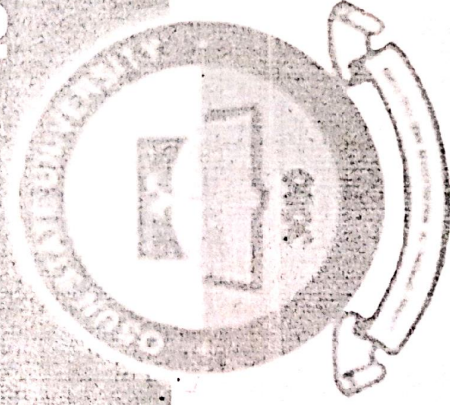


ISSN: 12449-1314



OSUN SOCIOLOGICAL REVIEW

Vol.2, No.1, September 2015

Published by the
DEPARTMENT OF SOCIOLOGY
OSUN STATE UNIVERSITY, OSOGBO
(Okuku Campus)

OSUN SOCIOLOGICAL REVIEW

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**EFFECT OF CLIMATE VARIABILITY ON SUSTAINABILITY OF FOOD
ITEMS IN KWARA STATE, NIGERIA**

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Abstract

Climate of Africa varies from humid tropical climate to hyper-arid Saharan climate. The rainfall is highly variable in space. Different weather conditions allow the occurrence as well as the degree of crop productivity. This work examines the impact of weather variables on crop productivity in the city of Ilorin, Kwara state. The climate data were collected from Nigerian Metrological Agency (NIMET) Ilorin Airport, while the agricultural yields were collected from Kwara Agricultural Development Programme (Kwara ADP). Climatic data on rainfall, temperature, relative humidity, wind speed and sunshine hours were collected for a period of 10 years alongside agricultural data on maize, cassava, cowpea, tomato and groundnut. Linear regression, correlation analytical techniques and analysis of variance (ANOVA) were employed to analyze the data. The result of analysis of variance shows that a magnificent relationship exists between crop yield and the selected weather variables. Also, the regression outcome shows weather variables have control of nothing less than 80% on crop productivity in Ilorin. This study however recommends that proper and regular monitoring of prevailing weather condition would enable farmers to understand the farming techniques to adopt for maximum production of agricultural produce.

Keywords: Agriculture; Climate; Sustainability; Variability

Introduction

Weather is the prevailing atmospheric condition in a given place. Weather is dynamic having elements such as rainfall, temperature, pressure, cloud, wind and humidity. Weather condition existing at a point in time can be observed by anyone; for instance, it can be seen by all if it is raining, windy, sunny or cloudy and can also find out how hot it is by checking a thermometer or just feeling it. Weather is what is happening now, or is likely to happen tomorrow or in the very near future while Climate is average weather condition of a given place or a region. It is typically weather conditions for a given area based on long-term averages. For example, on average, Ilorin is expected to be sunny in February and March, rainy in July and cold in January but there may be annual deviations. Climate is therefore accumulation of daily and seasonal weather events of a given location over a period of 30-35 years (Ayoade, 2004).

Climate variability is the way climate fluctuates yearly above or below a long term average value, this occur over seasons or years (Keely, 2001). It is the variation in the mean state and other statistics of climate on all temporal and spatial scales beyond that of individual weather events. Meanwhile, climate change refers to any change in climate over time, either due to natural variability or human driven forces. Climate change is attributed to both natural variability and human activities. Variation in climate parameters is generally attributed to natural causes. However, because of changes in the earth's climate since the pre-industrial era, some of these changes are now considered attributable to human activities. According to intergovernmental panel on climate change (IPCC, 2007), climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean or the variability of its properties that persists for an extended period, typically a decade or longer. This change has a profound effect on many systems including the food production and storage.

Food is the fuel that stimulates the body for effective performance and the lack of food makes an individual weary, indolent, cheeky and rude. It often leads to mood swings. Food is explained as anything edible that can be solid, semisolid or liquid which when swallowed, digested and assimilated in the body, proves useful to it. Food is important to humans so as to tap those nutrients embedded in them which man needs in sufficient amounts in order to grow, reproduce and lead a normal healthy life. The nutrients in food include Protein, Carbohydrates, Fats, Vitamins, Minerals and Water. Without food, man would constantly go weak, fall sick and grow skinny. Human body needs food to survive because food is the sustainer of the organs. Man can only survive 7days without food after which the body must have undergone some setbacks. Food is the source of energy to man without which man would die (FAO, 2008).

Food nutrients perform numerous functions in human body. For instance, Proteins, water and minerals build cells muscles and blood. Protein sources are cereals and pulses while Minerals can be found in green leafy vegetables. Body tissues are continually broken down and replaced by new ones. Proteins, minerals and water are required to replace them. Essential fatty acids present in certain fats, proteins, minerals, vitamins and water all perform certain regulatory functions such as the coagulation of blood, maintenance of body temperature, activation of enzymes among others.

Climate scenario for West Africa including Nigeria indicates that the climate variability currently experiencing is likely to increase and intensify. Storms, drought and floods are likely to increase in the same frequency and intensity because changes in precipitation levels and pattern are likely to occur and temperatures are likely to rise across the country, intensifying other climatic impacts (John Odey, 2009).

The food and agricultural organization (FAO, 2008) reported that 48 countries, including Nigeria are likely to face food shortage in future. Nigeria estimated population according to the National Population Commission (2012) has risen from 150 million to 168 million. The implication of this according to (FAO, 2008) is that there will be a further pressure on the available food resources in Nigeria.

The issue of food insecurity is of high importance to Nigeria because average calorie and protein intake is grossly inadequate. Estimates showed that at least 41% of the population is food insecure; with 16 percent being severely undernourished (Olayemi

1996). The daily per capital calorie supply as a proportion of requirement was 90% between 1988-1990; 85% 1992-1996, federal office of statistics (FOS, 1999).

Following the above, the need to be fore armed about the devastating effect of drought on food production activities and security motivates this discourse as the drought problem persists in the country. Combating this problem therefore became an imperative issue at hand which needed to be dealt with as a matter of urgency.

- recognizing weather conditions conducive for food production and security.
- implication of severe weather conditions on food productivity.

Study Area

Ilorin is one of the largest cities in Nigeria; being the capital of Kwara state. Ilorin is located within latitude 8°24' N and 8°36' N and longitude 4°10' E and 4°36' E. It covers about 100Km² (Kwara State Diary, 1997). Ilorin has a tropical wet and dry climate. Wet season is experienced from May to November and dry season from November to March. The soils of Ilorin are suitable for farming. These include loamy soil with sodium and low fertility. Because of the high seasonal rainfall coupled with the high temperature, there is tendency for lateritic soil to constitute the major soil types due to the leaching of minerals nutrients of the soil (Ajibade and Ojeola, 2004). The vegetation of Ilorin is composed of species of plants such as locust beans trees, elephant grasses, shrubs and herbaceous plants, among others. The vegetation in Ilorin falls within the derived savanna. The city is underlain by Precambrian basement complex; comprising mostly gneiss, granite, schist, undifferentiated meta-sediments rocks and overburden that are composed mainly of clay, sand and silt soils. The underlying Precambrian igneous-metamorphic rock of basement complex is neither porous nor permeable except in places where they are deeply weathered or have zones weakness. Some part of the town is also laid by sedimentary rocks, which contains both primary and secondary laterites and alluvial deposits.

The most likely scenarios of climate change indicate that increases in weather variability and the incidence of severe weather events will be particularly significant now and in the nearest future, Food and Agriculture organization (FAO, 2008). Evidence indicates that more frequent and more intense extreme weather events (droughts, heat and cold waves, heavy storms, floods), rising sea levels and increasing irregularities in seasonal rainfall patterns (including flooding) are already having immediate impacts not only on food production, but also on food distribution, infrastructure, incidence of food emergencies, livelihood assets and human health in both rural and urban areas.

United Nations Framework Convention on Climate Change (UNFCCC, 2007) submitted that agricultural sector is one of the most vulnerable to climate variability and increased frequency of extreme events in all the economic sectors. It is important to know that not even industrialized countries are immune to considerable impact of climate variability. The yield of key crops dropped by as much as 36 percent in some countries in Europe as a result of the 2003 heat waves, and uninsured economic losses for the agricultural sector in European Union were estimated at €13 billion (IPCC, 2007).

According to Ayode (2003a; 2004 and 2008) drought constitutes a grave hazard to agriculture in both the temperate and tropical regions of world. In his study, he divided drought into permanent, seasonal, contingent, and invisible drought. He stressed that a slow drying of the soil results and crop fail to grow at their optimum rate; the need for supplemental irrigation to combat invisible drought is rather difficult to establish since the crops do not wilt. He recommended decreasing the water needs of crops and increasing the water supply for solution. The impact of drought can be felt on reduced crop yield. The crop yields obtainable in the recent years have reduced owing to emergence of drought. Decrease in the number of rainy days as well as drying up of various inland water-ways have contributed to reduction in food crop production. This decline in food product available for consumption ultimately increases the price of food leaving the poor with little access to food.

Ojo (1991: cited in Geo-studies forum, 2006) viewed food security to imply ability of the part of Nigeria to meet the food needs of her people for an active and healthy life within the framework of her national development aspirations.

Current evidence in Nigeria reveals that apart from being a food deficit nation, the country is characterized by escalating food prices, severe food scarcity and post-harvest losses. According to Salaudeen (2005) as quoted by Oshodi and Oloni (2006), there is the danger of food insecurity in Nigeria due to escalating costs of food stuffs. "Nigerian citizens are hungry and the cost of meeting basic food needs is prohibitive". He opined that the problem of hunger and malnutrition in the country are more severe now than ever before. According to him, "the percentage of Nigerians households that are food insecure has risen from 18 percent in 1995 to over 40 percent now". This findings support earlier studies by Egbuna (2001) that Nigeria is food insecure. Egbuna (2001) study reveals that the country is food insecure because domestic aggregate production of food grows at a slower rate than population. He opined as quoted in Geo-studies forum, 2006; that the Nigeria's food production is not balanced since the demand side is greater than the supply side.

Materials and Methods

Data required for this work are mainly from secondary sources which include Climatic data such as rainfall (mm), maximum and minimum temperature ($^{\circ}\text{C}$), and evaporation (mm) of Ilorin, from (2002-2011). Data on crop yields such as maize, groundnut, cowpea, cassava, tomato in Ilorin from (2002-2011). These data are collected from; Kwara State Agricultural Development Programme (Kwara ADP) and Nigerian Meteorological Agency (NIMET) Ilorin Airport. The quantity of agricultural crop productively supplied by the Kwara agricultural development programme (Kwara ADP) run for 10 years (2002 - 2011) being the only available data supplied by the agency.

The obtained data for this research are analyzed using both descriptive and inferential statistics. Descriptive statistics summarizes a mass of data with pieces of information that characterize the whole data set, such values include; variance (V), coefficient of variance (CV), mean ($\bar{x}$), tables and charts and standard deviation (SD). Inferential statistics that will be used include; correlation analysis, multiple regressions and the analysis of variance (ANOVA).

Correlation measures the degree of linear association between two or more variables. This statistics will measure the degree of association between crop variables and crop yields to know if any relationship exists between them.

$$r = \frac{n \sum XY - \sum X \sum Y}{\sqrt{\{n \sum Y^2 - (\sum Y)^2\} \{n \sum X^2 - (\sum X)^2\}}}$$

Where n = numbers of observations

X = climate variables (rainfall, winds, sunshine etc)

Y = crop yields (maize, cowpea, cassava etc)

Regression analysis

This is used when examining the effect one variable has over another variable; that is it analyses the relationships that exists between variables. Regression analysis is the study of nature and extent of association between two or more variables on the basis of assumed relationships than with a view to predict the value of one variable from the other. Simple regression analysis is represented with the formula:

$$Y = a + bx_1 + e \dots \dots \dots \text{eqn.4}$$

While the multiple regression is presented thus;

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + e \dots \dots \dots \text{eqn.5}$$

Where x = crop yields (maize, cowpea, cassava etc)

Y = weather variables (rainfall, winds, sunshine etc)

One Way Analysis of Variance

The technique known as analysis of variance employs test based on variance, ratio to determine whether or not significant difference exist among the means of several groups of observations where each group follows a normal distribution. It is particularly useful when the basic difference between the groups cannot be stated quantitatively. The formula for the analysis of variance is written thus:

- The hypothesis to be tested in this work is; weather variables have no significant impact on crops yield in Ilorin. The variables adopted are;
- Independent variables: weather variables such as rainfall, maximum temperature, sunshine etc.
 - Dependent variables: maize, cowpea, groundnut, tomato and cassava.

The hypothesis is thus stated:

- Null hypothesis (H_0): weather variables have no significant effect on crop yield in Ilorin.
- Alternative hypothesis (H_1): weather variables have significant effect on crop yield in Ilorin.

Results and Discussions

Table 4.0 Weather Variables Distribution over a Period of 10 Years

Years	Max Temp °C	Min Temp °C	Rainfall (mm)	Relative Humidity (%)	Winds (km/h)	Sunshine (hours)
2002	36.44	20.30	1028.50	77.00	6.15	6.00
2003	31.17	17.50	811.75	83.00	5.80	6.00
2004	33.33	20.15	1597.40	82.00	5.32	6.20
2005	35.90	23.90	1144.50	82.50	5.51	6.20
2006	36.47	22.79	1236.99	81.40	4.35	6.30
2007	37.08	22.50	1481.63	78.60	5.07	7.40
2008	36.00	22.00	1381.90	84.00	5.26	6.53
2009	38.00	23.40	1526.57	87.10	5.46	6.30
2010	36.00	23.30	1165.70	87.40	5.33	7.00
2011	35.72	22.73	113.95	84.45	5.42	6.40
Mean	35.611	21.857	1148.889	82.745	5.367	6.433
Std Dev	1.96112	1.97273	436.6710	3.29633	0.46786	0.44547
C.V	5.51	9.03	38.01	4.00	8.72	6.92

Source: Nigerian Metrological Agency, Ilorin Airport 2014.

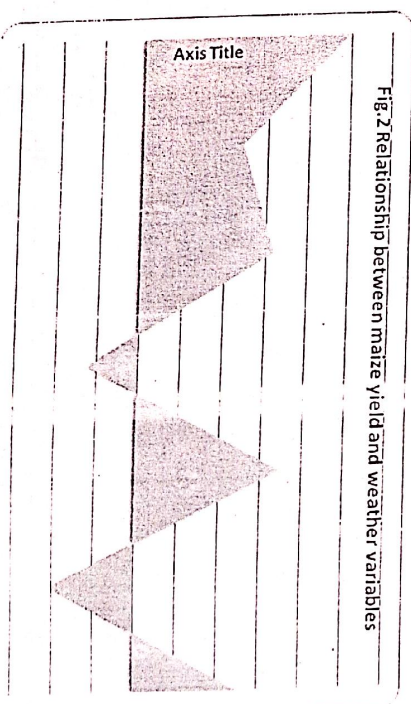
The descriptive statistics result shown in Table 4.0 indicates that the weather variables are homogeneous in their distribution as their coefficient of variation is less than 33% with the exception of rainfall which had 38.01% value. This is suggesting that the weather variables are regularly distributed over the 10years period of study. While maize, cowpea, cassava, tomato and groundnut yields are generally heterogeneous signifying that these crops need different thresholds of weather elements for their growth. On the other hand, the standard deviation shows the deviation of the mean value from each year's variable values. For instance, S.D value for max temp = 1.96112 indicating a slight from the mean annual temperature values, whereas rainfall has S.D = 436.67104 showing a great deviation from the mean annual rainfall values. This deviation is as a result of fluctuation in value of climatic variables during the period of study

Table 4.1 Relationship between weather variables and Maize yield

Maize	Max Temp °C	Min Temp °C	Rainfall (mm)	Relative Humidity (%)	Winds (km/h)	Sunshine (hours)
Maize	1	0.484	0.646	-0.238	0.700	-0.403
Max Temp °C		1	0.824	0.237	0.024	-0.274
Min Temp °C			1	0.118	0.338	-0.452
Rainfall (mm)				1	-0.075	-0.270
Relative Humidity (%)					1	-0.115
Winds (km/h)						1
Sunshine (hours)						

Source : Author's computation, 2014.

Fig. 2 Relationship between maize yield and weather variables



4.2 Relationship between Weather Variables and Maize Yield

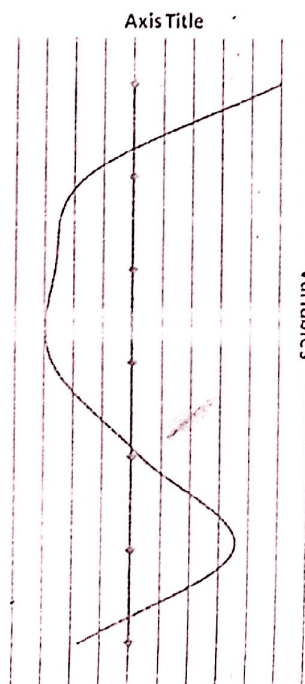
Table 4.1 shows the level of relationship between weather variables and the crop yields are examined. Maximum temperature ($r = 0.484$), minimum temperature ($r = 0.646$), relative humidity ($r = 0.700$), sunshine ($r = 0.510$), rainfall ($r = -0.238$) and winds ($r = -0.403$). The positive relationship that exist between maximum temperature, minimum temperature, relative humidity, sunshine and maize yield simply means that as these variables increases the rate of maize yield also increase this is due to the fact that in the tropical environment temperature is one of the important parameters that aid increment in crop yield. On the other hand, rainfall and winds are inversely correlated to maize yield because of a number of reasons such as; water-logged prone areas and heavy rainfall in such area lead to crop failure as well as occurrence of diseases due to heavy rainfall. As for winds, increase wind speed destroys plantation, for instance wind speed beyond 27km/h is not suitable for tropical crops as high wind speed tends to break the crop stands and in turn reducing the yield. This finding is supported by the fact gradual changes in mean temperatures and rainfall will affect the suitability of land for different types of crops and pasture, climate change and food security (CCFS, 2007) framework.

Table 4.2 Relationship between weather variables and Cowpea yield

	Cowpea	Max Temp °C	Min Temp °C	Rainfall (mm)	Relative Humidity (%)	Winds (km/h)	Sunshine (hours)
Cowpea	1	-0.313	-0.526	-0.544	0.065	0.709	-0.347
Max Temp °C	1	0.824	0.237	0.024	-0.274	0.416	
Min Temp °C	1	0.118	0.338	-0.452	0.452		
Rainfall (mm)	1	-0.075	-0.270	0.240			
Relative Humidity (%)	1	-0.115	0.068				
Winds (km/h)	1	-0.398					
Sunshine (hours)	1						

Source: Author's computation, 2014.

Fig.3 Relationship between cowpea yield and weather variables



4.3 Relationship between Weather Variables and Cowpea Yield

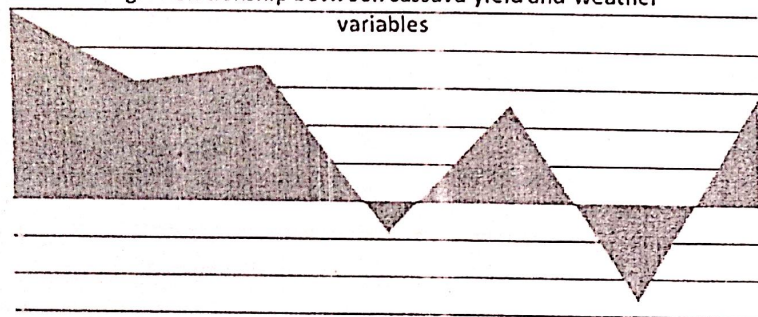
Table 4.2, demonstrates the level of connection between weather variables and cowpea yield in Ilorin. Consequently, two of the weather characteristics namely; relative humidity ($r = 0.065$) and winds ($r = 0.709$) have positive relationship with cowpea yield. This result suggests that increase in these variables will create an increase in cowpea yield. On the contrary, four other parameters; sunshine ($r = -0.347$), rainfall ($r = -0.544$), maximum temperature ($r = -0.313$), and minimum temperature ($r = -0.526$) are inversely correlated against cowpea production in the study area. The negative relationship that exist between rainfall and cowpea yield is based on the moisture requirement of cowpea, which does not need much water to germinate in fact, excess water lead to poor production.

Table 4.3 Relationship between weather variables and Cassava yield

	Cassava	Max Temp °C	Min Temp °C	Rainfall (mm)	Relative Humidity (%)	Winds (km/h)	Sunshine (hours)
Cassava	1	0.628	0.721	-0.169	0.522	-0.524	0.573
Max Temp °C	1	0.824	0.237	0.024	-0.274	0.416	
Min Temp °C	1	0.118	0.338	-0.452	0.452		
Rainfall (mm)	1	-0.075	-0.270	0.240			
Relative Humidity (%)	1	-0.115	0.068				
Winds (km/h)	1	-0.398					
Sunshine (hours)	1						

Source: Author's computation, 2013.

Fig.4 Relationship between cassava yield and weather variables



4.4 Relationship between Weather Variables and Cassava Yield

According to Table 4.3, the result explains that there is a positive relationship between cassava and maximum temperature ($r = 0.628$), minimum temperature ($r = 0.721$), sunshine ($r = 0.573$) and relative humidity ($r = 0.522$). Whereas rainfall ($r = -0.169$) and winds ($r = -0.524$) are inversely correlated. However, as maximum temperature, minimum temperature, sunshine and relative humidity increase, the rate of cassava yield also increases as temperature improves its productivity whereas average rainfall is enough for its proper growth. The inverse relation of winds with cassava yield can be explained on the fact that increase in wind speed beyond 27km/h destroys plantation. It is also not suitable for tropical crops. High wind speed tends to break the crop stands and in turn generating poor production. Ayoade (2004), support this finding that solar radiation, temperature and moisture (humidity) largely determine the global distribution of crops and livestock as well as crop yield and livestock productivity.

Table 4.4 Relationship between weather variables and Tomato yield

	Tomato	Max Temp °C	Min Temp °C	Rainfall (mm)	Relative Humidity (%)	Winds (km/h)	Sunshine (hours)
Tomato	1						
Max Temp °C		1					
Min Temp °C			1				
Rainfall (mm)				1			
Relative Humidity (%)					1		
Winds (km/h)						1	
Sunshine (hours)							1

Source : Author's computation, 2013.

Fig.5 Relationship between Tomato yield and weather variables



4.5 Relationship between Weather Variables and Tomato Yield

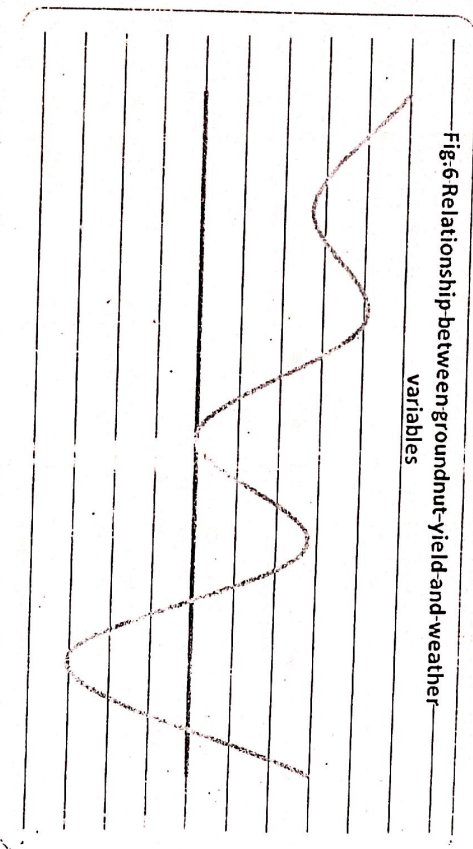
Table 4.4 exhibits the pattern of link between weather variables and tomato yield in the study area. All the parameters seem to have a positive relationship with tomato yield; maximum temperature ($r = 0.389$), minimum temperature ($r = 0.473$), sunshine ($r = 0.251$) and relative humidity ($r = 0.681$) and winds ($r = 0.015$) except for rainfall that is inversely correlated with tomato yield ($r = -0.396$). This result simply means that as the five positively correlated variables increases so does tomato yield and for rainfall, as the amount of rainfall increases, the tomato yield decreases and vice versa. The inverse relationship with tomato yield has with rainfall is due to the fact that tomato cannot be grown successfully in places of high rainfall but flourishes well under warm climate.

Table 4.5 Relationship between weather variables and Groundnut yield

	Groundnut	Max Temp °C	Min Temp °C	Rainfall (mm)	Relative Humidity (%)	Winds (km/h)	Sunshine (hours)
Groundnut	1						
Max Temp °C		1					
Min Temp °C			1				
Rainfall (mm)				1			
Relative Humidity (%)					1		
Winds (km/h)						1	
Sunshine (hours)							1

Source : Author's computation, 2013.

Fig.6 Relationship between groundnut-yield and weather variables



4.6 Relationship between Weather Variables and Groundnut Yield

Table 4.5 above exhibits the relationship between the weather variables and groundnut yield in Ilorin between 2002 and 2011. The result shows that maximum temperature ($r = 0.542$), minimum temperature ($r = 0.807$), sunshine ($r = 0.593$) and relative humidity ($r = 0.548$) have positive relationships with groundnut yield, demonstrating that groundnut yield will increase with increase in these weather variables. On the other hand, weather variables; rainfall ($r = -0.003$) and winds ($r = -0.615$) are inversely related to the yield of groundnut. This indicates that increase in rainfall and winds leads to decrease in groundnut yield. One major reason why a positive relationship exists between groundnut yield and maximum temperature, minimum temperature, relative humidity and sunshine is because groundnut thrives better under hot weather condition than it does in the presence of heavy rain as well as strong wind which can easily blow away the soil cover and distort the opening of the stomata of plants.

Table 4.6 Relationship between weather variables and crops yield

Variables	R	R ²	Standard Error
Maize	0.993	0.986	10.04268
Cowpea	0.937	0.878	1.13365
Cassava	0.991	0.981	85.43043
Tomato	0.934	0.872	3.17384
Groundnut	0.951	0.904	4.47167

Predictors: Maximum Temperature, Minimum Temperature, Rainfall, Relative Humidity, Winds, Sunshine.

Dependent variables: maize, cowpea, cassava, tomato and groundnut.

Source : Author's computation, 2013.

4.7 Strength of Relationship between Weather Variables and Crops Yield

The result presented in Table 4.6 shows the degree of relationship between the weather parameters and crops yield in the study area. The strength of the relationship varies for each crop; Maize ($R = 0.993$ and $R^2 = 0.986$), this implies that maize production is highly dependent on the relationship between maize and weather variables. There is a very strong positive relationship of 99 %. Cowpea has ($R = 0.937$ and $R^2 = 0.878$), the result indicates that 88% relationship exists between cowpea yield and weather elements. Although it is strong positive relationship, it is not as weather dependent as Maize. Cassava on the other hand is estimated to have these values ($R = 0.991$ and $R^2 = 0.981$), meaning that there is a strong positive relationship value of 98% between cassava yield and weather elements in Ilorin. For Tomato, ($R = 0.934$ and $R^2 = 0.872$) which also indicate a strong positive relationship but at a lesser degree. Finally, Groundnut yield relationship with climate parameters gives ($R = 0.951$ and $R^2 = 0.904$), also implying a strong positive relationship of 90% between groundnut yield and weather variables.

From the results of the analysis of the relationship between weather variables and crop yield, it is obvious that climate plays a very vital role in determining rate of crop productivities, although the level of weather dependence varies from one crop to another due to differences in weather conditions requirements for buoyant yield for different crop.

Table 4.7 Analysis of variance (ANOVA) explaining the level of significance between Weather variables and crops yield

Variables	Fc	Fa	Level of significance
Maize	34.680	0.007	0.05
Cowpea	3.600	0.160	0.05
Cassava	26.133	0.011	0.05
Tomato	3.418	0.170	0.05
Groundnut	4.682	0.116	0.05

Predictors: Maximum Temperature, Minimum Temperature, Rainfall, Relative Humidity, Winds, Sunshine.

Dependent variables: maize, cowpea, cassava, tomato and groundnut.

Source : Author's computation, 2013.

4.8 Level of Significance between Weather Variables and Crops Yield

Null hypothesis (H_0): weather variables have no significant effect on crop yield in Ilorin.

Alternative hypothesis (H_1): weather variables have significant effect on crop yield in Ilorin.

Decision rule: Reject H_0 when F-calculated > F-table.

Conclusion: from Table 4.7, F-calculated values are greater than F-table values therefore we reject the H_0 stating that weather variables have no significant effect on crop yield and accept the H_1 , meaning that weather variables have significant effects on crop yield. This

implies that weather variables are crucial determinants of level of crop productivity. There are other factors like soil fertility, presence of micro-organisms, slope and elevations, crop rotation which either directly or indirectly depend on weather condition. Agricultural production in Ilorin is therefore a product of climate variability.

Conclusions and Recommendation

This study observed the effect of weather variables on crop yields in Ilorin, the result obtained from the regression and correlation statistics reveals that climate has huge impact on crop productivity during the years of study. In other word, the result implies that, although there are variations in climatic parameters within the years, such variation has considerable impact on the selected crops and the degree of the impact varies for different crop. For instance, maize productivity is more vulnerable to weather variability than any of other crops examined. Both minimum and maximum temperature favours the yield of cassava while excess rainfall disrupts proper growth of in maize and tomato.

However, it should be noted that variation in crop yield could be as a result of other factors. Such factors account for about 20% of reasons for variation in crop productivity. These factors include; soil type and nutrient, farm techniques and soil morphology of an area also determine how blossom crop will yield. Such crop like cowpea and groundnut do not require much rainfall to grow well. In fact, the results also show that increase in both minimum and maximum temperature favours the yield of Cassava while excess rainfall disrupts proper development in Maize and Tomato. Proper orientation should therefore be given to the local farmers on how to maximize the available climatic resources i.e. planting of crops under conditions that favours its productivity. More so, regular monitoring of the prevailing weather conditions should be put in place so that farmers would understand the farming practice to adopt at different weather condition for maximum production.

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