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The Effect of Climate on Yam Production in Kwara State, Nigeria.

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Abstract: Weather extremes constitute formidable constraints to yam cropping in Nigeria. For instance, Bello (1983) emphasized the negative roles played by flooding on fadama yam farmlands. Thus, this paper examines the impact of climate on yam by correlating climatic variables of rainfall, relative humidity, number of rain days, maximum and minimum temperature, evaporation and sunshine hours with yam production. Both meteorological data and yam production data were collected for forty years (1961-2000). The climate data were obtained from the National Meteorological archive Oshodi, Lagos; while the information on yam yield were obtained from the Bureau of Statistics, Ilorin. The result of the analysis showed that rainfall amount is the most crucial climatic parameter for yam production in Kwara State. Farmers in Kwara State were encouraged to focus attention more on controlling other factors to suit any option climate present.

Keyword: Yam; climate, rainfall, relative humidity, rain days, temperature, correlation.

Introduction

Yam is an important root crop grown in Nigeria. Yam is put into various uses. The major ones include: human consumption (Igbokwe 2001), animal feed (Okoli 1986), raw material particularly in the manufacturing of various drugs within the pharmaceutical industries (Courtesy 1967) and planting material for yam propagation (Okonkwo 1986). However, it is not all yam species that are edible. Meanwhile, this study focuses on the edible ones.

Edible species of yam is a major source of carbohydrate to man's diet. The edible species are mainly different species of *Dioscorea* (such as: *D. alata*, *D. bulbifera* L., *D. dumentorumpax*, *D. Japonica* Thumb, *D. Oppositea* Thumb, *D. rotundatapor*, *D. Trifida* Thumb) (Ozo 1978)). In Nigeria and other parts of the tropics the most widely grown species are *D. rotundata*, *D. Cayenesis*, *D. dumentorum*, *D. bulbifera*, *D. alata* and *D. esculenta*.

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Nigeria has been recognized as one of the leading producers of yam in the world. For instance, out of the annual global output of 28 million tones (Yisa 1999) and 33million metric tons as reported by Oloko (2001), 95% comes from Africa alone out of which 96% is grown West Africa. From this, Nigeria alone produces 70% (Akoroda 1995). This level of contribution to the global pool of yam by Nigeria was further increased by 5% to 75% and later to to about 80% (Abdullahi 2002).

Although Nigeria is witnessing a sporadic rise in yam production, yet the present yield per hectare computed as a percentage of the potential yield for yam crop is still very low. For instance, Nigeria has not met the recommended accelerated growth rate of 4.5% as supplies of yam still run behind demand. Besides, not all yam producing areas in Nigeria can boast of the upward trend in yam production. Example of such area is KwaraState (Table 1).

Table I: Yam yields during various decades

Decade	Yield
1961-1970	11.45
1971-1980	10.30
1981-1990	11.40
1990-2000	10.0

Source: Federal Bureau of Statistics, Lagos 2004

Fluctuation in yield corresponds with area devoted to yam cultivation. The implication of this is that more areas are being put under yam cultivation to increase yield in Kwara State. This may lead farmers to go beyond the potential ecological range for yam cultivation. Such spatial shifts in yam cropping patterns may result in mismatch of environment and yam cropping. To reduce or at least limit yam - climate mal-adjustment, it is therefore necessary to identify and estimate the effects of climate change on yam cropping pattern in Kwara State. Thus, this study attempts identification and quantification of environmental indices that limit spatial extent of yam region in Kwara State.

Weather hazards and variable climate in relation to yam production in Nigeria

Any extreme weather condition, which makes crop vulnerable to low yield, could be described as climatic hazard. Weather extremes are formidable constraints to yam cropping in Nigeria. Bello (1983) reported that whenever there is flooding, fadama yam farmlands are inundated with water. This results in poor soil aeration, reduction of soil oxygen and rapid formation of compound toxic to plant root. This fact was corroborated by the correlation values of crop yield and annual flooding computed nationwide in 1999 (Adefolalu, 1999). The

flooding incidences led to drastic drop in yam production in the yam producing communities in the same period (FBS 1999). For instance, yam production level dropped from 450 thousand tons by 1998 to 210 thousand tons in 1999 record for Delta State, from 703 thousand tones to 436 thousand tones for Oyo, from 730 thousand tones to 452 thousand tones for Oshun and from 14 thousand tones to 5 thousand tones for Ogun State, etc.

On the other hand, moisture stress in the early part of yam plant's life results in significant delay in the onset of tuberizing (Onwueme 1975^b). For instance, the downward trend in yam yield observed in Nigeria during the period of 1970s to greater part of 1980s reported by FOS (2002) corresponds with the time Nigeria witnessed significant reduction in rainfall amount due to El-Nino Southern Oscillation (ENSO) events reported by Afiesimama (1999).

The Study area

Kwara State is located between latitudes 8° 05'N to 10° 05' N and longitude 2° 50' E to 6° 05' E.

Based on Koppen's (1936) classification of climate, Kwara State lies within a region described as tropical climate (Aw). It has a tropical dry and wet climate. The region is characterized by double rainfall maxima. The rainy season commences in April and

lasts till October. Fluctuation exists in amount of rainfall received per year. Temperature is uniformly high throughout the year except in July-August when the clouding of the sky prevents direct insolation.

The climate of Kwara State supports tall grass interspersed with short scattered trees. This attribute predisposes the people of Kwara State to make farming their major occupation. Food crops are grown mostly and cereals and root crops constitute the main food crops produced in the state. The most important root crop grown is yam. Considerable amount of tradition and fanfare is developed around yam production most especially the harvesting in Kwara State example include New Yam Festival, etc. Besides, in every part of the state pounded yam delicacy is reserved for special occasions and festivities. Continual consumption of pounded yam may often be a symbol of wealth or status symbol.

Data and Method of Study

Meteorological data and yam yield data were used in this study. The meteorological

data (rainfall amount, number, of rain days, relative humidity, maximum temperature, minimum temperature, soil temperature, sunshine hours and evaporation) were collected for a period of forty years (1961-2000) from the Nigeria meteorological archive. Yam yield data for similar period was obtained from Federal Office of Statistics, Lagos.

Data Processing

Both climatic and yam yield data were partitioned into four decades of 1961-1970, 1971, 1980, 1981-1990 and 1991-2000. This method of partitioning sheds light on the impact of each climatic variable on yam yield over decades. It also affords comparison in yield as affected by climate between decades. However, to bring out all detailed effects that might have been masked by or lost into decadal grouping; the entire data (both yam yield and climatic variables) were computed and correlated for future prediction of yam yield in Kwara State. Multiple correlation and regression were used to establish these relationships.

Table 2: Yam yield and climatic pattern

Decades	Yield 000/tones	Rainfall (mm)	No. of rainday	R.H (%)	Max. temp (°C)	Min. temp (°C)	Soil temp (°C)	Sunshine (hrs)	Evap. (mm)
1961-1970	11.45	1033.2	91	75	33	20	26	6.6	4.6
1971-1980	10.3	850.9	86	74	33	21	29	6.4	4.7
1981-1990	11.40	925.9	78	72	32	22	32	6.6	5.7
1991-2000	10.10	991.5	77	71	33	22	29	6.2	5.8

Source: Authors Computation.

Results and Discussions

Yam yield and climatic pattern during the various decades of study

Yam yield fluctuates throughout the four decades and the range is between 10.0 and 11.45 thousand tones.

The pattern of climatic variation displayed in Table 2 is an evidence of climate change in Kwara State. Rainfall amount fluctuates; number of rainday and relative humidity are on downward trend. Numbers of rainday drops progressively from 91 during

the first decade to 86, 78 and 77 during the second, third and fourth decades. Similarly, relative humidity stands at 75%, 74%, 72% and 71 % respectively. Maximum temperature is high throughout the four decades with a decadal range of 1° C. A rise in minimum temperature from 20° C record of 1961-1970 to 22° C during the last two decades is observed. Soil temperature also rises steadily from 26° C observed during the first decade to 29° C and 32° C but dropped to 29° C during the fourth decade. Sunshine hours fluctuate between 6.2 hours recorded in the last decade and 6.6 hours observed during the first and third decades. Evaporation maintained a steady rise throughout the four decades of study (4.6mm, 4.7mm, 5.7mm and 5.8mm).

When the fluctuation observed in yam yield was compared with that of climatic pattern some observations were made. For instance, pattern of fluctuation in rainfall

amount and sunshine hours correspond with yam yield. Increase in the above climatic parameters brings an increase in yam yield and vice versa. Other climatic variables that fluctuate with yam yield to a certain extent are number of raindays, relative humidity and evaporation. For instance, decline in number of raindays and relative humidity seems to reduce yam yield throughout the decades considered except for the third decade. On the other hand increase in evaporation rates results in yield reduction except for the third decade.

The implication of the above findings is that when moisture indices is high yam yield is increased but when thermal indices are high low yam yield is expected.

However, to examine the relationship between yam yield and climate with precision, the entire data from 1961-2000 were correlated and the result discussed thus.

Table 3: correlation analysis between yam yield and climate Indices

CLIMATIC VARIABLE	CORRELATION
Rainfall amount (mm)	0.66**
No. of rain days	0.24
Relative humidity (%)	0.18
Maximum . Temperature. (°C)	0.19
Minimum. Temperature (°C)	0.25
Soil Temperature (°C)	-0.10
Sunshine hour	0.20
Evaporation (mm)	-0.21

** Significant at 99.9% Level of confidence

Source: Author's Computation 2004

Positive relationship exists between every other climatic parameters and yam yield except soil temperature and evaporation. The strength of these relationships varies. For instance rainfall amount displayed the strongest positive relationship of 0.66 which is significant at 99.9% confidence level. Others displayed weak positive

relationship while soil temperature and evaporation showed weak negative relationship.

Generally 56% explanation of variation observed in yam yield in Kwara State between 1961 and 2000 was attributed to climate. The remaining 44% may be ascribed to other factors such as edaphic

characteristics, management techniques adopted by farmers, pests/diseases etc.

Conclusion

It is evident from the foregoing discussion that the climate of Kwara State has changed and thus yam production is vulnerable. Both climate and yam yield data examined revealed this. For instance, the fifty-six per cent explanation of variation in yam yield observed is supplied by climate and rainfall amount which represents the most crucial climatic parameter affecting yam yield in Kwara State.

Planning implication

When the arrays of factors affecting yam yield are considered, climate is the most difficult to control of all. Therefore farmers in Kwara state should be encouraged to focus more attention on the control of other factors which affect yield (e.g soil characteristics, management techniques, pests/diseases etc) to suit any option dictates by climate. This may include fertilizer application, irrigation, and application of both appropriate pesticides and insecticides etc to increase yam yield in Kwara State.

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