EFFECT OF SOME ENVIRONMENTAL FACTORS ON THE HEIGHT AND GIRTH INCREMENT OF *Adansonia digitata* SAPLINGS PLANTED AT THE UNIVERSITY FARM, GAYA, KANO STATE, NIGERIA

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Abstract
Fluctuations were observed in the yield of products grown by farmers in the study area. A field experiment to determine the effect of some environmental factor on the growth of *Adansonia digitata* sapling using Completely Randomize Block Designwas conducted. Measurements of the height and girth during the dry and rainy seasons were taken using measuring tape and veneer calipher weekly. Data on temperature, relative humidity and moisture content were collected from metrological station of Kano University of Science and Technology, Wudil, and the data obtained were analyzed using multiple linear regression analysis. The result during dry season showed that the temperature and relative humidity were not significant at 10 % level of significance while moisture content was significant. This showed that a unit increase in temperature will account for a unit decrease in the growth of *Adonsonia digitata* by -7.274 while a unit increase in relative humidity and moisture content will account for a unit decrease in the growth of *Adansonia digitata* by -6.920. However, during the rainy season the result showed that temperature and moisture content were not significant thus, a unit increase in temperature and moisture content will account for a unit decrease by -0.704 and 0.594 respectively. Yet a unit increase in relative humidity will account for a unit increase in the height of *Adansonia digitata* by 0.142.

Introduction

Research is needed on how trees respond to the changing climate. Scientists know a fair amount on how individual factors of climate like higher temperature or more carbon dioxide (CO_2) in the air may affect plant growth. But there are several limitations on applying this knowledge directly to the real world (Williams and Joel, 2002).

Currently, knowledge mostly comes from experiments on individual plants rather than long term work on whole ecosystem and we don't know much about how the different factors will interact with each other, Lukac (2010) conducted a research on how these factors such as temperature and (CO_2) affect tree growth.

Complex feedback and interactions affecting other variables such as temperature and its effects on the activities of soil fungi and microbes, with direct implication for the pool of nutrient held in the soil is needed. Hotter summer may also make drought more common and this will have ramifications both for the availability of nutrients and how well trees

can use them. For example, very dry conditions may reduce and hinder nutrient acquisition by affecting root physiology (Emdel, 1980).

Forest ecosystems play an important role in the global biogeochemical cycles. A recent study demonstrated that mankind is having a significant impact on the carbon balance of temperate and boreal forests, either directly (through forest management) or indirectly (through nitrogen deposition) (Pock. 2009). Forests act both as sources and sinks of greenhouse gases (GHGs), through which they exert significant influence on the earth's climate. Forests can contribute to the mitigation of climate change, but under the existing global climate policy frame this alone will not be enough to halt climate change.

The human influence on the earth's climate is becoming more and more obvious. Climate observations prove the existence of a global warming trend: global average temperature has increased by 0.8°C since 1900 (Hansen et al., 2006) and the 12 hottest years observed globally since 1880 all occurred between 1990 and 2005.

Forests are long lived ecosystem and the experiment will also need to take place over long periods, Lukac (2010) observed that otherwise, they miss important variation over time in forest process for example certain types of soil micro organisms are associated only with specific stages of forest development. So short term experiments may not provide a complete picture of how nutrients availability in forest soil will respond to environmental changes (Buchmann, 2010).

The African baobab, *Adansonia digitata* (Family *Malvaceae*), is a deciduous stem-succulent tree native to the dry regions of tropical Africa (Sidibé & Williams, 2002). In total, more than 300 uses have been reported for this species, with the most important ones being related to food, medicine and income generation (Buchmann *et al*., 2010). The highly nutritious fruits, seeds and leaves are frequently consumed by rural people in both western and south-eastern Africa, thereby supplementing the local diet and improving food security (Buchmann *et al*., 2010).

Recently, baobab fruit pulp has entered the European and the US food market raising the potential international commercial value of this species to an estimated one billion US dollar (Akinnifesi *et al*., 2007). Despite its known importance, lack of recruitment seems to threaten the species, as little natural regeneration has been reported in different parts of Africa (Schumann et al., 2010). Low natural regeneration of the baobab tree has been partially related to increasing drought events (Hansen 2006), which are predicted to become more common in dry land Africa according to future climate projections (IPCC, 2007). The physiological mechanisms behind the drought withstanding capability of the baobab tree, which are very important for its survival in its natural environment, have

never been accurately characterized. An understanding of these mechanisms is also of importance for the selection of drought adapted plant material for reforestation purposes.

Materials and Method

Description of the study area

Gaya Local Government area of Kano State lies within the Sudan vegetation zone, It is located between the latitude 11,52N and longitude 90E and it is about 473m above sea level. It is situated in the north-east of Kano State. The landforms are generally flat with loamy soil which is favorable for the cultivation of millet, sorghum, groundnut and cowpea. The above is the dominant tree species of *Azadrachta indica, Acacia spp, Tamarinds Indcia* and *Adansonia digitata* (Danbazau & Olofin, 2008).

The climatic conditions of the study area are characterized by rapid changes of temperature and humidity. Humidity at times can rise up to 80%. The mean daily maximum and minimum temperature are 31.1°C and 20°C respectively. During the month of December, January and February the harmattan (dry north-eastern winds) the year is divided into rainy and dry season. The dry season last from October to April and the rainfall is expected between May and September. Rainfall varies from year to year ranging from 686.1-934mm.

Sampling Procedure and Sampling Size

The plot was located at Kano University farm in Gaya Local Government area. The experimental design used was Completely Randomize Block Design, 12 saplings were planted per block using 4 replications. Numbering of stand in the plot was maintained by giving constant numbers to the stands, in the plot from stand number one to stand number 12.

Measuring tape was used to measure the height of the seedlings. The height measurement was taken every week; the climatic data was collected from the Kano University of Science and Technology, Wudil metrological station weekly.

Data Analysis

The data collected were analyzed using multiple linear regression analysis.

a) Linear function

$$Y= \beta_o+\beta_1X_1+\beta_2X_2+\beta_3X_3+e \quad \text{.....(i)}$$

Where;

Y1= Height

X1= Temperature

X2= soil moisture content

X3= Relative humidity

e – Random error term

Result and discussion

Table 1: Result of Regression Analysis of the Growth increment of *Adansonia digitata* during Dry Season

Model	Co-efficient	Std. Error	T-value	Significance
Constant	21.680	11.058	1.960	0.086
Moisture	-6.920	3.181	-2.176	0.061
Temperature	-7.274	7.169	-1.015	0.340
Relative humidity	0.142	0.162	0.876	0.407
R^2 = 43.5				
R^2Adjusted = 22.3	F - value = 205.2			

Source: Field survey, 2013

The result showed that 43.5% of the total variation in the dependent variables is explained by the independent variable included in the model. The remaining variables were accounted by the constant value of 21.680%. The R^2 adjusted (22.3%) further confirmed the fitness of the model. Moreover, F-value was significance at 10% level of significance. Therefore, the result showed that moisture was found to be significance at 10% level while temperature and relative humidity were non-significant; this implies that a unit increase in moisture content will account to a unit increment decrease by -6.920 in the height of *Adansonia digitata* during dry season. However, temperature is negatively related in the model, thus, a unit increase in temperature will lead to a decrease in a unit increment in the height by -7.274 **(**Table 1).

Table 2: Result of Regression Analysis of the Growth increment of *Adansonia digitata* during Rainy Season

Model	Co-efficient	Std. Error	T-value	Significance
Constant	3.505	7.711	0.454	0.662
Moisture	-0.704	0.306	0.677	0.662
Temperature	-0.594	1.020	-0.691	0.509
Relative humidity	0.142	4.262	-0.139	0.893
R^2 = 44.7				
R^2Adjusted = 23.9	F - value = 215.1			

Source: Field survey, 2013

The result of the multiple regressions during the rainy season indicated that 44.7% of the total variation in the dependent variables is explained by the independent variable included in the model. The remaining variables were accounted for by the constant value of 3.505%. The R^2 adjusted (23.9%) further confirmed the fitness of the model. Therefore, the result showed that Temperature, moisture and relative humidity were found to be non-significant. Where relative humidity was positively related in the model meaning a unit increment in the relative humidity will account for a unit increment in the height by 0.142. While temperature and moisture were negatively related in the model, meaning a unit increment will lead to a decrease in a unit increment in the height by -0.704 and -0.594 **(Table 2).**

Conclusions and Recommendations

The research indicated that availability of moisture is the most significant environmental factor affecting the growth of Adansonia digitata saplings planted in the study area. In conclusion, moisture content has significant effect on height and girth increment of Adansonia digitata under plantation conditions in the study area.

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