THE INFLUENCE OF CLIMATE VARIABLES ON WATERLEAF PRODUCTION IN CALABAR SOUTH LOCAL GOVERNMENT AREA, CROSS RIVER STATE, NIGERIA

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ABSTRACT

Waterleaf is a very important food component in Cross River State and Nigeria as a whole. The study examines the influence of climate variables on waterleaf production in Calabar South Local Government Area Cross River State, Nigeria. The sampling technique used was systematic random sampling. Five waterleaf farm plots from each area were selected within an interval of 2m in each area of the Unical farm and Airport farm. Each plot was gridded into cells of 5×5m and waterleaf within each cell was randomly selected for yield analysis. The method used for data analysis was both descriptive and inferential statistics. The descriptive statistics results shows that waterleaf yield from Unical farm and Airport farm experiences significant increase during December to January 210-210.6 kg with a relative humidity of 65-68%, rainfall 0-0mm and temperature 27.2-28.3^{0}C respectively. While from April to November waterleaf yield from Unical farm and Airport farm ranges between 174.6-144.6kg, rainfall 678.7-100.2mm, temperature 28-22.5^{0}C and 93-65% respectively. The inferential statistics revealed that the results from the regression model for rainfall and temperature for both Unical farm and Airport farm are not significant, indicating that these variables do not contribute much to the model. To determine the relative importance of the significant predictors, the standardized coefficients shows that, in Unical farm temperature, rainfall and relative humidity were -0.176, -0.265 and -0.842 respectively. Airport farm, temperature, rainfall and relative humidity were -0.190, -0.248 and -0.863 respectively. Relative humidity for both Unical farm and Airport farm actually contributes more to the model because it has a larger absolute standardized coefficient. Unical farm and Airport farm Relative humidity are (r=-4.606, p, <0.01) and (r=-4.629, p, <0.01) respectively. This implies that there is a significant relationship between waterleaf yield and relative humidity in Unical farm and Airport farm. The study therefore recommends training scheme for farmers on new and improved farming techniques that will help reduce the effect of climate variables on waterleaf production.

KEYWORDS

Waterleaf yield, Climate variables, Temperature, Rainfall, Relative humidity.

1.INTRODUCTION

Micro climate are set of meteorological variables that defines a particular local area. Micro-climate is distinguished climate of a small area such as a garden, park, valley and part of a city. The micro-climate of an area may determine the level of success or failure of a small area such as a waterleaf garden. A favorable condition of climate may contribute in the improvement of waterleaf yield, while the fluctuations of climate variables can threaten waterleaf yield. The influence of these fluctuations is producing serious challenges to waterleaf production in Nigeria as a whole and in Calabar South Local Government Area, Cross River State in particular.

According to(1), Major fluctuations in climate may affect yield negatively and destroy crops most especially during the 21^{st} century era. The problems associated with climatic fluctuations and change on the output of crops has been a serious concern and deciding factors for agricultural production. The challenges posed by climate variables such as rainfall, temperature and relative humidity on the production of vegetables and crops are numerous and these could include major distortions in the life cycle of vegetables and crops.

Generally, rainfall pattern has been established as one of the most dramatic variable of climate affecting the processes of agriculture especially in the tropics regions (2; 3). Rainfall pattern can also vary significantly within locations that are not too far apart and even on different scales of determination. This implies that the output of crops is fluctuating tremendously within a particular geographical location. This actually exhibits the largest effect in ascertaining the major vegetables and crops that can be produced, the system of farming, the particular sequence to follow as well as the operational procedures of the farm in terms of time Adejuwom[3]. Rainfall regimes can also be seen and considered as the producer of the moisture content that vegetables like waterleaf needs.

Calabar South seems to have a high degree of rainfall during the rainy season, the yield of waterleaf seems not to be responding positively to the rate of rainfall. One would normally expect that the area with the unique rainfall patter should be able to produce the quantity of water lead that is beyond the state consumption capacity, thereby presenting the need to transport them to other states in the country, but this appears not to be the case.

Consequently, the production of waterleaf in Calabar South Local Government Area has not increased significantly in quality and quantity because the region experience severe variability in its climate in terms of rainfall amount and intensity, temperature and the percentage of relative humidity. Fluctuations in the duration, intensity and volume of rainfall, degree of temperature and percentage of relative humidity are believed to be of great concern to waterleaf production. Another area of great concern is the availability of temperature in the study area, considering the fact that temperature as one of the major climatic variables has the tendency to improve waterleaf production.

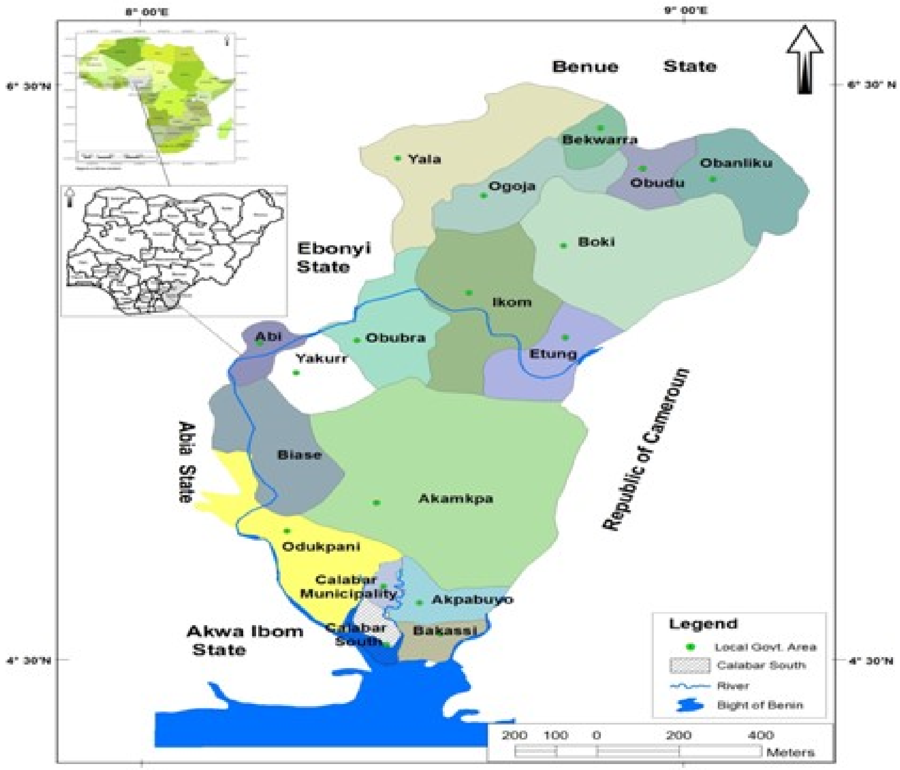
Some studies had been carried out by (4; 5; 6; 7; 8). Unfortunately, there is dearth of literature as regards climatic variables and waterleaf production in Calabar South Local Government Area, Cross River State Nigeria. It is based on this limitation that this study examines the influence of climate variables on waterleaf production in Calabar South Local Government Area, Cross River State, Nigeria with the aim of examining the influence of climate variables on waterleaf production in Calabar South Local Government Area of Cross River State, Nigeria.

2.METHODOLOGY

2.1.STUDY LOCATION

The study area is Calabar South Local Government Area, Cross River State, Nigeria. The study is located on longitude $8^0$19' and $8^0$21' east of the Greenwich meridian and latitude $4^0$54' and $4^0$58' north of the equator. The region is bounded on the north by Calabar municipality and lies on a peninsula of the Calabar River in the west. The Great Kwa River is in the eastern flank of the region while the Cross River Estuary and the Atlantic Ocean are in the southern part of the region (Fig. 1).

The area has a sub-equatorial type of climate. It experiences a moderately high temperature which ranges from 27^0 to 35^0C. The average annual rainfall is between 2000 to 3500mm and relative humidity of 80 to 100 percent throughout the year (9). The area lies in the low lying coastal lands and plains which form part of the larger coastal plains of south eastern Nigeria. The coastal plains are characterizes by level to gentle undulating topography. The elevation varies from zero to fifty metres (0-50m) above sea level and increase northwards from the coast (10).



Source: Cartography / GIS Unit, Dept. of Geography & Environmental Sc., Unical

3.SAMPLING TECHNIQUE

A muti-stage sampling technique was employed in choosing the required samples. In the first stage, the purposive sampling was used to select two areas with high level of waterleaf production. The areas include New Airport and Unical waterleaf farms. The second stage was the selection of five farm plots from each area through the systematic random sampling technique. A sampling interval of 2m was used in each of the waterleaf farm. Each plot was gridded into cells of 5×5m and water leaf within each cell was randomly selected for yield analysis. The water leaves in the farm plots were harvested and the weight in kilogram was determined using a weighing balance.

4.TECHNIQUES FOR DATA ANALYSES

The data collected were analyzed using both the descriptive and inferential statistics. Descriptive tools such as tables, graphs, mean and standard deviation were used. While the inferential statistics such as the paired sampled t-test and multiple regression techniques were also used for the analyses. The IBM SPSS version 22 software was used for the analyses.

5.Results And Discussion

TABLE 1: Mean Climate Variables And Waterleaf Yield

Months	Mean Rainfall (mm)	Mean Temperature (^{0}C)	Mean Relative Humidity (%)	Mean Waterleaf yield Airport farm (kg)	Mean waterleaf yield Unical Farm (kg)
April	100.2	28	80	174	174.6
May	401	27.6	84	149	149.6
June	678.7	25.8	92	144.8	144.6
July	386.6	22.5	93	152	151.6
August	422	25.5	93	148	148.4
September	476.8	26.4	92	147.4	147.4
October	208.4	26.5	88	160.6	161.4
November	392	27.4	86	151.4	151.6
December	0	27.2	65	210	210
January	0	28.3	68	210.6	210.6

Trend of rainfall, temperature and relative humidity for the months of April to December 2015 and January, 2016. Source: (9; 11; 12).

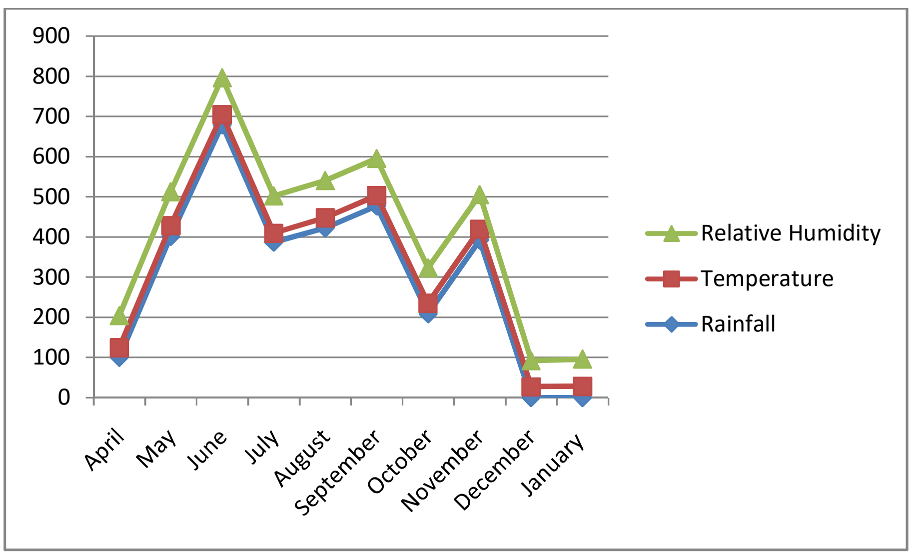


FIG 2: Trend of rainfall, temperature and relative humidity for the months of April to December 2015 and January, 2016. Source: (9; 11; 12).

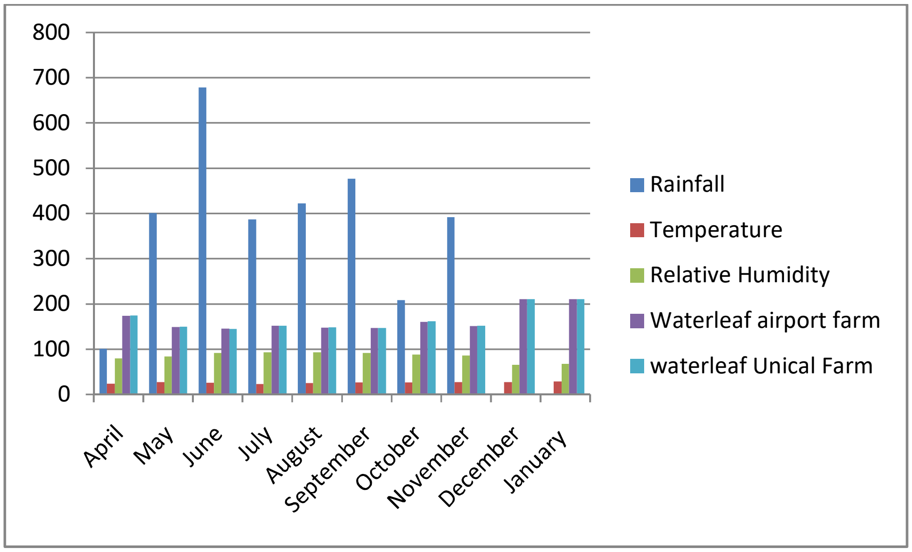


FIG 3: Trend of rainfall, temperature and relative humidity for the months of April to December 2015 and January, 2016. Source: (9; 11; 12).

Figure 2 represent the trend of rainfall, temperature and relative humidity for the months of April to December 2015 and January, 2016. Figure 3 also represent the trend of rainfall, temperature, relative humidity, Unical farm and Airport farm waterleaf yield for the months of April to December 2015 and January, 2016 respectively.

The results in the table from April to December 2015 and January 2016 as it relate to waterleaf in Unical farm and Airport farm revealed that, in April rainfall was 100.2mm, temperature 28^{0}C, relative humidity 80%, Uncial waterleaf yield 174.6kg and Airport farm waterleaf yield 174kg respectively. In May rainfall was 401mm, temperature 27.6^{0}C, relative humidity 84%, Unical farm waterleaf yield 149.6kg and Airport farm waterleaf yield 149kg respectively. June rainfall was 678.7mm, temperature 25.8^{0}C, relative humility 92%, Unical waterleaf yield 144.6kg and Airport farm waterleaf yield 144.8kg respectively. In July, rainfall was 386.6mm, temperature22.5^{0}C, relative humidity 93%, with a corresponding waterleaf yield of 151.6kg and 152kg respectively in Unical and Airport farms. August rainfall was 422mm, temperature 25.5^{0}C, relative humidity 93%, Unical farm waterleaf yield 148.4kg and Airport farm waterleaf 148kg respectively. September rainfall was 476.8mm, temperature 26.4^{0}C, relative humidity 92%, Unical waterleaf yield147.4kg and Airport waterleaf yield of 147.4kg respectively.

In October rainfall was 208.4mm, temperature 26.5^{0}C, relative humidity 88%, Unical waterleaf yield 161.4kg and Airport waterleaf yield 160.6kg respectively. November rainfall was 392mm, temperature 27.4^{0}C, relative humidity 86%, Unical waterleaf yield 151.6kg and Airport waterleaf 151.4kg respectively. December rainfall was 0mm, temperature 27.2^{0}C, relative humidity 65%, Unical waterleaf yield 210kg and Airport waterleaf yield 210kg respectively. In January rainfall was also 0mm, temperature 28.3^{0}C, relative humidity 68%, waterleaf yield 210.6kg and Airport waterleaf yield 210.6kg respectively. The results show that the three climate variables rainfall, temperature and relative humidity contributed to waterleaf yield. These can also be presented among the major factors of the environment influencing agricultural productivity (13; 14; 15).

TABLE 2: COEFFICIENTS[a] FOR UNICAL WATER LEAF FARM

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	420.192	67.640		6.212	.001
	Rainfall	-.030	.018	-.265	-1.639	.152
	Temperature	-2.650	1.642	-.176	-1.614	.158
	Relativehumidity	-2.088	.453	-.842	-4.606	.004

a. Dependent Variable: UnicalwaterLeaf

TABLE 3: ANOVA[a] ANALYSIS FOR UNICAL WATER LEAF FARM

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5563.877	3	1854.626	45.726	.000[b]
	Residual	243.359	6	40.560		
	Total	5807.236	9			

a. Dependent Variable: UnicalwaterLeaf

b. Predictors: (Constant), Relativehumidity, Temperature, Rainfall

The results revealed that, rainfall and temperature are non-significant coefficients, indicating that these variables do not contribute much to the model. To determine the relative importance of the significant predictors, the standardized coefficients shows that, temperature, rainfall and relative humidity were -0.176, -0.265 and -0.842 respectively. Relative humidity actually contributes more to the model because it has a larger absolute standardized coefficient. Relative humidity was statistically significant at (r=-4.606, p, <0.01) (Table 2). This implies that there is a significantly relationship between waterleaf yield and relative humidity. Waterleaf yield increases during December and January 210-210.6 kg with a relative humidity of 65-68%, rainfall 0-0mm and temperature 27.2-28.3^{0}C respectively.

While from April to November waterleaf yield from Unical farm ranges between 174.6-144.6kg, rainfall 678.7-100.2mm and temperature 28-22.5^{0}C respectively. This suggests that a relative humidity between 65-68%, temperature between 27.2-27.3 and rainfall of 0mm can improve water leaf yield around Unical farm. Rainfall of 0mm does not imply that water was not a contributing element to waterleaf yield. Perhaps excess rainfall (moisture) reduces waterleaf yield and farmers in the area prefer timely and conventional watering of their waterleaf gardens during December and January than the natural uncontrolled rainfall. This also implies that farmers should cultivate more waterleaf during December and January.

The ANOVA result in table 3 reports a significant *F* statistic (F=45.726, p<0.01), indicating that using the regression model is better than guessing the mean. The model summary shows a positive fit of R=97.9%, R-square=95.8% and Adjusted R=93.7% respectively.

TABLE 4: COEFFICIENTS[A] AIRPORT WATERLEAF FARM

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	429.866	69.100		6.221	.001
	Rainfall	-.028	.019	-.248	-1.508	.182
	Temperature	-2.868	1.677	-.190	-1.709	.138
	Relative humidity	-2.144	.463	-.863	-4.629	.004

a. Dependent Variable: Airportwaterleaf

TABLE 5: ANOVA[A] FOR AIRPORT WATERLEAF FARM

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5567.015	3	1855.672	43.838	.000[b]
	Residual	253.981	6	42.330		
	Total	5820.996	9			

a. Dependent Variable: Airportwaterleaf

b. Predictors: (Constant), Relativehumidity, Temperature, Rainfall

The results revealed that, rainfall and temperature are not significant, indicating that these variables do not contribute much to the model. To determine the relative importance of the significant predictors, the standardized coefficients shows that, temperature, rainfall and relative humidity were -0.190, -0.248 and -0.863 respectively. Relative humidity actually contributes more to the model because it has a larger absolute standardized coefficient. Relative humidity was statistically significant at (r=-4.629, p, <0.01). This implies that there is a significant relationship between waterleaf yield and relative humidity in Airport farm. Waterleaf yield experiences significant increase during December and January 210-210.6 kg with a relative humidity of 65 and 68%, rainfall 0-0mm and temperature 27.2-28.3^{0}C respectively. This implies that waterleaf yield is on the increase during the dry season with low to moderate precipitation than when the rainfall amount and intensity is copious or torrential.

The ANOVA table reports a significant *F* statistic (F=43.838, p<0.01), indicating that using the regression model is better than guessing the mean. The model summary shows a positive fit of R=97.8%, R-square=95.6% and Adjusted R=93.5% respectively.

6.CONCLUSION

The study examines the influence of climate variables on waterleaf production in Calabar South Local Government Area, Cross River State, Nigeria. The results from the regression model revealed that, rainfall and temperature for both Unical farm and Airport farm are not significant, indicating that these variables do not contribute much to the model. To determine the relative importance of the significant predictors, the standardized coefficients shows that, in Unical farm temperature, rainfall and relative humidity were -0.176, -0.265 and -0.842 respectively. Airport farm, temperature, rainfall and relative humidity were -0.190, -0.248 and -0.863 respectively. Relative humidity for both Unical farm and Airport farm actually contributes more to the model because it has a larger absolute standardized coefficient. Unical farm and Airport farm Relative humidity are (r=-4.606, p, <0.01) and (r=-4.629, p, <0.01) respectively. This implies that there is a significant relationship between waterleaf yield and relative humidity in Unical farm and Airport farm. Additionally, waterleaf yield experiences significant increase during December to January 210-210.6 kg with a relative humidity of 65- 68%, rainfall 0-0mm and temperature 27.2-28.3^{0}C respectively. While from April to November waterleaf yield from Unical farm and Airport farm ranges between 174.6-144.6kg, rainfall 678.7-100.2mm and temperature 28-22.5^{0}C respectively. This suggests that a relative humidity between 65-68%, temperature 28.3-27.2^{0}C and rainfall of 0mm can improve waterleaf yield significantly around Unical and Airport farms. Rainfall of 0mm did not imply that water was not a contributing element to waterleaf yield. Perhaps excess water reduces water leaf yield and farmers prefer timely and conventional watering of their water leaf garden during December and January than the natural uncontrolled rainfall. This also implies that farmers should cultivate more waterleaf during December and January. The study therefore recommends training scheme for farmers on new and improved farming techniques that will help reduce the effect of climate variables on waterleaf production.

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