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INFLUENCE OF SOME SELECTED CLIMATIC VARIABLES ON YAM PRODUCTION IN BOSSO LOCAL GOVERNMENT OF NIGER STATE

Grace Jude Idoko
Department of Agricultural Economics and Extension, Ibrahim Badamasi Babanida University
Lapai, Nigeria
Email: gracejude9@gmail.com

ABSTRACT:

This study focused on the influence of Some Selected Climatic Variables on Yam Production in Bosso Local Government of Niger State. Secondary data was obtained from the Nigerian Meteorological Agency, Minna (NIMET). The data acquired include rainfall and humidity data. Also, data for crop was obtained from the Agricultural development program Minna. The result of the study therefore shows that positive relationship exists between yam production and rainfall/relative humidity in the area under study. As for the rainfall, it was observed that in 2020, where the rainfall value was maximum, the accompanying yam production was also very high, also in 2010 when the rainfall amount was recorded least, the yam production for that year was not much. Any variation in result could be associated with the source of data and the study areas. Summarily, it can be stated that there is an established positive relationship between climatic data (rainfall and relative humidity) and the production of yam for the period under study. The study recommended that there is a need to develop and promote yam varieties that can withstand drought conditions given the impact of rainfall and humidity on yam production. Farmers should also be encouraged to adopt improved irrigation systems to mitigate the impact of low rainfall on yam production. This could include the use of drip irrigation systems or rainwater harvesting. Finally, farmers should be advised to plant yam at optimal times, taking into consideration the climatic conditions of their region.

Keywords: *Climate change, Farmers, Yam production.*

INTRODUCTION

Extreme weather events, natural disasters, and failure of climate change mitigation and adaptation are listed as the fourth most likely and impactful global risks in 2018 after only weapons of mass destruction, according to the World Economic Forum's Global Risks Landscape 2018 Report (WEF, 2018). Changes in climate have already occurred and are increasing the challenges for agriculture nationally and globally. Many of these impacts will continue or intensify in the future (United States Department of Agriculture, 2016). Like many other countries and regions of the world, the sensitivity of agriculture to weather and climate conditions could be severe and their impacts could have substantial direct (effects of changing climate conditions on crop and livestock yield) and indirect effects (effects arising from changes in the severity of pest pressures, availability of pollination services, etc.) on farm production and profitability (USDA, 2016).

Moreso, Climate change and agriculture are two intertwined entities. A change in weather condition over a certain period of time is identified as climate change. The activities of agricultural production impact climate change adversely, vice versa. Climate change has become an imperative challenge facing African countries, while the impact is largely due to little revenue, more dependence on climate-sensitive sectors such as agriculture, and the lack or poor ability to get acclimatized to the changing climate (Belloumi, 2014). Agriculture has been known to be an important component of the human society for its numerous importance to man. Agriculture refers to the production of crops and rearing of livestock for man's benefit (Tamini, 2011).

Yam is an important crop in many tropical regions of the world, providing food and income for millions of people. It is a versatile crop, with various cultivars and uses in different regions, from staple food to cultural and religious practices. However, yam production is vulnerable to the effects of climate change, which could potentially affect crop yields and quality (Bamire & Amujoyegbe, 2005). Yams are agronomical, annual rain fed crops which grow for 6-12 months depending on the cultivar, ecology and soil properties in the production area. They serve as staple food in many tropical and even sub-tropical countries. World yam production is about 30 million tons annually with 90% grown in the yam production belts of West Africa (FAO, 2015).

Rainfall and humidity are the leading climatic factor that influences crop growth and productivity. Rainfall variability is increasingly becoming a source of concern, particularly in the rain fed agricultural regions of the world, this is due to its pattern, distribution and seasonality. In a typical rain fed agricultural region, scarcity of water and uncertainties in both the amount received and spread, remains a major threat to agricultural development which is usually associated with significantly poor yield and

high variability in crop production on yearly basis (Agidi, 2014). Therefore a change or unpredictable pattern of rainfall onset, cessation and length of growing season in a location can have a negative effect on the farmers in an area that depend on rainfall for their farming activities (Agidi, 2017).

Studies on annual rainfall variability impact on crop yield used model-base simulations in their analysis. Despite there is sufficient rain, its irregularity can affect yields adversely if rains fail to arrive during the actual growing stage of crops (Hassan, 2013). According to Odekunle (2004), it is clear that, of the climatic factors which influence the pattern and productivity of rain fed agriculture in Nigeria, the availability of water to crops is by far the most important. Generally, based on rainfall distribution, certain crops are found at a particular geographical location. (Akpodiogaga-a & Odjugo, 2010) pointed out that rainfall distribution explains why the drought resistance crops such as millet and sorghum are grown largely in the Northern part while crops that are more moisture demanding such as rice, maize and cassava are grown in the North Central areas of Nigeria extensively. To date, much of the effort to analyze rainfall pattern in Nigeria with respect to agriculture has generally focused on the exploitation of the seasonal rainfall (Yamusa et al., 2013).

The season distribution of rainfall and its subsequent effects on crop productivity especially yam has however received less attention although its effects may be as important as the total seasonal rainfall. For a better understanding of the issue of rainfall availability in tropical rain fed agriculture, much more attention needs to be given to the quantification of season rainfall pattern (Yamusa et al., 2013). Therefore, understanding the influence of climatic variables on yam production is critical for effective agricultural planning and management. This study aims to investigate the relationship between selected climatic variables and yam production, focusing on rainfall, and humidity.

Statement of the Problem

Over the years, despite the technological advances to crop production in Niger State such as the introduction of high yield crops, the application of fertilizer and provision of extension services, the yield of crops still varies in different parts of Niger State. This results in hunger and starvation of people who solely depend on this crop for their socio- economic activities. Yam is an important staple crop in many tropical regions of the world and is a source of livelihood for many farmers. However, the yield and quality of yam are influenced by various climatic variables such as temperature, rainfall, and humidity. Understanding the effects of these variables on yam production is crucial for effective agricultural planning and management (FAO, 2015).

The length of rainy season and humidity causes a lot of problems to the farmers in their effort to put an increase in

the production of yam. Igwebuike, *et al*., (2014), noted that climate prediction and analysis of past and present trends indicate that small- scale farming households in tropical and sub- tropical areas are exposed to increased climate risk and become more and more vulnerable to these risks resulting in the decline of crop yields. The intergovernmental Panel on Climate Change, (IPCC, 2012), noted that yield from rain-fed agriculture in different African countries could be reduced by up to 50 % by the year 2020. Agidi (2017) noted that the inter-annual rainfall variability and crop yields in Nasarawa State, have resulted in the decline of crop yields due to variability of rainfall pattern. Akpenpuun (2013) observed that the relationship between tuber crop yield variations in Kwara State to climate variation. Therefore, the problem addressed in this study is to assess the influence of some selected climatic variables on yam production in Bosso LGA, Niger State.

Aim and Objectives

The aim of this research work is to assess the influence of some selected climatic variables on yam production in Bosso LGA, Niger State. Within this given aim, the specific objectives are to; (1) ssess the rainfall and humidity variability in Bosso LGA for the period under study (2010-2020), (2) evaluate the pattern in yam production for the period under study (2010-2020), and (3) examine the relationship between rainfall and humidity distribution pattern on yam production.

RESEARCH METHODS

This session contains a detail of the materials (data) that was used and the procedures that will be followed in the study of the influence of some selected climatic variables on yam production in Bosso LGA, Niger State.

Sources of Data

The sources of data for the study was secondary data. Meteorological weather data was acquired and used for this research work. The data was obtained from the Nigerian Meteorological Agency, Minna (NIMET). The data acquired include rainfall data. Also, data for crop was obtained from the Agricultural development program Minna.

Instrument for data collection

The instruments for data collection was data obtained from the Nigerian Meteorological Agency, Minna (NIMET). The data acquired include rainfall and humidity data. Also, data for crop was obtained from the Agricultural development program Minna.

Method of Data analysis

Data was analyzed with the Statistical Package for Social Scientists (SPSS). Graphs was produced with Microsoft Excel. Data analysis process in relation to the stated objectives below:

Assess the rainfall and humidity variability in Bosso LGA for the period under study (2010-2020); Secondary data from NIMET was used to get information on the rainfall and humidity variability in Bosso LGA for the period under study (2010-2020). The data was analysed using descriptive statistics such as bar chart, pie chart, histogram etc.

Evaluate the pattern of yam production for the period under study (2010-2020); Secondary data was used to get information on the yam production for the period under study (2010-2020) from ADP. The data will be analyzed using descriptive statistics such as bar chart, pie chart, histogram etc.

Examine the relationship of rainfall and humidity distribution pattern on yam production; The linear regression was employed to examine the relationship between rainfall/ humidity and Yam production over the period of 11 years respectively. Through the use of the linear regression on each of these variables was analysed at a time, which is to say, their analysis was done individually. This was used to model and analyse some variable with the aim of establishing a relationship between dependent and independent variables. Regression analysis was helpful in understanding how typical values of dependent variable change if a given independent variable are altered and keeping another independent variable constant. Regression graph is plotted to give visual relationship.

RESULTS AND DISCUSSION

Examination of the Daily Rainfall Pattern from 2010-2020

The daily rainfall data for the month of January-December for the period of eleven years from (2010 – 2020).

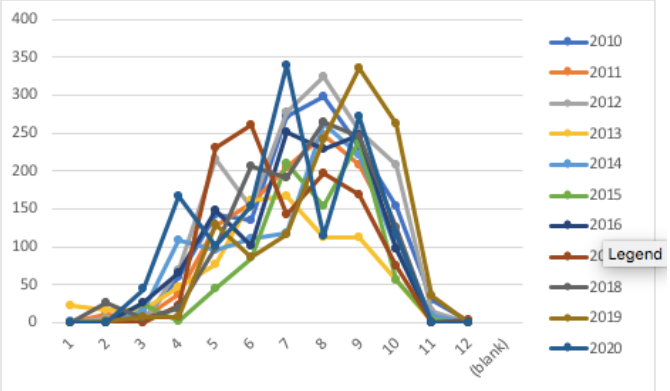

Figure 1. Daily Rainfall Pattern from January-December (2012 – 2021)

Source: Authors computation (2023).

As seen from the figure 1, the blue line which represents 2010 which appears to have the highest tip among all others. From this, it is deduced that on the graph that 2017 has the highest rainfall amount was recorded in 2010, 2012 and 2019. But amazingly, in all ten (11) years, there was no rainfall from 8th – 11th of January throughout all the years.

Examination of the Daily Pattern of Rainfall for The Growing Season of Yam

For good yam production, planting at high standard density, can be carried out in the month of (May). This gives the basis for studying the daily rainfall pattern of the month of (May) for the period under study

(2010 – 2020). Hence, figure 2, presents the data.

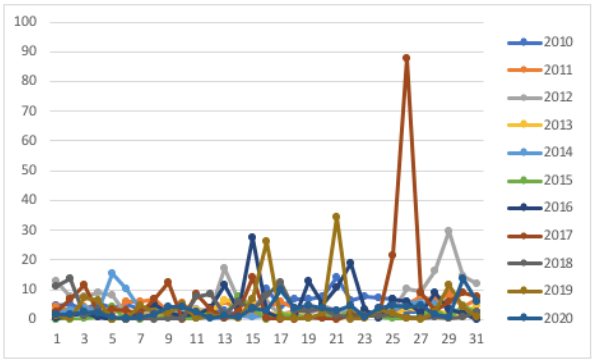

Figure 2. Daily Rainfall Pattern for the Months of May (2012 - 2021)

Source: Authors computation (2023)

Examination of the Daily Rainfall Pattern at the End of the Rainy Season

From the data obtained on the study area, it was carefully observed that, the last month of rainfall were October. The months of October was then chosen to represent the month which brought the rainy season to an end. Hence, for the period under study (2010 - 2020), the daily rainfall in the months of October shall then be considered. As seen in figure 3 below.

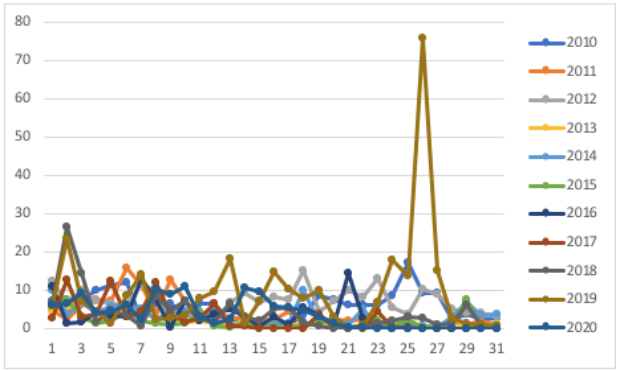

Figure 3. Daily Rainfall Pattern at the end of the Rainy Season

Source: Authors Computation (2023)

The figure 4.3 presents the day with highest rainfall as (25-27) day of 2017 as being represented by the dark brown colour on the chart. Next to the highest value of rainfall is the dark ash colour on the chart (2 day of October 2018) and the least was recorded in every year is zero.

Examination of the Relative Humidity Pattern from 2010-2020.

The daily relative humidity data for the month of January-December for the period of eleven years from (2010 – 2020).

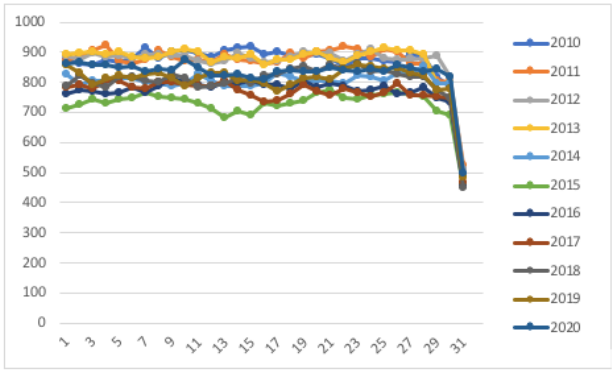

Figure 4. Daily Relative Humidity Pattern From 2010-2020

Source: Authors Computation (2023)

As seen from the figure 4, the blue line which represents 2010 appears to have the highest tip among all others. From this, it is deduced that on the graph 2010 has the highest relative humidity amount which was recorded in 2010, 2011 and 2013.

Examination of the pattern of Yam production from (2012 – 2021)

The total yam produced for a given growing season was calculated and summed up to give the annual yam production in ('000

tons) for the period under study (2010 – 2020). Table 1 gives the data for yam produced.

Table 1. Yam produced in Bosso from 2010 - 2020

YEAR	YAM PRODUCTION
2010	2940000
2011	2987240
2012	4224800
2013	4685810
2014	5399300
2015	6236200
2016	4846110
2017	6091046
2018	14928936
2019	36101860
2020	50101860

Source: Niger State Ministry of Agriculture (2023)

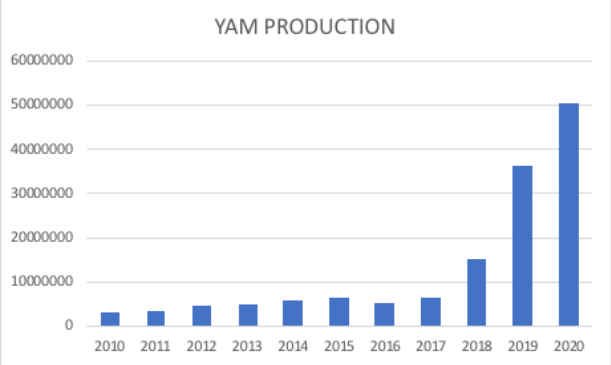

Figure 5. The pattern of Yam production from 2010 – 2020

Source: Authors computation (2023)

As seen from figure 5 there was a fluctuation in the yam production. There was a steady rise in the in the production from 2010 down to 2017. The highest production was observed in 2020 at (50101860), and the least production was obtained in the year 2010 at (2940000).

Examination of the Relationship Between Rainfall Pattern and Yam Production for The Growing Season

Since yam is cultivated in the month of May, the rainfall in this period is being considered, that is to say, the daily rainfall data for the month of May is summed up to give the monthly data. Which is then used to compute the relationship between the two. The table below presents the data for the two variables.

Table 2. Rainfall and Yam Production Data 2010 - 2020

Year	Yam Production	Rainfall
2010	2940000	143.3
2011	2987240	126.98
2012	4224800	215.6
2013	4685810	76.1
2014	5399300	94.84
2015	6236200	45.6
2016	4846110	148
2017	6091046	229.7
2018	14928936	98.53
2019	36101860	129.8
2020	50101860	102.11

Source NIMET Minna (2023)

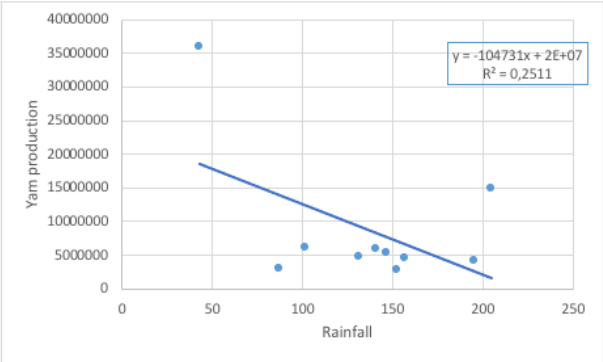

Figure 6. Relationship between rainfall and yam production in Minna from 2010 – 2020

Source: Authors computation (2023)

As seen from the figure 6, the year with the highest yam production was 2020 with a total output of (50101860 tons) but the rainfall for the month of May of that particular year was (102.11mm), furthermore, the least production of yam was obtained in 2010 at (2940000 tons), whereas rainfall for the month of May in that year was (143.3mm). The linear regression analysis carried out between the two variables gave a positive relationship with a value of (R^2 = 0.25), which indicates that rainfall affects the production of yam in the study area.

Examination of the Relationship Between Relative Humidity Pattern and Yam Production for The Growing Season

Since yam is cultivated in the month of May, the relative humidity in this period is being considered, which is used to compute the relationships. The table below presents the data for the two variables.

Table 3. Relative Humidity and Yam Production Data 2010 - 2020

Year	Yam Production	Relative Humidity
2010	2940000	2561.02
2011	2987240	2561.92
2012	4224800	2546.4
2013	4685810	2524.18
2014	5399300	2469.63
2015	6236200	1886.15
2016	4846110	2289.75
2017	6091046	2388.62
2018	14928936	2319.81
2019	36101860	2316.3
2020	50101860	2374.05

Source NIMET Minna (2023).

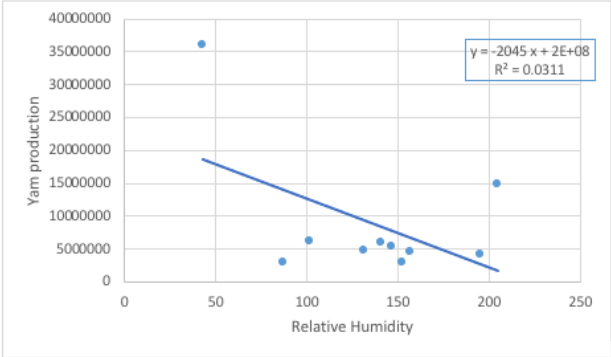

Figure 7. Relationship between relative humidity and yam production in Minna from 2010 – 2020

Source: Authors computation (2023)

As seen from the figure 7 the year with the highest yam production was 2020 with a total output of (50101860 tons) but the relative humidity for the month of May of that particular year was (2374.05mm), furthermore, the least production of yam was obtained in 2010 at (2940000 tons), whereas relative humidity for the month of May in that year was (2561.02mm). The linear regression analysis carried out between the two variables gave a positive relationship with a value of (R^2 = 0.03), this indicates that relative humidity affects the production of yam in the study area.

CONCLUSION

In conclusion, this study aimed to investigate the influence of selected climatic variables, including temperature, rainfall, and humidity, on yam production. The findings from this study highlight the vulnerability of yam production to changes in climatic variables, particularly in regions where yam is a major source of livelihood.

The results of this study demonstrate that rainfall, and humidity significantly affect yam yield and quality. High temperatures and low rainfall negatively impact yam production, particularly during critical growth stages, such as tuber initiation and development. Conversely, optimal temperatures and rainfall positively influence yam production, leading to increased yields and better quality.

The results of this study have important implications for agricultural planning and management, particularly in the face of climate change. Strategies to mitigate the impacts of climate change on yam production should focus on improving irrigation systems, developing drought-resistant varieties, and optimizing planting and harvesting times. Overall, this study contributes to the understanding of the effects of climatic variables on yam production and provides insights into how farmers and policymakers can adapt to changing climatic conditions to enhance yam production and promote food security.

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