Gassol Taraba state. However this is at variance with the report of Ayanlade *et.al,* (2010) where they found out that rainfall is very high in most parts of Northern Nigeria Guinea Savanna including Yola, Minna and Kaduna except Jos which has a unique pattern. Similarly (Mkoda,2014) stated that mean annual rainfall pattern in Tanzania appears to decrease at a non-significant rate. His findings show that mean annual rainfall has been fluctuating overtime at a decreasing trend. In the same vein Adebayo, (2012) and Oruonye (2014) shows that rainfall decreases as latitude increases from south to north in Taraba state. Nigeria.

Seasonal Variation of Rainfall on the Jos Plateau

Analysis of seasonal pattern of rainfall on the Jos Plateau shows that on the average, rainfall tends to increase from January with a figure of 0.016mm, increasing rapidly as raining season set in to a highest value of 263.79 mm in the month of August. Which is the peak of rainy season on the Jos Plateau. Thereafter rainfall start to decrease to a lowest value of 0.21mm in the month of December. Though the pattern of rainfall on the Jos Plateau is orographic in nature, its seasonal pattern is controlled by the movement of the Inter Tropical Discontinuity (ITD). By August it is expected that the ITD is at its Northern-most position of 22^{0} N of the equator when all Northern locations will experience highest down pour of rain as shown in the single maxima graph in figure 4. It is worthy to note that when Northern stations are enjoying maximum rainfall in August, southern stations will record a slight break. The ITD retreats at twice the speed of its ascend Binbol (2007).

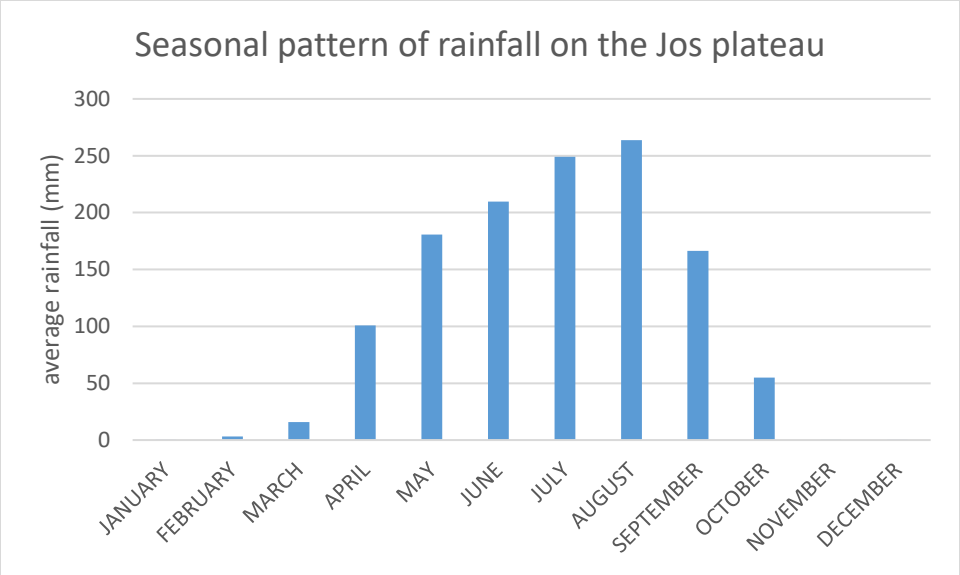


Figure 4. Seasonal pattern of Rainfall on the Jos Plateau Heipang airport station

Length of Rainy Season (LRS)

The length of raining season sometimes is referred to as hydrologic growing season, which is the number of days between onset and cessation of rain in a particular location within the raining season. The mean length of raining season for the study period was found to be 173 days with a minimum occurrence of 129 rain days occurring in the year 2017, and a maximum of 203 rain days occurring in the year 2003.

Analysis of the study period shows a high variability on annual basis of length of raining season (refer to table 2).Knowing this will enable farmers streamline their crop calendar with respect to rain-fed agriculture, Further analysis of length of raining season within the study period shows a steady decrease from 182 days in the year 1998 to a low of 150 days in the year 1995. Thereafter it started to increase gradually from 168 days in the year 1996 to a peak time high of 203 days in the year 2003. This findings disagree with the report of Oruonye *et.al*, (2014) which stated that the length of rainy season (LRS) was decreasing leading to a reduction

in annual rainfall amount and consequent decline in crop yield with an invariably will lead to famine and hunger in Gassol Local Government Area of Taraba State Nigeria.

Table 2: Summary of Rainfall Characteristics and Irish Potato Yield on the Jos Plateau

Year	Annual Rainfall	Length of Rain (Days)	Seasonality Index (SI)	Onset Days	Cessation	
1988	123.7	182	0.85	5th April (93 days)	2nd Oct (275)	4987
1989	1222	176	0.91	15th April (103 days)	6th Oct (279)	5038
1990	1230.9	147	0.91	1st May (121 days)	25th Sept (268)	5289
1991	1309.4	155	0.89	5th April (95 days)	28th Sept (271)	5389
1992	1173.1	173	0.92	18th April (108 days)	8th (281)	5494
1993	1125.5	172	0.82	9th April (93 days)	28th Sept (271)	5580
1994	1217.3	170	0.95	17th April (107 days)	4th Oct (275)	5609
1995	814.7	150	0.96	24th April (104 days)	21st Sept (264)	5709
1996	1382	168	0.88	17th March (93 days)	1st Sept (244)	5804
1997	1323.2	187	0.85	3rd April (93 days)	7th Oct. (280)	5987
1998	1261.3	172	0.99	15th April (105 days)	4th Oct. (277)	6108
1999	1148.2	177	0.99	27th April (117 days)	21st Oct.(294)	6209
2000	1160	188	0.88	23rd April (113 days)	28th Sept (271)	6585
2001	1247.4	194	1.0	15th April (105 days)	26th Sept (269)	7048
2002	1582.7	187	1.1	7th April (99 days)	13th Sept (256)	7446
2003	1308.4	203	0.94	8th April (98 days)	28th Sept (271)	7443
2004	1211.7	163	0.99	11th March (70 days)	20th Aug/ (231)	7502
2005	1203.9	186	0.92	17th April (107 days)	20th Oct (273)	7824

2006	1245.7	187	0.93	7th March (97 days)	8th Oct (271)	8088
2007	1357.2	162	0.99	11th April (101 days)	20th Sept (263)	8253
2008	1259.8	175	0.89	22nd April (112 days)	4th Oct (287)	9231
2009	1207.4	199	0.85	17th April (107 days)	23rd Oct (293)	9518
2010	1364	194	0.86	1st April (91 days)	12th Oct (285)	9762
2011	1176.8	185	0.98	1st April (91 days)	3rd Oct (276)	9788
2012	1467.2	165	0.99	22nd April (112 days)	4th Oct (277)	9796
2013	1185.9	187	0.90	9th April (99 days)	13th Oct (286)	9890
2014	1302	187	1.1	11th April (94 days)	8th Oct (281)	9950
2015	1214.3	136	1.0	9th May (129 days)	22nd Sept (265)	1003
2016	983.7	139	1.1	5th May (125 days)	21st Sept (271)	1084
2017	1423.2	129	1.0	18th May (138 days)	24th Sept (267)	1098

Source: Author's Computation (2018).

Seasonality Index of rainfall on the Jos plateau

Rainfall seasonality index (S.I) measures the spread and steadiness of rainfall during the wet season. It uses the sum of absolute deviations of mean monthly rainfall from the overall monthly rainfall mean divided by the mean rainfall for the year, in order to calculate the seasonality index on the Jos Plateau the average value of all monthly rainfall for the study period was used. Finding shows that mean seasonality index for Jos Plateau is 0.94. This can be interpreted as the rainfall on the Jos Plateau is markedly seasonal with a long dry season of about 6months according to Walsh and Lawler (1981) classification. Analysis for the study period also shows a high degree of variability (refer to table 2). The lowest seasonality index was recorded in 1993 with a value of 0.82 while the highest seasonality index recorded is 1.10 occurring in the year 2002. Observation on the deviation of the

seasonality index for the study period shows that most of the years confirm to Walsh and Lawler (1981) classification for Jos plateau which is within the range of 0.80 to 0.99. Exceptional years with high seasonality index are 2001, 2002 and 2014 to 2017. This result is not in line with report of Francis and Tsunemi, (2015) who found out that seasonality index ranges from 0.18 to 0.19 respectively, and that rainfall variability across the years and seasons are generally moderate in Ghana. The varied views might be as a result of variation in the location of the two study area. In the same similarly Case *et.al.* **(**2008**)** observed that the wet and dry season have changed with an increase in wet season rainfall in the southern region and a decreased dry season rainfall in the northern region of Indonesia. The seasonality, amount, distribution and the timing of the rainfall is of particular importance to the population that depends on rain-fed agriculture for their subsistence.

Relationship between Rainfall Characteristics and Irish potatoYield

The correlation between rainfall characteristics and Irish potato yield is presented on table3. Findings shows that the length of rains days has a strong *significant* positive correlation with Irish potato yield with a correlation coefficient of 0.727. This relationship is significant at the 99% confidence level. This implies that the length of raining season play a very significant role in determining the final yield of Irish Potato. On the Jos plateau Irish potato is planted between May/June and harvested after a period of about 90 days of rain. Analysis of length of raining season for the study period shows that there was no year that recorded less than 90 days. This therefore informs the high correlation coefficient value and the strong relationship established between

length of raining season and yield of Irish potato on the Jos Plateau.

Relationship between cessation dates and the yield of Irish potato observe in table 4 shows a positive but weak relationship with a correlation coefficient of 0.325. This relationship is not significant because Irish potato is normally harvested before the cessation dates within the period under study. It is for this reason that cessation date cannot exert any influence on the yield of Irish potato on the Jos Plateau. The relationship between annual rainfall and yield of Irish potato also exhibit a weak but positive relationship with correlation coefficient value of 0.233. This could be so because Irish potato is harvested mid-way into the raining season on the Jos Plateau, therefore the effect of total rainfall on the yield cannot be quantified.in terms of the relationship between onset date and yield of Irish potato findings shows there is a strong but negative correlation with a coefficient value of -0.521. This relationship is significant at 0.01 confidence level on the (2-tailed) table. This negative relationship indicates that the planting period of Irish potato on the Jos Plateau which currently stand at May to be harvested in July/August is not favourable to Irish potato, this present planting period tends to expose Irish potato to excess moisture during yield formation between the months of June/July thereby resulting to potato blight, a disease that diminishes potato yield greatly. This result is in line with the report of Zaag, (1981) and Ambrose *et.al,* (2013) who found out that excess soil moisture at tuber bulking / ripering stage causes poor soil aeration and root damage which in turn affects crop development and yield. In like manner Nwakocha (1987) also reported that blight causes between 40 to 80 % reduction in yield of Irish. The peak incidence of this disease is between July and August incited by pathogen phythopthora. The disease is accompanied by high relative humidity and

frequent rainfall. Earliest onset date analyzed for the study area, spanning the same study period shows that by 4th April the rains are fully established on the Jos Plateau to guarantee rain-fed agriculture. The relationship between seasonality index and yield of Irish potatoe as observe in table 2 also demonstrate a very weak and negative relationship with a correlation coefficient of -0.144. This findings buttress the earlier result of mean seasonality index for the Jos Plateau which stand at 0.94 and meanings that rainfall on the Jos Plateau is markedly seasonal with a raining season of about 6 months. This seasonality value of 6 months rainfall when analyze against the yield of Irish potato that requires 3 months of rainfall will show that the seasonality value of 0.94 will naturally exhibit a negative effect on Irish potato.

The final determinant yield of any crop is not just an input of soil factor or the annual rainfall but the characteristics studied shows that they play important roles. For Irish potato the residual factors include things like time of planting, cultural practice, weeding, fertilizer application, farming method, soil characteristics, seed varieties, pest and diseases, harvesting and other rainfall chacteristics.

Table 3.Regression summary of the selected crop yield and rainfall characteristics on the Jos Plateau

S/N	Crop Yield	R	r^2	r^2 adjusted	Standard Error of Estimate
1	Irish yield potato	.791	.625	.547	1687.948

a. Predictors: (Constant) cessation, cessation, Ann. RF. S. Index. Onset, LRS

Combine effects of rainfall characteristics on crop yield on the jos plateau

The combined effects of rainfall characteristics were also investigated using regression analysis techniques and the result is presented on table 3. Findings on table 5 shows that the combined effects of rainfall characteristics used in the study which are annual rainfall, length of raining, seasonality index, onset, cessation of rainfall all have a positive combined effect on the yield of Irish irish potato with a correlation coefficient of 0.791. This relationship is found to be strong and significant with a coefficient of determination of r^2 =0.625 this relationship simply means that the combined effect of rainfall characteristics studied will determine 62.5% of the variation in the final yield of Irish potato on the Jos Plateau.

CONCLUSION

Based on the result of thirty (30) years data on rainfall and irish potato yield. It has been observed that there was variation in both rainfall and crop yield on the Jos Plateau. Agriculture as the mainstay of rural food and economy suffers a lot of erratic weather patterns such as heat stress, longer dry seasons and uncertain rainfall pattern. Declined in crop yields due to unfavorable weather and climate will lead to vulnerability in the form of food insecurity, hunger and shorter life expectances.

RECOMMENDATIONS

On the basis of this research certain recommendations have been made in order to ensure that the effect of rainfall characteristics on Irish and maize yield is reduced (and indeed crop yield) is generally enhanced at the study area. The following has been recommended:

(i) The Nigerian Meteorological Agency (MlMET) should issue seasonal forecasts of dates of rainy season onset and cessation, duration of rainy season and

annual number of rain days each year. Considering the sensitivity of crop yields to these variables, farmers should be encouraged to avail themselves of these services and apply such information to enhance early planting and reduce yield losses attributed late planting after dates of onset;

(ii) Agricultural Extension Officers (AEOs) should be deployed to guide farmers through routine visits, sensitization programs on variability in rainfall characteristics, use of farm inputs and monitoring of crop-climate relationship in the area in order to achieve improved crop yield;

(iii) Farmers and agricultural administrators must learn and understand the rainfall characteristics in order to target when to plant their crops.

(iv) To add value, the plateau state government should establish Irish and maize processing plant especially in plateau Northern senatorial district of the state.

(v) The research recommended that further researches be conducted with respect to phenological growth stages of crops and their climatic requirement.

(vi) Finally, these measures will reduce the uncertainties associated with the variability in climatic conditions that would impact on the production of Irish potato and maize in the study area.

The paper is a general attempt is a general attempt to fill dome gaps in the present knowledge on the relationship between rainfall characteristics and irish potato yield. Thus, there is a definite need to further investigate other aspects of effect of

rainfall characteristics on the yield of other crops on the Jos Plateau.

CONTRIBUTION TO KNOWLEDGE

This paper is on exploring the relationship between rainfall characteristics and the yield of Irish poatato on the Jos Plateau identified major contributions to knowledge. These include an establishment of the average nature of rainfall characteristics of annual rainfall, length of raining season, seasonality index, onset date and cessation of rainfall. In addition to these, the paper established the relationship of each rainfall characteristics studied on the yield of Irish potato on the Jos Plateau, as well as the combined effects of the rainfall characteristics studied on the yield of Irish potato.

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Competing interest

The authors declare no competing interest.

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