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Influence of Climate Variability on Oil Palm Pests in NIFOR, Nigeria

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ABSTRACT : Agricultural production is very sensitive to climate variability in the humid and sub-humid tropics, especially under the seasonal climates of West Africa. The Oil palm is native to West and Central Africa surviving in seasonal climatic conditions. Oil palm growth and production patterns are affected by climatic variations.
A comprehensive evaluation of climate variability on insect pests in the main station of the Nigerian Institute for Oil Palm Research (NIFOR) has not been assessed in spite of the Oil palm serving as an important food and cash crop in Nigeria. Climatological data from 1952 to 2006 obtained from the NIFOR weather station has been analyzed in this paper. Data analysis utilizes the GenStat statistical package.

The paper seeks to assess the vulnerability of insect pests of the Oil palm to climate variability impacts. It focuses attention on areas where key intervention could reduce the *impacts* of climate change. It provides information that would aid management of negative consequences of climate change and variability in Nigeria.

Key Words: Agricultural production, Climate variability, Oil palm, Insect pests, Vulnerability Assessment

Introduction

The Oil Palm (Elaeis *guineensis*)

Palm oil has been a safe and nutritious source of edible oil for healthy humans for thousands of years (Cottrell, 1991). Like other common edible fats and oils, palm oil is easily digested, absorbed and utilized in normal metabolic processes. It plays a useful role in meeting energy and essential fatty acid needs in many regions of the world (Calloway and Kurtz (1956). Normally, oil palm grows in the lowlands of the humid tropics, 15^0N-15^0S with evenly distributed rainfall of 1800-5000 mm/year. The palm has a wide adaptability range of soils, to low pH, but sensitive to high pH (above 7.5), and to stagnant water. NIFOR's recommended planting density is 150 palms per hectare. Oil palm production in Nigeria currently stands at 1.287 million metric tonnes per annum.

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The climate of a place is concerned with the weather conditions over a long period of time. There have been a lot of investigations on climate change in developed countries,
But developing countries have not contributed significantly to climate change and variability research.
This is of particular concern in Nigeria where a large part of the population depends on rain-fed agriculture for its livelihood coupled with observed increase in amplitude and frequency of extreme events across the country which are likely to increase in future as a result of climate change and variability.
Major impacts on food production will come from changes in temperature, moisture levels, ultraviolet (UV) radiation, CO2 levels, pests and diseases (IPCC,2001).
The effect of climate change in Nigeria is already contributing to extreme weather events: amount of rainfall, proliferation of pests, crop diseases and high temperature effects (NEST, 2004). Climatic events based on long term meteorological data show discernible evidence of climate change in Nigeria (NIMET, 2008).
The objective of this study is to assess the vulnerability of insect pests of the Oil palm to climate variability impacts.

Materials and Methods

Study Site

The study site is located at the main station of the Nigerian Institute for Oil Palm Research (NIFOR) near Benin, Edo State, Nigeria.

Climatological Data

Climatological data (temperature, rainfall and relative humidity) between 1952 and 2006 was obtained from the NIFOR weather station.

Insect pests – Temperature Analysis

Correlation between mean insect pests per frond of oil palm and mean temperature from 1975 to 1982 has been determined using regression analysis. Pest data collections from various insect orders were obtained from NIFOR entomology division which was categorized into years and plots. Insect pest species comprise of the following:

Alogista sp, *Aspidiotus destructor*, *Atelocera sp*, *Anacatantops*, *Beluta sp*, *Catantops sp*, *Catantops spissus spissus*, *Catantops axillaris*, *Cassida sp*,*Cedusa aeginosa*, *Cedusa sp*, *Ceroplastes sp*, *Coelaenomenodera elaeidis*, *Crytacatacris aeruginosa*, *Diostrombus dilatata*, *Diostrombus luteus*, *Dylispa achinata*, *Homoecerus nitidus*, *Homoecerus sp*, *Icerya pattersoni*, *Latoia virissidima*, *Lycus latissimus*, *Lema incognita*, *Meenolepta sp*, *Meenolepta sp*, M*eenoplus sp*, *Meenoplus proximus*, *Podagrica dilecta*, *Proutista fritillaris*, *Saissetia sp*, *Sterstroides* caterpillar, *Urophorus nitidus*, *Zophorestes cymica*, and *Zoenocerus variegatus*

Statistical Analysis

Statistical analyses utilized the GenStat software version release 8.1 (Lawes Agricultural Trust, 2005), Eight edition.

Results

A table of Oil Palm mean insect pests per frond and average mean temperature from 1975 to 1982 (8 years) is presented in Table 1.

Table 1: Mean values of insect pests and temperature between 1975 and 1982 in NIFOR

Year	Mean No. of Insects pests per frond	Mean Temperature(^{o}C)
1975	5.14	25.921
1976	10.54	26.246
1977	10.86	26.854
1978	14.18	26.467
1979	21.68	26.825
1980	16.18	26.771
1981	19.31	26.85
1982	15.38	26.696

Temperature

Average mean air temperature during the period ranged between 31.194 ^{o}C (max.) and 21.982 ^{o}C (min.), while the average mean was 26.588 ^{o}C. February and March had the highest temperatures. Average temperature variation over months is provided in figure 1.

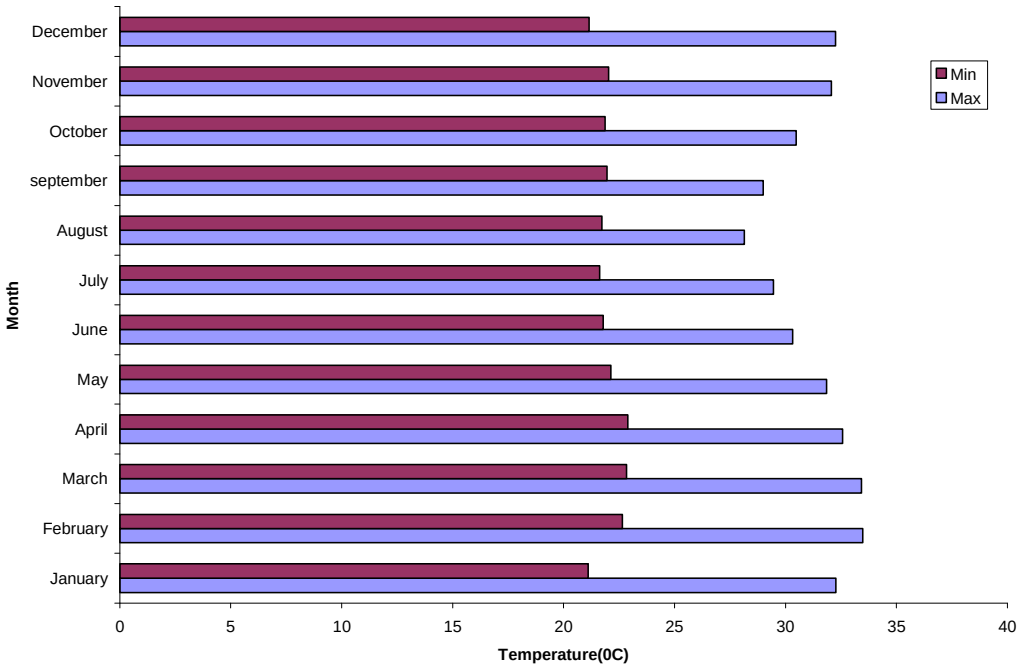

Fig. 1: Average Temperature variation over months (1952 - 2006)

Rainfall

Average mean monthly rainfall during the period was 162mm. Average mean maximum rainfall was recorded in 1979 (213.3mm) and minimum rainfall in 1977 (96.9mm). July and September had highest rainfall while December and January had lowest corresponding rainfall. Average monthly rainfall is provided in Figure 2.

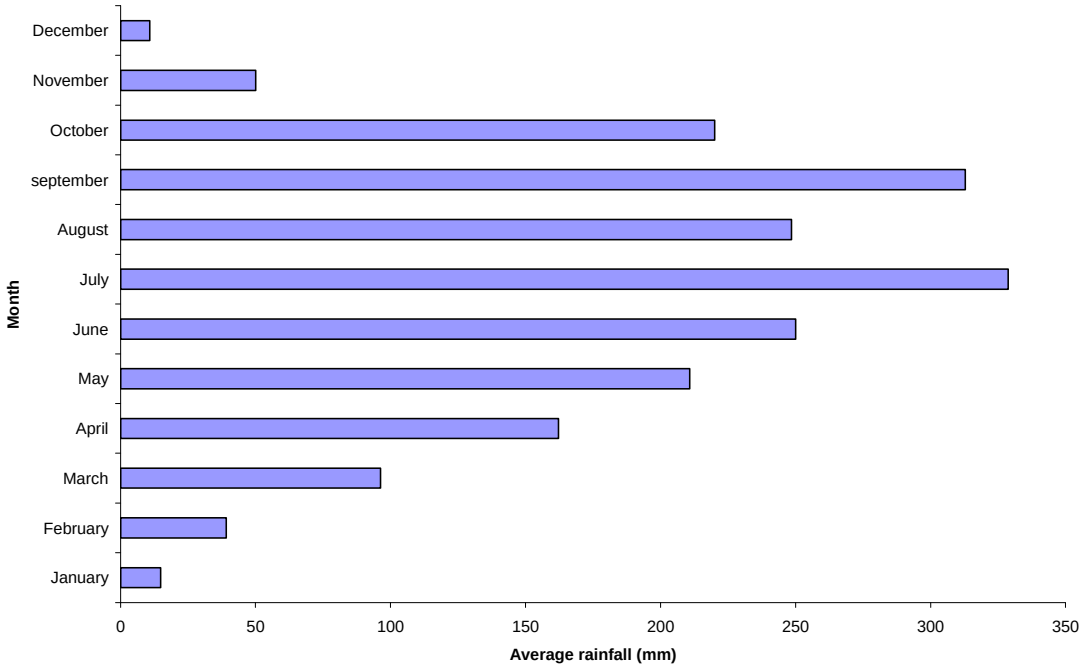

Fig. 2: Average Monthly Rainfall Distribution pattern(1952-2006)

Relative Humidity

During the period under review, relative humidity recorded a monthly mean average of 76.77%, while maximum values were recorded in August (85.17%) and minimum values in February (67.66). Average mean monthly relative humidity is provided in figure 3.

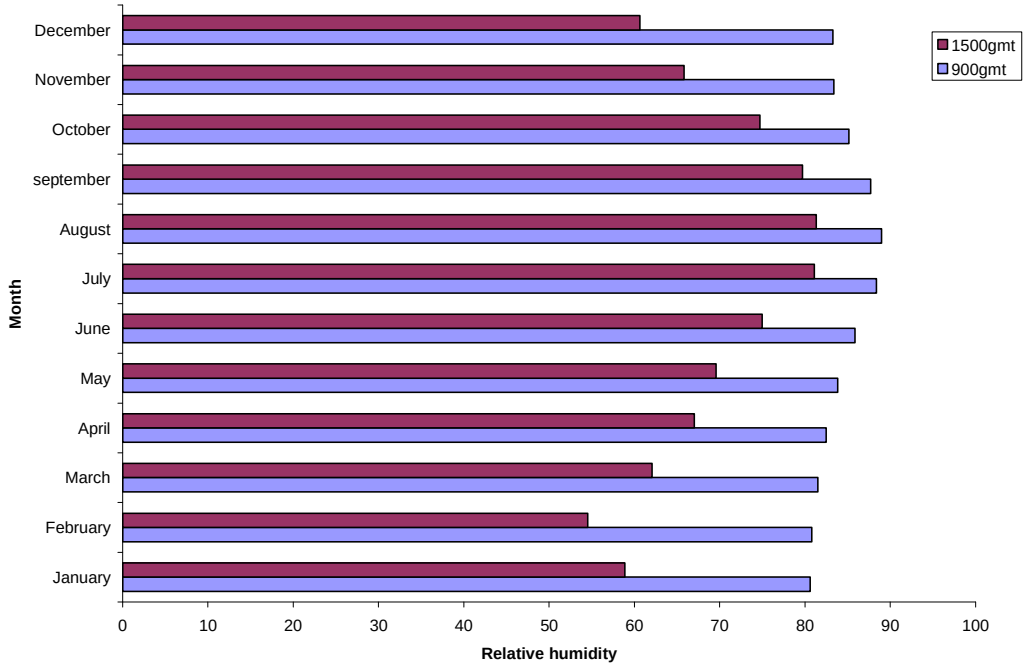

Fig. 3: Distribution of average monthly relative humidity (1952 -2006)

Insect pests – Temperature Analysis

There is a strong positive correlation between insect pests and temperature. Figure 4 shows the relationship between mean annual temperature and number of insects.

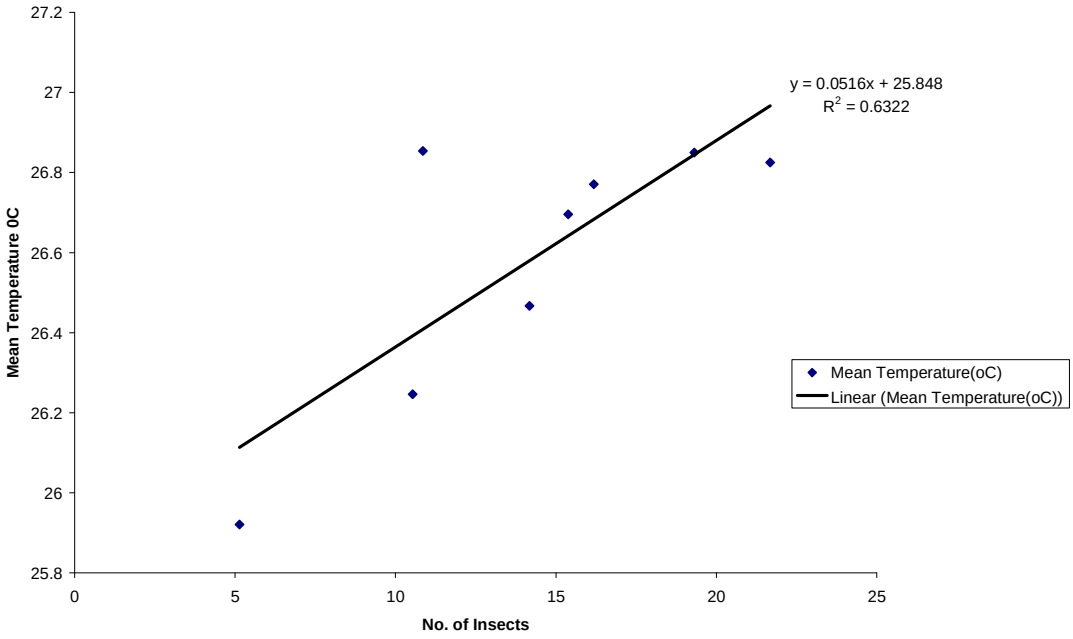

Fig. 4: Relationship between Mean Annual Temperature(oC) and No. of insects

Discussion

Changes in greenhouse gas concentration and potential changes in climate will have significant effect on crop systems and their associated pests, since the distribution of weeds, pathogens and insects are determined to a large extent by climate. Understanding these effects is essential for maintaining agricultural productivity in the face of global change. Control measures require extensive high quality and information on climate, and on agricultural, environmental and social systems affected by climate, with a view to carrying out realistic vulnerability assessments and looking towards the near future (F.A.O. 2007).

Analysis of climatological data from the NIFOR main station show evidence of climate variability. This is corroborated by long term meteorological data which indicates discernible evidence of climate change in Nigeria. Records also show departure in the range of 0.9 ^{o}C – 1.9 ^{o}C in the last sixty years (NIMET, 2008).

Temperature

The dry season had higher temperatures than the rainy season. Significant changes in the temperature data were observed. High temperatures are not known to be destructive to the oil palm, however, excessive heat may destroy plant protoplasm and rapid rates of transpiration may lead to wilting.

Rainfall

The rainfall pattern recorded higher values in the rainy season while minimal values were recorded in the dry season. An even rainfall distribution of 2000mm or more per annum throughout the year is suitable for oil palm cultivation. Observed data records a decline in average rainfall between 1952-1956 and 2002-2006 (5 year periods). This infers a decrease that could be attributed to climate variability. A continuous decrease in rainfall, especially with the increasing rate of desertification from Northern Nigeria, will hamper maximum yields from oil palm production.

Relative Humidity

Humidity is the invisible water vapor content of the air. Expectedly, relative humidity followed the same pattern with rainfall recording higher values between 1952-1956 and 2002-2006 (5 year periods). It recorded maximum values in the rainy season when moisture content of the air was highest and a minimum value in the dry season.

Insect pests – Temperature Analysis

Insects have been noted to respond to various levels of ultra violet light (Harvard et al., 2002). Major impacts on food production will come from changes in temperature, moisture levels, ultraviolet (UV) radiation, CO_2 levels, pests and diseases (IPCC, 2001). In this study, it was observed that as temperature increased, insect pests increase correspondingly (fig. 4). This increases the vulnerability of the oil palm to pest attack. It has been established empirically in this study that there is a linkage between oil palm pests and temperature. It could therefore be inferred that if the current scenario of temperature increases as a result of climate variability continues, there will be lower oil palm production as a result of increased pest infestation.

Conclusion

Climate variability is a key development challenge. There is visible evidence of climate change in Nigeria. It is a crucial problem that already impedes progress in agriculture, particularly in the vast marginal rain fed farming areas of Nigeria. It is a threat to our socio-economic development, achievement of Government's implementation of its 7-point agenda and the Millennium Development Goals (MDGs). The urgent challenge, therefore, especially for developing countries like Nigeria is to strengthen adaptation strategies that are matched to ascertained vulnerabilities of sectors and geographical regions.

Recommendations

- Nigerian Oil palm farmers require better climate and weather information that is timely and accurate
- Realignment of the Nigerian Meteorological Agency (NIMET) towards agriculture through substantial investment in human capacity and weather data gathering and forecasting
- Up scaling climate and weather data information ensuring that farmers get information in ways they can use to make on-farm decisions
- Transition to an energy efficient and low carbon economy

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