Impact of Weather on Guinea Corn Production In Kaduna State, Nigeria

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ABSTRACT

Weather variations has become a topical issue in recent time because of its largely detrimental impacts on natural and human systems. The study examines the impact of weather on guinea core production in Kaduna State, it analyse the trend of rainfall and temperature over the past 20 years (1999-2018) and examine the impact of these weather variables on guinea corn production. Rainfall, temperature and guinea corn yield was acquired, data collected were subjected to regression analysis. The findings show that the coefficient of variation as seen above of maximum temperature 4.4 and minimum temperature 2.72 shows that there is a consistency in the variation although not too strong. The findings also show that there is uneven pattern of rainfall implying that crop yield differs from year to year. This is as a result of the relationship between rainfall and Guinea corn in this investigation. The study thereby recommend that Guinea corn production should be regressed on other environmental factors such as soil fertility.

Key words: Weather, Rainfall, Temperature and Guinea corn

Introduction

Year-to-year variations in crop yields pose a significant risk to subsistence farmers or people depending on local supply (Headey, 2011; Schewe *et al*., 2017). Annual crop yields depend on several factors. In addition to weather conditions, the occurrence of weeds, diseases, and pests can result in yield fluctuations (Gregory *et al.,* 2009). Weather has emerged as a global concern in the past 20 years and weather impacts are already being experienced through increasing temperatures, variable rainfall and climate related extreme events. Guinea corn is one of the major cereal crops widely grown in Nigeria, and a very important staple food for the populace particularly in the northern part of the country (Tashikalma *et al*., 2012). The Nigerian guinea corn production was 11.5 tons in 2010 and forecast was 11.7 tons in 2011 (United States Department of Agriculture, 2010). The crop yield has increased because of the acceptance by farmers of improved varieties developed by local research institutes.

The impact of weather on crop production in Kaduna State has received limited attention despite the fact that over 60% of the active populations are farmers. Studies on weather variations have revealed that the potential impacts of weather will include every aspect of the four dimensions of food security; food availability (production and trade), food accessibility, food stable supplies, and food utilization (Nwafor, 2007). Olarenwaju (2012) reported that many of the problems facing agricultural production are weather related. It is against this background that this study analyse the trend of rainfall and temperature over the past 20 years (1999-2018) and examine the impact of these weather variables on guinea corn production in in Igabi Local Government Area of Kaduna State.

Igabi Local Governmnet Area lies on latitudes 10^0 25′ 28″ N and 11^0 35′ 53″ N and Longitudes 7^0 21′ 49″ E and 7^0 50′ 00″ E (Figure 1.1). The area covers an area approximately 3,727 square kilometers and shares boundaries with Kaduna North, Kaduna South, Zaria, Kajuru, Kauru, Igabi and Birnin-Gwari Local Government Councils. Turunku is the headquarters of Igabi LGA which was the seat of power of the famous Queen Amina of Zazzau. The study area has an average annual rainfall of 1250mm. The rains occurs between months of April – October when the South Westerly humid winds brings in rain. The dry seasons last between November and March when the prevailing North Easterly winds (Harmattan) brings with it dusty, dry and cool air of the Sahara desert ushering in the dry season. The mean annual rainfall in the study area ranged from 1000mm to 1500mm. The month of August-September recording highest rains of 300mm (Yamusa, Abubakar and Falaki, 2015). The rainy season starts between 10th of April to 20th of May and extends to October. The temperature of the study area resembles that of the North Central Zone of the country. Temperature ranges between 25^0 C – 35^0C during the dry season. The temperature may rise to about 42^0C in March/April which is the hottest period. The coldest month is December/January. During the harmattan popularly referred to as the West Africa Doctor, temperature sometimes reaches freezing point (Record from the nearest meteorological station over a period of 15years) (Yamusa, Abubakar and Falaki, 2015).

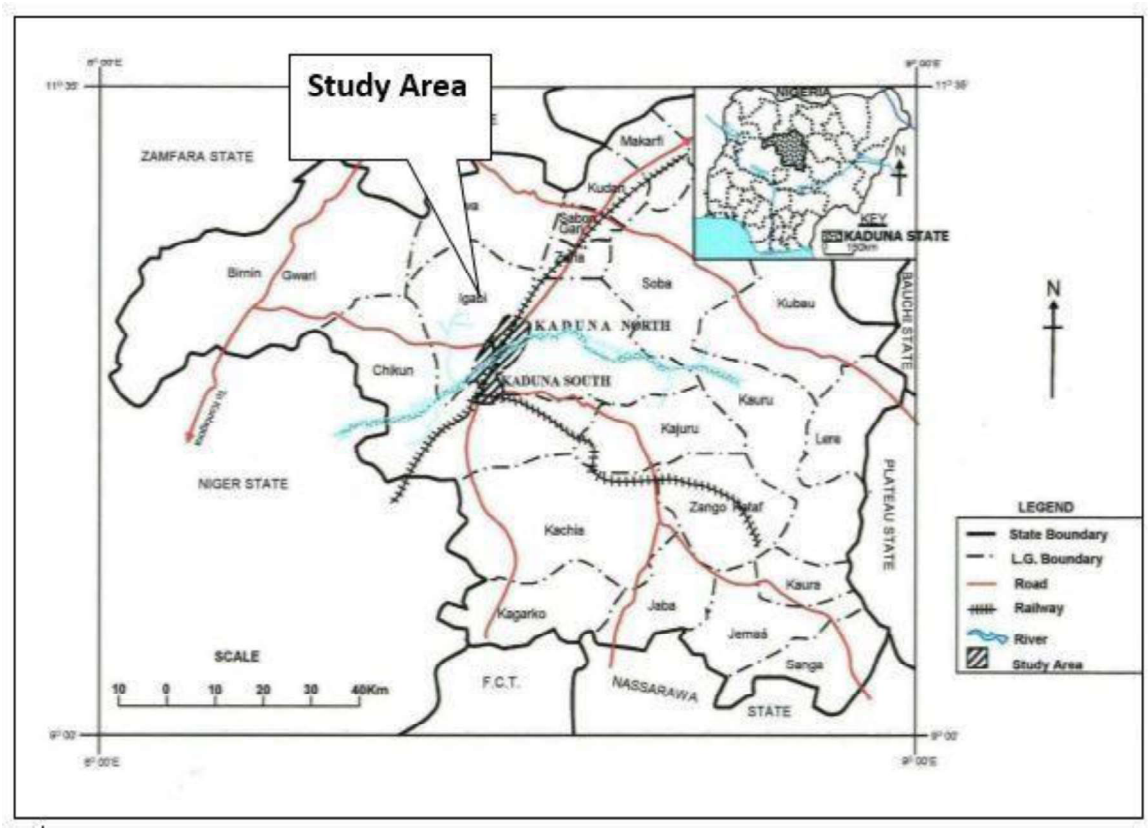

Figure 1.1: Kaduna Map showing Igabi

Source: Kaduna State Ministry of Land and Geoinformatics, 2018

Literature Review

Weather plays an important role in agricultural production (Stern, 2011). It has a profound influence on crop growth, development and yields; on the incidence of pests and diseases; on water needs; and on fertilizer requirements (Tenge, 2011). This is due to differences in nutrient mobilization as a result of water stresses, as well as the timeliness and effectiveness of preventive measures and cultural operations with crops (Timofeev, 2012). Weather aberrations may cause physical damage to crops and soil erosion (Stern, 2011). Weather factors contribute to optimal crop growth, development and yield (Bradshaw, 2013). They also play a role in the incidence and spread of pests and diseases. Susceptibility to weather-induced stresses and

affliction by pests and diseases varies among crops, among different varieties within the same crop, and among different growth stages within the same crop variety (Selvaraju *et al*, 2015). Even on a climatological basis, weather factors show spatial variations in an area at a given time, temporal variations at a given place, and year-to-year variations for a given place and time. For cropping purposes, weather over short periods and year-to-year fluctuations at a particular place over the selected time interval have to be considered. For any given time unit, the percentage departures of extreme values from a mean or median value, called the coefficient of variability, are a measure of variability of the parameter.

Greenhouse gases emissions from human activities are responsible for weather variation (Li *et al.* 2011). Weather variations leads to increased temperatures, changing rainfall patterns and amounts, and a higher frequency and intensity of extreme climate events such as floods, cyclone, droughts, and heatwave (Roudier *et al*. 2011). Temperature increases and erratic rainfall patterns affect crop agriculture most directly and adversely (Lansigan *et al*. 2013;4 Almaraz *et al.* 2016). Variation in weather over time affects guinea corn production adversely (Behnassi 2011). The channels of the impacts are depicted in Figure 2. Variations in weather generally involve changes in two major climate variables: temperature and rainfall. The increase in temperature shortens the phenological phases of crops (such as planting, flowering and harvesting) (Liu *et al*. 2010; Teixeira *et al*. 2011) and affects plant growth and development. The fluctuations and occurrence of extreme weather events reduce guinea corn yields significantly, particularly at critical crop growth stages (Lansigan *et al*. 2000; Teixeira *et al.* 2011).

Rainfall extremes, through droughts and floods are very detrimental to guinea corn productivity. Higher and/or heavy rainfall results in higher yield losses through flooding (Roudier *et al.* 2011). In contrast, insufficient rainfall leads to greater drought frequency and intensity, while increased evaporation leads to complete crop failure (Liu *et al.* 2010). Overall, temperature and rainfall changes reduce the cropped area, production level and yield. This

reduction or fluctuation in guinea corn yield warrant farmers' adaptability to minimise these adverse effects. However, adaptation strategies at the farm level vary from area to area and from farm to farm. Farmers' adaptive capacity is determined by their socio-demographic characteristics, farm characteristics and accessibility to institutional factors

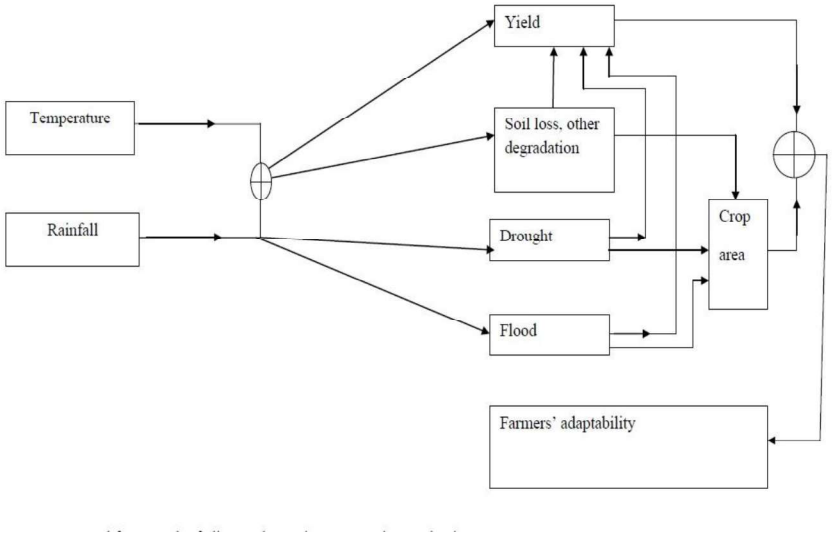

Figure 1.1: Conceptual framework of weather impacts on guinea corn production

Materials and Methods

Quantitative data technique was used, rainfall and temperature data from Nigeria Meteorological Agency (NIMET) of the Nigerian College of Aviation Technology (NCAT) School Zaria and Guinea corn yield was also obtain from Kaduna State Agricultural Development Agency for a period of 20 years (1999 – 2018).

Methods of Data Analysis

The trends of rainfall and temperature variations was analyses using Standardized Precipitation Index (SPI), mean and Diurnal Temperature Range (DTR). Rainfall and maximum temperature were obtained on daily and monthly basis for a period of 20 years (1999 to 2018) and converted into mean annual value using the statistical technique. Multiple linear regression was used to examine the impact of rainfall and temperature and guinea corn production.

Results

The relationship of crop and rainfall gave a negative relationship and others positive relationship. The relationship of both rainfall and temperature on Guinea showed a strong negative relationship. From the 2 it can be deduced that there is a constant increase in temperature. This shows that there is yearly change in temperature that can alter the yield of Guinea corn in the study area. The coefficient of variation as seen above of maximum temperature 34.2 and minimum temperature 32.3 shows that there is a consistency in the variation although not too strong.

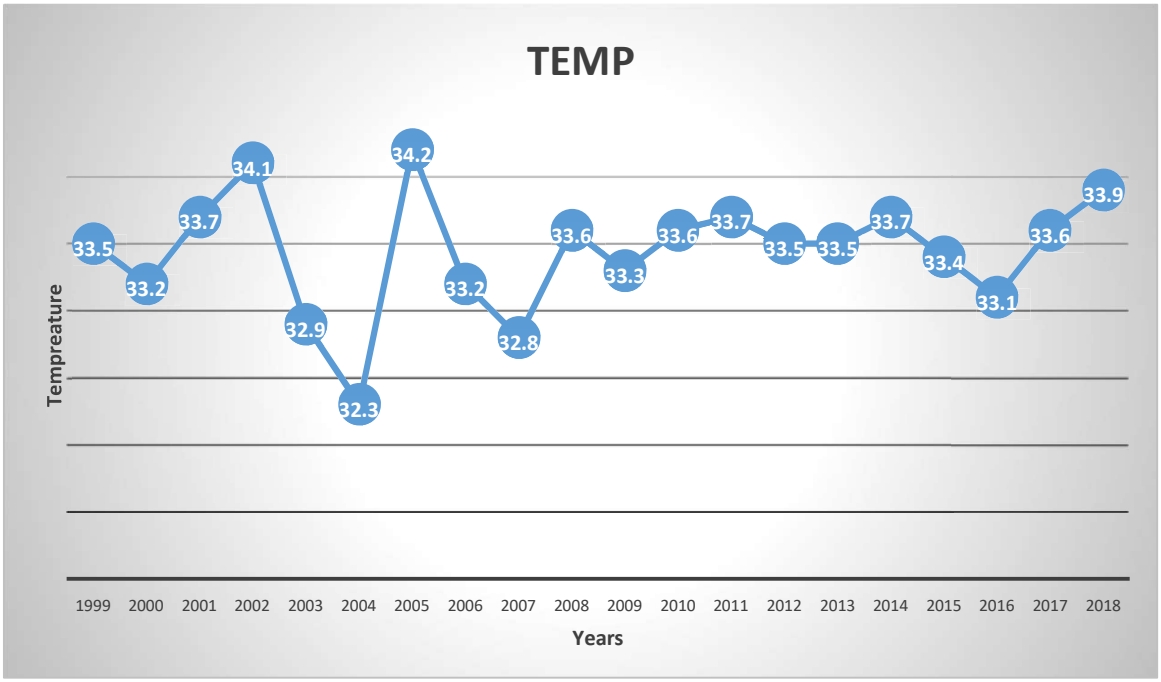

Figure 2: Pattern of Maximum Temperature in the study area

The figure showed the trend of temperature over the years in the study area, a close look at the graph reveals that the temperature from 2010 was constantly increasing except for the fall in 2016, but they never went below 32°C in 2004. The year 2005 experienced the highest temperature of 35°C. Figure 3 shows the annual total rainfall in the study

area from 1999-2018. The average rainfalls were gotten from the estimate of rainfall in a year.

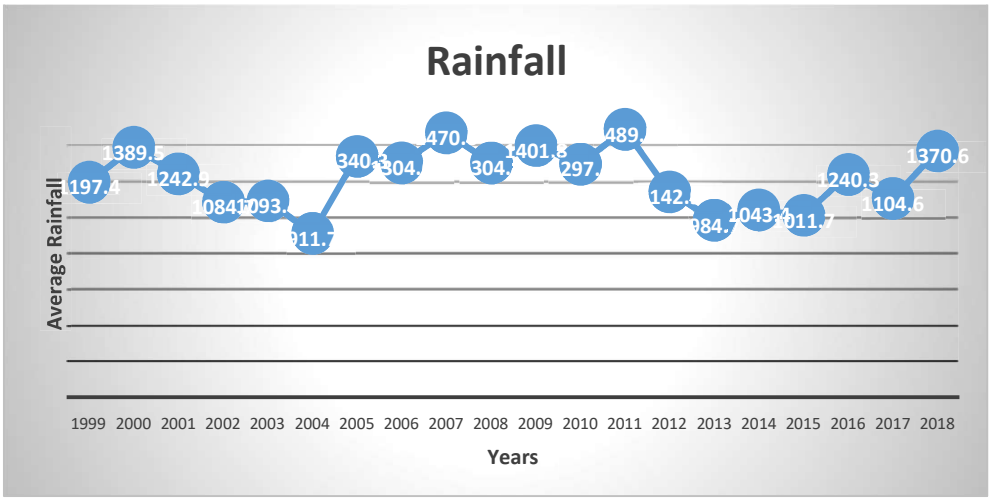

Figure 3: Rainfall pattern in the study area

The graph in figure 3 displays the pattern of rainfall in the study area. A look at the graph shows that there has not been constant rainfall pattern in the study area. But the graph has it that 2012 recorded the highest rain fall followed by 2007. From the graph it is observed that the rainfall pattern fluctuates. this is to show that the rainfall pattern was not stable throughout the decade. The data on Guinea corn yield per tones covers a period of (20) twenty years, that is 1999-2019 and the area cultivated in hectare is presented in figure 4.

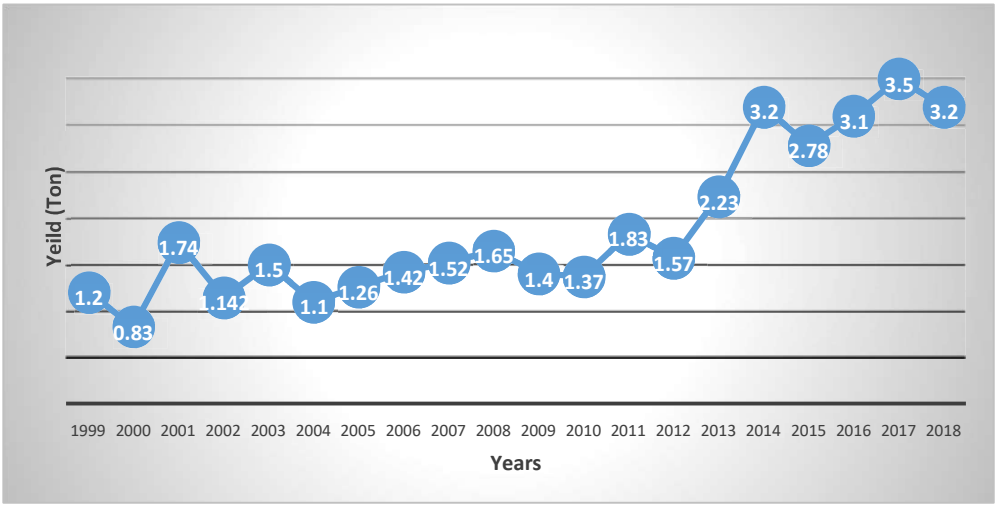

Figure 4: Guinea Corn yield in the study area

Impact of Rainfall and Guinea corn Yield

Figure 5 showed the rainfall pattern over the years. This shows that there is uneven pattern of rainfall implying that crop yield differs from year to year. This is as a result of the relationship between rainfall and Guinea corn in this investigation.

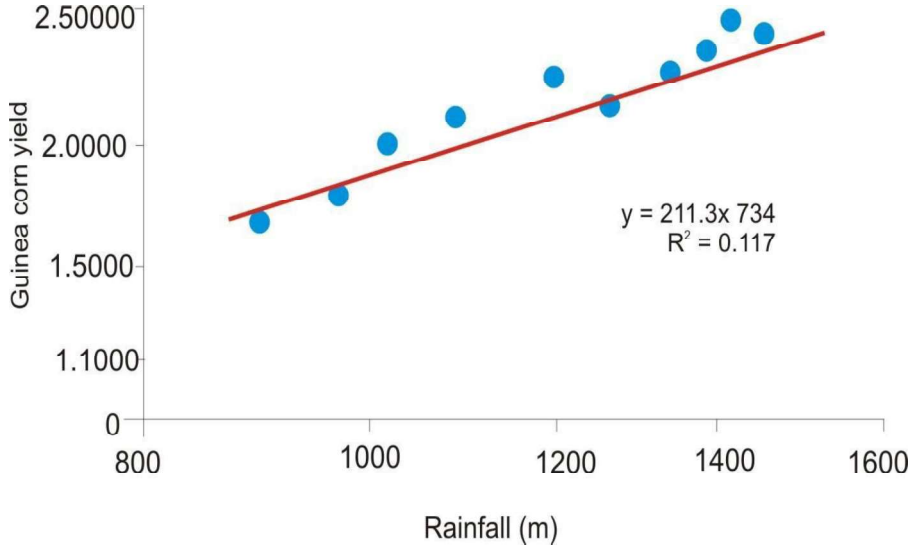

Figure 5: Line graph showing the relationship between annual rainfall and Guinea corn yield

It is also noted that Guinea corn yield in the study area is uneven; this is as a result of the area coverage which differ from year to year. This goes a long way to affect the amount of Guinea corn and the coefficient of variation in the study area. The relationship between temperature and guinea corn yields in the area using the Pearson correlation technique where Guinea corn is dependent variables and temperature, the independent variable. The mean value of crops against the numbers of hectare of land cultivated and the mean value of temperature were used to determine their relationship.

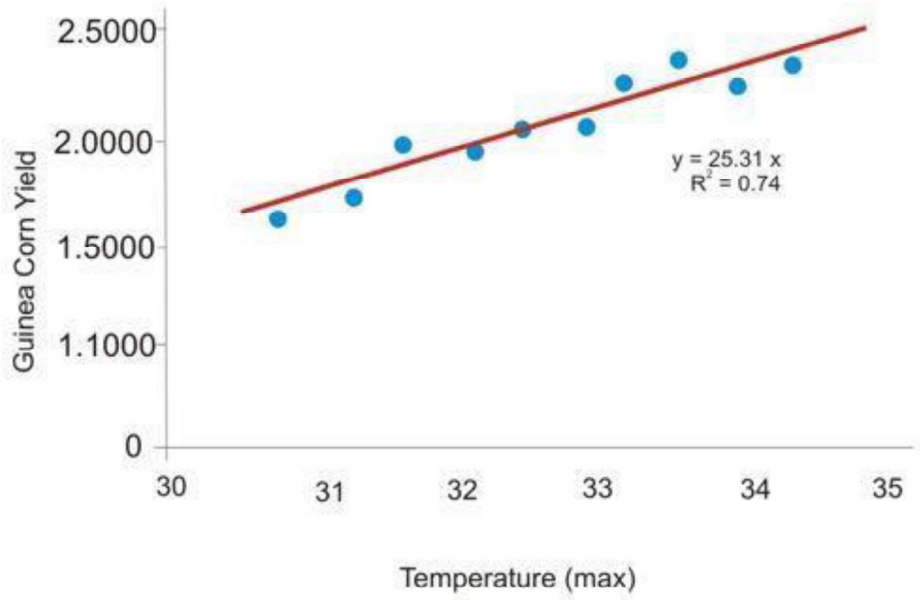

Figure 6: Line graph showing the relationship between temperature and Guinea corn yield

In line with the aim of this study which is to examine the relationship between rainfall and temperature variability on Guinea corn production, multiple regression was applied. The annual yield was regressed against rainfall and temperature to established the relationship that exist between them. Thus, these results were obtained from the regression, as shown in the table below:

Table 1. Summary of the analysis

Variables	Regression value	Remarks
Temperature	0.74	There exists a strong positive relationship between temperature and Guinea corn yield
Rainfall	0.117	There exists a strong positive relationship between temperature and Guinea corn yield

Conclusion

In the relationship between rainfall and Guinea corn yield which has a positive relationship means that there exists relationship between the two parameters. This could be as a result of the data being a secondary data and the author could not monitor the collection which could have some errors. It observed that any amount of rainfall above 1800mm will have a negative effect on Guinea corn yield. Too much rain could lead to water logging. The correlation between rainfall, temperature and Guinea corn yield all show a positive relationship. This means that combination of rainfall and temperature has a great influence on Guinea corn yield and other environment factors such as, soil fertility, seed variety or type etc. The study concluded that the relationship between climatic elements and Guinea corn yield in Igabi local government area is positively significant. This means that rainfall and temperature influence Guinea corn yield but other environmental factor such as soil fertility, type, and temperature technology etc. should also be put into consideration.

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