academicJournals

Vol. 8(1), pp. 54-57, January 2014
DOI: 10.5897/AJEST2013. 1593
ISSN 1996-0786 © 2014 Academic Journals
http://www.academicjournals.org/AJEST

African Journal of Environmental Science and Technology

Full Length Research Paper

Rainfall variability and rubber production in Nigeria

Mesike C. S.* and Esekhade T. U.

Rubber Research Institute of Nigeria, P.M.B. 1049, Benin City, Edo State, Nigeria.

Accepted 9 December, 2013

The role of rainfall in plant could not be overemphasized because rainfall determines the amount of moisture present in the soil which is ultimately made available to plants. The aim of this paper was to determine the variability of rainfall and its effect on rubber production in Nigeria. Towards achieving this aim, time series data from 1971 to 2009 were collected on mean annual rainfall and total annual rubber production. The data was analyzed using descriptive statistics as well as correlation analysis. The results showed that high rubber production was recorded in 1991 while production was low in 1980 and 1983. Results also show that there is an inverse relationship between rubber production and rainfall. The study recommended that protective water proof containers should be used for collection of latex during raining season so as to prevent washing away of latex by rain.

Key words: Rainfall, variability, trend, correlation, rubber production.

INTRODUCTION

Climate plays a dominant role in agriculture having a direct impact on the productivity of physical production factors, for example the soil's moisture and fertility. Adverse climate effects can influence farming outputs at any stage from cultivation through the final harvest. Even if there is sufficient rain, its irregularity can affect yields adversely if rains fail to arrive during the crucial growing stage of the crops (Smith and Skinner, 2002; Molua and Lambi, 2007; Rudolf and Hermann, 2009).

Generally, there are many factors influencing crop production and these include soil, climate and diseases among others. In relation to climate, rainfall is the dominant controlling variable in tropical agriculture since it supplies soil moisture for crops and grasses for animals. According to Ayoade (1983), agriculture largely depends on climate to function. Hence, precipitation, solar radiation, wind, temperature, relative humidity and other climatic parameters affect and solely determine the global distribution of crops and livestock as well as their productivity.

Rainfall, among other factors, has always dictated how land is used in one way or another and it also affects the humidity condition of the atmosphere. Rainfall determines the vegetation cover of a particular geological zone and crop distribution. Heavy rainfall facilitates the growing of tree crops like cocoa, rubber, oil palm possible in the rainforest. Some of the attributes of rainfall that are important to crop production are the time of onset of the raining season, total amount of rainfall, distribution, number of rainy days and duration of rainfall as well as the time of its cessation (Akintola, 1995). Furthermore, rainfall determines the amount of moisture present in the soil which is ultimately made available to plants. Water plays a vital role in the growth of plant and it provides the medium through which nutrients are carried through the plant. According to Olaoye (1999), regular occurrence of drought as a result of erratic rainfall distribution and/or cessation of rain during the growing season reduce Nigeria's capability for increased crop production. Sdoodee and Rongsawat (2012) concluded that high rainfall tended to decrease tapping days per year. From the results, it was suggested that climate change and climate variability in Songkhla province tends to reduce latex yield because of an increase of rainfall leading to a reduction of tapping days.

Rain-fed crop production is a dominant mode of

*Corresponding author. E-mail: sammesike@gmail.com.

Table 1. Analysis of rainfall data from 1971 - 2009.

Variable	Coefficient	Std. error	t-statistic	Prob.
Constant	318.89	37.41685	8.522643	0.0000
DR(-1)	- 0.376412	0.159985	- 2.352793	0.0242
Mean (mm)			231.41	
Standard deviation (mm)			27.31	
Maximum rainfall (mm)			283.05	
Minimum rainfall (mm)			189.02	
Trend coefficient (mm/ year)			- 0.38	
Coefficient of variability (CV)			11.80	

Table 2. Analysis of rubber production from 1971-2009.

Variable	Coefficient	Std. error	t-statistic	Prob.
Constant	8369.54	6469.65	1.293662	0.2040
Q(-1)	0.935243	0.062823	14.88697	0.0000
Mean (tonnes)		97315.36		
Standard deviation (tonnes)		37765.84		
Maximum rubber production (tonnes)		155000.00		
Minimum rubber production (tonnes)		45000.00		
Coefficient of variability (%)		38.81		
Sum		3795299		

agricultural production in the majority of rural sub-Saharan Africa (Cooper et al., 2008). The reliance of the agricultural sector on natural rainfall places it at a serious risk of shrinkage due to the inter-annual rainfall variations. Climate change impact assessments done by the Intergovernmental Panel on Climate Change (IPCC) (2007) and Buddenhagen et al. (1992) concluded that rain fed agriculture in Africa risks negative impacts due to climate change. Rain fed agricultural production in Africa in general is projected to be reduced by up to 50% by 2020 (IPCC, 2007). With the declining rainfall trends in most of the sub-Saharan Africa, agricultural production is most likely to decline (Droogers et al., 2001; Nnyaladzi, 2009).

Rubber is very important in the economy of Nigeria and contributes significantly to Nigeria export trade. Natural rubber thrives well in humid climate with well-distributed rainfall of 1800 to 2000 mm on a well-drained soil. The rain must be evenly distributed through the year and with not more than one dry month. Ideally, the number of rainy day should range from 100-150 days (Watson, 1989). Production statistics indicated that Nigeria has a total of 247,100 hectares of land under natural rubber cultivation where over 70% are owned by small scale farmers (Delabarre and Series, 2000). Rubber cultivation in Nigeria is mainly rainfed. The rain being generally seasonal, regulate the production of planting materials and tapping activities. For this reason we studied the rainfall variability in line with rubber production in Nigeria.

MATERIALS AND METHODS

The empirical analysis covers the period between 1971 and 2009. Secondary data used for the analysis were obtained from Nigeria Meteorological Agency (NIMET), Central Bank of Nigeria (CBN) publications, such as Annual Reports and Statements of Accounts, and the Statistical Bulletin. Rainfall data used for this study were obtained from NIMET and the data related specifically to Delta state where over 70% of Nigeria rubber is produced was used. Data on quantity of rubber produced in Nigeria were obtained from CBN publications.

The data collected were analyzed with the use of descriptive statistics to analyze the trend of rainfall and rubber production in Nigeria. Correlation analysis was used to analyze the relationship between rainfall and rubber production.

RESULTS AND DISCUSSION

Trend analysis of rainfall

Rainfall shows a decreasing trend with the minimum value for the period (189.02 mm) recorded in 1977 and maximum value for the period (283.05 mm) recorded in 1999 (Figure 1). The mean and standard deviation values of rainfall are 231.41 and 27.31 mm, respectively (Table 1). This indicates that rainfall has a large variability of 11.8% with time. The rainfall trend coefficient of -0.38 mm per year is significant at 5%. This indicates a decreasing trend of rainfall in the region. The coefficient of the graph is DR = 318.89 - 0.38 t. Where: DR is the annual mean rainfall (mm) and t is the time (years). The trend equation had a negative slope of 0.38 indicating that over the time period of 1971 to 2009, the annual mean rainfall decreased by 0.38 mm per unit change in time.

Trend of rubber production in Nigeria

Figure 2 shows the trend of rubber production in Nigeria. It could be observed that the highest rubber production of 155,000 metric tonnes was recorded in 1991 and the lowest productions of 45,000 tonnes were recorded in 1980 and 1983. This however, represents 4.1% of the total production during the period. There were steady increases in rubber production in 1987-1991. This period however fall within the first decade of economic deregulation. Table 2 shows that the mean and standard deviation value of rubber production are 97315.36 tonnes and 37765.84, respectively and this indicated that rubber production has a large variability of 38.81% over time.

Correlation analysis

The result of the correlation analysis showed that rainfall

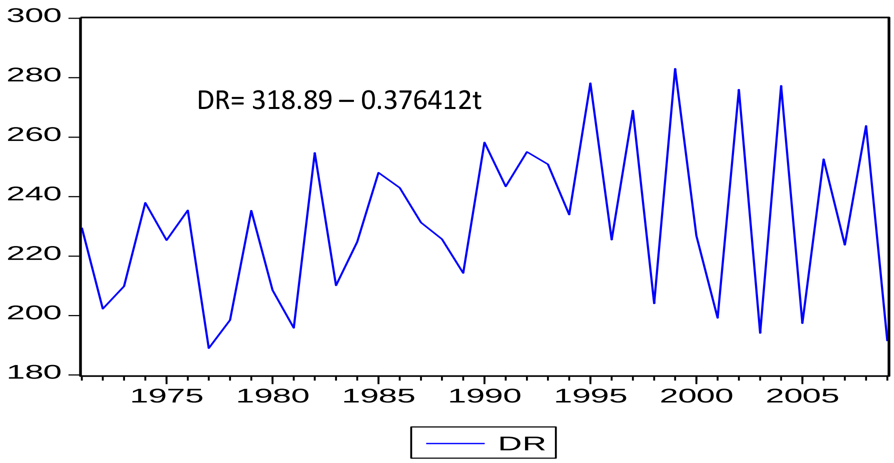

Figure 1. Trend of rainfall (1971 – 2009).

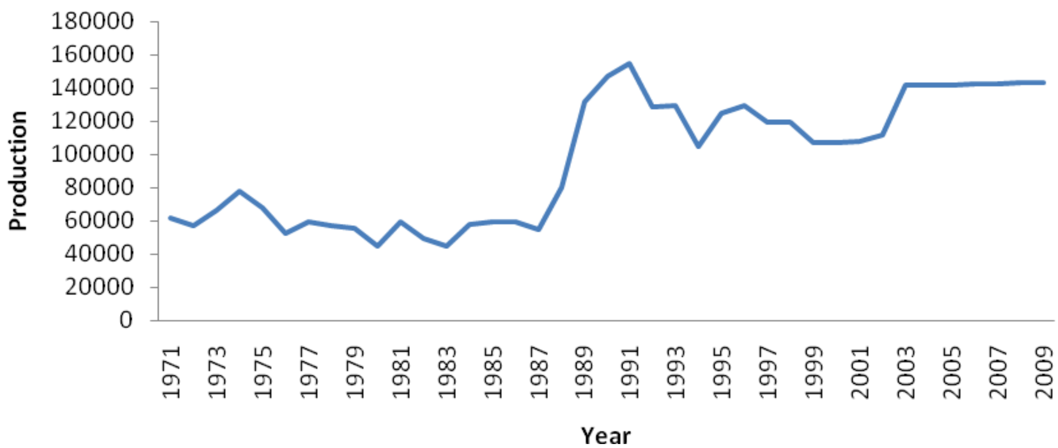

Figure 2. Trend of rubber production in Nigeria.

is inversely correlated with rubber production (-0.132). This result is line with Perera and Ranasinghe (2013) that recorded an inverse relationship between rainfall and rubber yield in Sri Lanka. The negative relationship between rubber and rainfall might be due to the fact that excess rainfall may affect tapping operation thus reducing latex yield.

Conclusion and recommendation

The study has revealed that there was high variability and decreasing trend of rainfall during the period (1971-2009). High rubber production of 155,000 tonnes was recorded in 1991 while the lowest production of 45,000 tonnes was recorded in 1980 and 1983. Rubber production is inversely correlated with rainfall. The study therefore recommend that protective water proof containers should be used for collection of latex during raining season so as to prevent washing away of latex by rain.

REFERENCES

Akintola FO (1995). Rainfall Characteristics and Cocoa production in Nigeria. In Adegeye and Ajayi (eds.). Cocoa Revolution in Nigeria. Proceedings of a National Seminar on Revolutionizing Nigeria's Cocoa Industry, University of Ibadan.

Ayoade JO (1983). Introduction to Climatology for the tropics. Spectrum book Ltd, Ibadan.

Buddenhagen IW, Gibson RW, Sweetmore A (1992). Better cultivars for resource poor farmers. In: Proceedingsof the seminar on crop protection for resource poor farmers UK: The Netherlands NRI.

Cooper PJM, Dimes J, Rao KPC, Shapiro B, Shiferaw B, Twomlow S (2008). Coping better with current climatic variability in the rain-fed farming systems of Sub-Saharan Africa: An essential first step in adapting to future climate change? Agriculture, Ecosystems and Environment, 126: 24-35.

Delabarre MA, Series JB (2000). Rubber: The Tropical Agriculturalist. CTA Macmillan Education Ltd London pp. 4-11.

Droogers P, Seckler D, Makin I (2001). Estimating the potential of rain-fed agriculture: Working paper 20. Colombo, Sri Lanka: International

Water Management Institute.

IPCC (2007). Climate Change (2007): Synthesis Report PCC Plenary XXVII. Valencia, Spain

Molua EL, Lambi CM (2007). Economic Impact of Climate change on agriculture in Cameroon. Policy Research paper No 4364 World Bank, Washington, D. C. pp. 51-55.

Nnyaladzi BN (2009) Rainfall trends in semi-arid Botswana: Implications for climate adaptation policy. Appl. Geogr. **30**:483-489.

Olaoye O (1999). Developing drought tolerant varieties for the Savanna agro-ecologies of Nigeria in 25th year Commemoratives Publications of Genesis Society of Nigeria. pp. 173-182.

Perera KKE, Ranasinghe EMS (2013).The effect of rainfall variability on rubber cultivation: A case study of Madurawala AGA division in Kalutara District, Sri Lanka. Proceedings of the Annual Research Symposium, University of Colombo, October 3-4.

Rudolf W, Hermann W (2009). Climate risk and farming Systems in Rural Cameroon. Institute of Development and Agricultural Economics. University of Hannover, Germany pp. 21-24.

Sdoodee S, Rongsawat S (2012). Impact of Climate Change on Smallholders' Rubber Production in Songkhla Province, Southern Thailand. Proceedings International and National Conference for the Sustainable Community Development of "Local Community: The Foundation of Development in the ASEAN Economic Community (AEC)" February 16-19, pp 81-86.

Smith B, Skinner M (2002). Adaptation options in Agriculture to climate change: A typology, mitigation and Adaptation Strategies for Global Change. Afr. J. Agric. Res. Econs 3(5): 78-82.

Watson GA (1989). Climate and soil in Rubber, New York: Longman Scientific and Technical. pp. 125-164.