Climate Change and Agriculture in Nigeria

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ABSTRACT

Some factors are at work to fluctuate and lessen the trend in agriculture outputs and values in Nigeria. Hence, the need to assess the climate-agriculture nexus becomes imperative. This review takes a critical examination of available documentation on Climate Change and Agriculture in Nigeria, with a view to proffering long term proposition for proactive improvement. The characteristics of Nigerian agriculture (land tenure, low farm inputs in fertilizer, extension and machinery, low economies of scale in production, poor storage, lack of capital formation/investment, and being "prone to national disasters-drought, pests, weeds, and floods" or the vagaries of the climate) observed to significantly affect the agriculture output and value. Thus, as an early warning system climate change is asking whether the Nigerian government would please wake up, the peasant farmer of colonial days is waiting for maximum output.
Keywords: *Climate Change, Agriculture, early warning system, peasant farmer*

INTRODUCTION

Agriculture comprises crops, livestock, fishery and forestry. Every National Development plan and every political regime since Nigeria's independence has recognized the prime importance of agriculture in the national economy. It has been the main source of employment, the base from which the nation can feed itself, a regenerative source of wealth and foreign exchange earnings; a means of providing the nations industries with local raw materials and as a viable source of government revenue. More importantly, agriculture is the basis for the country's industrial take off (Adeboye, 1989). In spite of these plans and expectations, Nigeria's agricultural sector witnessed a steady decline in the first 25 years post independence from 61% share of GDP to 18% in 1980 (Bonat, 1989). It bounced back in the democratic (post 2000) era to attain 42% (El-Rufai, 2011). However, while in the pre-independence period, agriculture met 95% of Nigeria's food consumption needs and 70% of export earnings, this declined drastically to below 50% and 5% respectively, at the moment. Clearly some factors are at work in this fluctuating and declining trend in agriculture output and value. Adeboye (1989), for instance, notes the following five characteristics of Nigerian agriculture: land tenure, low farm inputs in fertilizer, extension and machinery, low economies of scale in production, poor storage, lack of capital formation/investment, and being "prone to national disasters-drought, pests, weeds, and floods" or the vagaries of the climate. Because of this, the need to assess the climate-agriculture nexus becomes imperative.

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Nigerian Agriculture and Climate

The geographic location of Nigeria between latitudes 5^0N and 14^0N places most of it in Koppen's Aw tropical continental climate with wet summers and dry winters. Koppen's Af climate type or tropical wet climate with rain all the year round exists in the Niger Delta region of the country. The dominant climate regime is responsible for Nigeria's dual ecoagricultural zone as follows: the Northern zone grows annuals and cereals such as sorghum rice, groundnuts, cotton, millet, and wheat; the southern zone grows tubers such as yams and cassava and perennial tree crops such are cocoa, cola nuts, palm produce and citrus fruits. Because of the nature of the land mass, typical farmland holdings in the south is 1ha but 1.9ha in the North (Adeboye, 1989). It has been estimated that out of Nigeria's total area of 923,768km^2, land area is 910,768km^2 while water is 13,000km^2. The land use pattern consists of: arable land 33%, permanent crops 3%, permanent pasture, 44%, forest and woodlands 12%, others 8% (Adamawa State Government, 2009). Thus, the scope for agricultural extension is quite large in Nigeria. Climate affects Nigerian agriculture in two ways: direct and indirect. The direct effect is the one recognized above as being responsible for the two broad ecoagricultural zones of cereals and annuals in the North, especially north of latitude 9^0N and tubers and perennials to the south. The indirect effects operate through climate's influence on pests, diseases and land/soil degradation.

The Concept of Climate Change

Change or variability is naturally inherent to climate on both geologic and human time scales. But recent increase in perturbations since the industrial revolution (1789) has been ascribed to anthropogenic causes and labeled global warming due to increased emissions of green house gases, especially carbon dioxide. These perturbations come in the forms of ''persistent droughts, flooding, off season rains, increased dry spells, drying lakes and rivers especially in arid and semi arid lands (ASALS) (Medugu, 2011). Conway (2009) observes that agricultural production and food security in many part of Africa are affected by natural climate variability and are likely to be severely compromised by climate change, in particular by damaging high temperatures and the greater incidence of drought. We can expect a decrease in the area suitable for agriculture and in the length of growing seasons and yield potentials, particularly along the margins of semi arid areas.

Many crops in Africa are grown close to their limit of thermal tolerance. It is already known that just a few days of high temperature near flowering can especially affect yields of crops such as wheat, fruit tree, groundnut and soya beans. Such extreme weather is likely to become more frequent with global warming creating high annual variability in crop production. But more prolonged high temperatures (the heat waves of India and America) and period of drought will force large regions of marginal agriculture out of production (Conway, 2009). Drought is the consequence of a natural reduction in the amount of precipitation received over an extended period of time, usually a season or more in length. Drought is also related to the timing (i.e. main season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to primary crop growth stages) and to the intensity and number of rainfall events. Thus, each drought is unique in its climatic characteristics and impacts. Realistically, definitions of drought must be made on a regional impact - specific basis - agricultural, water resource, etc. A closely related problem is that of climate stress. The US Department of Agriculture notes that climate stresses account for 62.5% of all stress on land degradation in Africa. Those climatic stresses include high soil temperature, seasonal excess water, short duration of low temperatures, seasonal moisture stress, and extended moisture stress.

Climate and Land Degradation

The main elements causing soil erosion or land degradation - water and wind - are climatic elements. In the forests, the main causative agent is rain, while in the dry savanna it is mainly wind. In the moist savanna, it is both. Indeed, Lal (1989) reports that, in general, soil erosion is the most severe in savanna regions with an annual rainfall of 500 to 1000mm where the cropland erosion rate of 10 - 20t/ha/yr has been recorded. The trouble with soil erosion are:

(i) The rapid rate of removal/imperceptivity even at the high rate of e.g 15 tones for a hectare of land from a single storm can remove about 1mm of soil from the surface unnoticed and,

(ii) The long renewal rate: under tropical and temperate agricultural conditions at least 500 years are required for the formation of 2.5cm of topsoil and the best estimate of a renewal rate is about 1t/ha/year (Pimental, 1989).

Soil Erosion and Crop Productivity

Soil erosion affects crop yields both directly and indirectly (Lal, 1989). Direct effects of erosion on yields are related to damage to crop stands and washing away or burial of young seedlings. Indirect effects are related to depletion of soil fertility, degradation of soil structure, reduction in plant available water reserves, and decreased ineffective rooting depths. Land degradation by soil erosion does not only affect crop productivity but also loss of biomass, and biodiversity through encroachment and depletion of forests. Pimental (1989) notes that more than half of the estimated 11.6million ha of forests cleared annually is to compensate for degraded agricultural lands. In fact, approximately 80% of the world's forest destroyed each year is for agriculture.

Factors and Policies Intensifying Erosion

Lal (1989) observes that excessive grazing, uncontrolled burning, voluntary bush fires, and mechanized land clearing are important factor responsible for several erosion in West Africa. Uncontrolled grazing and high stocking rate are major contributory factors for accelerated erosion in the subsahelian and savanna regions. Western Sahel and adjacent regions in West Africa witnessed fivefold increase in cattle population during the 25 years preceding the 1968 drought (Gallais, 1979).

Conservation

No discussion of soil erosion is complete without a mention of conservation as the antidote to the problem. According to Pimental (1989), the principal method of soil conservation is the maintenance of vegetation cover. Plants and biomass reduce both erosivity and erodibility – the two leading factors of soil erosion. The proven conservation technologies for different soils, slopes, crops and rainfall and wind conditions include the following: crop rotations; strip cropping; contour planting; terraces; mulches; no till planting; ridge planting; grass strips; tree/shrub hedges; rock hedges; pit-cultivations, agroforestry; shelter belts; and various combinations of theses conservation technologies. The climate agriculture or crop climate relationships, in spite of the data, remain contentious particularly for Nigeria. For instance, Sawa (2010), using regression analyses concluded that the "developed models (regression) are reliable and good enough for predicting the yields of five crops (groundnut, maize, millet, rice and sorghum) in northern Nigeria. That the onset , cessation and length of the raining season are all decreasing while dry spells of longer than 10 days are on the increase in Northern Nigeria north of latitude 10^0N. The region, therefore, is getting drier and drier and needs irrigation (from Southern rivers) to supplement water shortages.

In an earlier study, Lal (1991) notes that (i) since 1970, food production in Africa has increased only by half as much as the continent's population growth rate. Per capita food production in some countries declined from 160kg in 1970 to 100kg in 1984; and that (ii), yields of most agronomic crops in sub-Sahara Africa are low. The average yield of rice in the Congo (kinshasha) is only one quarter of that in Sri Lanka, and merely 10% of that in Japan. The average yield of sorghum (sorghum bicolor) is less than 300kg/ha in Nigeria compared to 400kg 1ha in the US. In the Sudan, the national average yield of maize is 800kg/ha compared to 7,500kg/ha in the USA. That Nigeria rice farmers get 5tonnes/ha to Cote D'ivoire's 15 – 20 tones/ha. Clearly, something more than climate or climate change is at work when you consider the diversity of countries involved. For instance, in Nigeria, Bonat (1989) reports that in 1977 the local wheat was selling at N423 per tone, while imported wheat sold at N188.89 per tone. In the same year, locally produced rice cost N654.00 per tone, while imported rice cost N374.00 per tonne, maize cost N260 while imported maize cost N208 per tone. In 1978, the prices were: wheat N585.60 vs N 197.00, rice N767 vs N471, and maize N316 vs N188.73 per tone of local vs imported. Nigeria is known to import rice from Thailand, India, and even next door Cameroon, how can climate alone explain this import list of countries?

As for correlations or regression analyses, Sawa's (2010) findings cannot be denied but what is the database for crop yields – is it subsistence, rainfed agriculture, Fadama farming, or World Bank assisted ADP farmers etc and what is the "strength" of the correlation because Conway (2009) had noted that maize yields in Zimbabwe have long been highly correlated with the El-NINO cycle as measured by sea surface temperatures, off the Peruvian coast, rather than with Zimbabwean rainfall. Conway notes that this correlation is so strong that it is possible to predict the Zimbabwean crop in March with 70% probability, using sea surface temperature in the eastern pacific from the previous September.

CONCLUSION

The crop climate relationships tend to agree with Adebayo (2009) who notes that climate is both a resource and a constraint to agriculture. Technology makes the difference in output in any climatic regime. And that technology ranges from soil conservation technologies to farming technologies to even climate research technologies. For instance, a survey of

Nigeria's agricultural output from colonial era, to post–independence, to oil–boom etc suggests the direction and strength of correlation other than climate. Thus, as an early warning system climate change is asking whether the Nigerian government would please wake up, the peasant farmer of colonial days is waiting for maximum output. In spite of the correlation result, Nigerian agricultural output is actually growing, accounting for 60% of ECOWAS output (El-Rufai, 2011). The final verdict is that organization and incentives matter more than climate change in steering Nigerian agricultural output.

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