

## Review.

# DECLINE IN CROP PRODUCTIVITY IN NIGERIA: A REVIEW OF POSSIBLE STRATEGIES FOR SELF RELIANCE, INCREASE AND SUSTAINED PRODUCTION.

BY

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**Nigeria agriculture is characterized by small holder farmers (0.05 to 3.0 ha per farm land) scattered over wide expanse of land area, multiple rudimentary cropping systems, low capitalization and low yield per hectare. The agriculture sector in Nigeria economy potentially provides primary means of employment and accounts for more than one-third of total Gross Domestic Product (GDP) and labour force. It shared about 90% GDP before independence in 1960, 56% between 1960—1969 and 40% since 1986. Decline in the performance of this sector in both GDP and export earnings is reflected in the slower growth of the sector relative to other sectors of the economy, environmental degradation, rapid climatic changes, mounting food deficits, farmer's inability to replenish nutrients lost in the continuous cultivation, increased food prices and import bills attributed to lack of adoption of modern farming technologies. These effects have further impoverished the smallholder farmers, locking them into a poverty web. National strategic importance of food is evident in its consideration as a key variable in matter relating to national security and in planning against disaster and other emergencies. However, a major indicator of depressed performance of the Nigeria agricultural sector is the food crisis experienced in the country in recent time. Hence there is every need to establish national agricultural development strategies directed towards self reliance, sustained and increase production system of smallholder production systems with environmental security**

**Keyword:** Agriculture, smallholder, farmer, decline, crop productivity, environmental security

## INTRODUCTION

Nigeria has an agrarian economy before the advent of oil in the late 1970's. According to Ogundari and Ojo (2007), Nigerian agriculture is characterized by: a multitude of small scale farmers (ranging from 0.05 to 3.0 hectares per farm land) scattered over wide expanse of land area, rudimentary farm systems, low capitalization and low yield per hectare. The role of agriculture remains significant in the Nigerian economy despite the strategic importance of the crude oil sector. The agricultural sector provides the primary means of employment for Nigerians accounting for more than one-third of total Gross Domestic Product (GDP) and labour force (FAO, 2003; World Bank, 2003). The agricultural share of the GDP stood at about 90% before independence in 1960, about 56% between 1960—1969 and more than 40% since 1986 (CBN, 2003). Thus agriculture plays basic role in kick-starting economic growth and reducing poverty and hunger in many developing countries (Hazell, 2005) especially in Nigeria before the advent of crude oil.

Production is a most obvious output and measure of the activity of a farming system. It can be measured as the biological or economic output from the system, for example as the grain or cash generated. It is implicitly an output from the activity of one or more management units (e.g., families). It is also a measure of the efficiency of the management of the cropping system and can be related to productivity - measured as output per unit of input (land, labour, capital, energy) (FAO 1993).

Food production in Nigeria can arise either through expansion of cropping area (extensification), through greater cropping intensity (intensification), bringing poor soils under cultivation through proper organic manuring to including use of shorter fallows, green manuring and efficient crop rotation system, perhaps coupled with good varieties and technologies. This is accompanied by increased complexity of cropping (Okigbo (1984)). These methods of increasing crop production but have their implications for sustainability.

## Decline in Agricultural Productivity in Nigeria

The decline in the contribution of agriculture to the GDP of developing countries especially Nigeria overtime is due to the slower growth of the sector relative to other sectors of the economy and most especially commercial exploration of petroleum (CBN, 2008). The daunting obstacles to agricultural development causing decline of food production in upland farming systems, especially in Nigeria for example, has often been attributed to poor rural infrastructure, poor market access and transport cost weak institutions to support agriculture (Hazell, 2005). Hazell, (2005) further emphasized that modern farming technology are either not accessible or simply not economical to adopt. In term of soil improvement, limitation seems to be the farmer's inability to replenish nutrients lost in the continuous cultivation which has replaced the traditional bush fallow system. "Slash and burn" agriculture remains the major food production system in Nigeria (Duguma, *et al.* 2000).

### Cropping Systems

Major food crops in the southwestern Nigeria include: plantain/banana (*Musa* spp), maize (*Zea mays* L.), rice (*Oryza sativa* L.) and root crops (such as cassava (*Manihot esculenta* Crantz), yam (*Dioscorea* spp), sweet potato (*Ipomoea batatas*(L.) Lam.) and cocoyam (*Xanthosoma* spp) and in the savannah zone; sorghum (*Sorghum bicolor* L.), maize, millet (*Pennisetum glaucum*) and cowpea (*Vigna unguiculata* (L.) Walps) (Okigbo 1980, Mudahar 1986). Traditional cropping systems vary, since they have evolved in response to prevailing soil and climatic conditions and social and ethnological preferences (Okigbo 1980, Kang 1986). Traditional farmers often plant more than one crop species in a small patch of cleared and burnt land after several years of bush fallow. The practice of growing two or more crops simultaneously in the same field (Intercropping) (Osiru, 1982), is common throughout the country and it is practiced in 80% of the cultivated areas (Osiru 1982, Steiner 1984). The multi-story homestead gardens, where more than three annual and vegetable crop species are mixed with tree crops, are also common (Juo 1989).

Rainfall distribution and solar radiation in the Savanna regions are better suited for a wider range of rainfed agriculture than the forest or semiarid zones. Most of the sorghum, millet, maize, cowpea, groundnuts and yams are produced on high base-status soils. In the forest region of southwestern Nigeria, which is dominated by low-base-status and acid Ultisols and Oxisols (Harpstead, 1973), systems based on trees, shrubs and root crops are more stable than cereal crop systems, as shown by the existence of highly successful tree crop plantations of rubber and oil palm (Kang 1986, van Wambeke 1991). Systems based on cassava and

plantain are prevalent in the humid region, which is dominated by acidic and low pH status soils. (Juo and Ezumah, 1992). Generally, cropping systems in tropical Nigeria may be grouped into five categories according to Hossner and Juo, (1999)

- Cassava-based cropping systems are mainly found in the southwestern forest zone (mainly Ultisols), where other food crops perform less satisfactorily except for coconuts or oil palm. Cassava is mainly intercropped with maize or upland rice. These fast-growing cereals reduce nutrient loss through leaching, runoff and erosion by utilizing a substantial amount of nitrogen (N) mineralized (100 to 300 kg N/ha) during the onset of the rainy season (Mueller-Harvey *et al.* 1985). These systems also recycle nutrients by returning residues to the soil.
- Cropping systems based on plantain or starchy banana are common in forested areas. Intercropped with plantain are cash crops like cacao, kola, coffee, cocoyam, maize and beans, planted so as to maximize light use efficiency.
- Yam-based systems are traditionally intercropped with a number of food crops, including cowpea, maize, cassava, vegetables, plantains, and groundnuts. Under upland conditions, cassava is intercropped with maize or upland rice during the second year as soil nutrient levels become inadequate to support a yam crop.
- Maize-based systems are widely practiced in the humid transitional zone as well as in the sub-humid region and tropical highlands. In wetter areas, maize is usually intercropped with cassava, yam or sweet potato. Commercial maize monoculture is hardly found and the intercropping system is the most predominant.

### Soil Fertility Constraints to Agricultural Production

Hanson (1992) reported that of the three billion hectares of arable land in tropical Africa, only 14.7% is considered to be free of physical or chemical constraints. One third (32.2%) has physical constraints, 13.2% has limited nutrient retention capacity, 16.9% has high soil acidity, and 6.8% has high phosphorus (P) fixation.

Nitrogen and phosphorus are the most serious limiting factors for cereals and food legumes, respectively (Jones and Wild 1975 and Takow *et al.* 1991). Deficiencies of potassium in root crops, sulfur and zinc in maize, and boron in cotton and groundnuts have been reported in continuously cultivated fields which have few or no inputs of crop residues or animal manure (Jones and Wild 1975 and Hanson 1992). Furthermore, aluminum toxicity and related calcium, magnesium and phosphorus deficiency also limit the growth and yield of cereals and legumes in

acid soils in both humid and semi-arid regions (Pieri 1989, Wilding and Hossner 1989).

Throughout the tropical regions in the world, the slash and burn method has been widely used by small-scale farmers as a means of land preparation and soil fertility maintenance. Practiced in different forms in different regions, slash and burn agriculture involves manually clearing, burning and cropping a relatively small area of land (e.g. 0.5 - 1 ha. IFPRI, 2005)) for one or two years, followed by a long period of natural fallow (e.g. 15-30 years). The land is usually allowed to return to forest or savanna vegetation, in order to restore soil fertility (Nye and Greenland 1960 and Mokwunye and Hammond 1992).

Where the period of fallow has been shortened and cultivation has been extended for more than two years, crop yields generally decrease rapidly, creating a constant pressure to clear new land (Ayodele 1986). Burning means that most of the N, S, and C associated with organic matter is lost to the atmosphere. Large-scale clearing accelerates soil erosion, surface sealing and crusting (van de Watt and Valentin 1992). Subsequent cultivation may result in rapid deterioration of the biological, chemical and physical properties of the soil (Mokwunye and Hammond 1992).

Continuous cropping of Alfisols, Ultisols and Oxisols in the tropics has resulted in a rapid decline in soil organic matter in the surface soil during the first few years following land clearing (Juo *et al.* 1994). Continuous cultivation also causes a significant decline in soil pH and exchangeable Ca and Mg levels. This is even more pronounced when acidifying fertilizers are used (Adepetu *et al.* 1979, Juo and Kang 1989 and Juo *et al.* 1994).

Soil fertility management on small farms in Nigeria has become a major issue, as a result of increasing pressure on land due to increasing population and competing uses for land have shortened fallow period resulting to continued land degradation (FAO 1981). Major arable soils are often poorly suited to high-input agriculture. Agricultural development efforts, therefore, must be directed towards the improvement of productivity and sustainability of smallholder production systems.

External nutrient inputs are essential to improve and sustain crop production on these soils. Nutrient inputs may either be from organic sources (i.e. crop residues, green manure, and animal manure) or from inorganic sources (i.e. chemical fertilizers and lime). Published results have shown that chemical fertilizers alone cannot sustain crop yields on poorly buffered kaolinitic soils.

The decline of crop yields under continuous cultivation has been attributed to factors such as acidification, soil compaction and loss of soil organic matter (Juo *et al.* 1994). Thus, application of organic materials is needed, not only to replenish soil nutrients but also to improve the physical, chemical, and biological properties of soil. To a large extent, this may be achieved by managing the agroecosystem in such a way that nutrient sources are generated, recycled and maintained. Options for soil fertility improvement could be by incorporating agroforestry into the cropping system and or proper incorporation of leguminous cropping into the system.

### **Prospects for Fertilizer Use**

The use of inorganic fertilizer in crop production among the subsistence farming communities in southwestern Nigeria have been greatly studied (Adesinmi, 1982 and IAR&T 1991). The scarcity and high cost, most smallholders farmers in Nigeria rarely use inorganic fertilizers on food crops. Moreover, many low-yielding local cultivars are developed to respond to low soil fertility and other environmental stresses, and are therefore less responsive to fertilizer use (McIntire 1986). Currently, an average of only 5 - 10 kg/ha of nutrients are applied as fertilizer on cropland in sub-Saharan Africa (Bumb and Baanate 1996). Juo and Lal (1977) indicated that at the current low rate of fertilizer use, the resultant effect is undesirable soil structure and nutrient status, as they have been for decades. Nutrient inputs from chemical fertilizers are needed to replace nutrients which are exported and lost during cropping, to maintain a positive nutrient balance.

While continuous monocropping of cereals with optimum fertilizer use can sustain crop yields on fertile soils such as Mollisols and Alfisols with high activity clays in the temperate regions, (Jenkinson 1989), continuous monoculture of cereals, using chemical fertilizers as the main source of nutrients, can lead to a significant decline in yields after only a few years of cropping because of soil acidification and compaction (Kang and Juo 1986).

### **Strategies to Promote Self Reliance, Sustained Production and Environmental Security**

Food production in Nigeria can rise either through expansion of cropping area and greater cropping intensity or through increases in agricultural productivity. International Food Policy Research Institute (IFPRI) (2002) in its executive summary of reaching sustainable food security for all by 2020 indicated that the nature of farming is changing rapidly in many developing countries. Small scale-family farms which was the traditionally backbone of much of developing-country agriculture, is under threat. These rapid emerging factors call for innovative approaches to agricultural policy and rural infrastructural development.

The primary role of government is to put resources behind their repeated pledges to provide more aid, better focused on contributing to sustainable development and poverty reduction. It bears the primary responsibility of creating an environment within which individuals and communities can effectively participate in production and also make available to small and poor people, a menu of technology options from which they can choose, rather than choosing an option for them. Governments have also key roles to play in facilitating access to financial services and credit for stakeholders in domestic the agricultural production sector; increase investment in water control technologies; expand the crop areas under irrigation; increase investment in regional research capacity to support the development of new varieties resistant to major pests and diseases and sufficiently robust to withstand drought and climate change-induced shocks; and accelerate the pace of investment in rural infrastructure as road, transport, storage facility and communication infrastructure which would enhance farmers' capacity to response to market signals and improve their access to market. Gbadebo, (2005) emphasized that Nigerian efforts in agricultural development over the past three decades have failed to improve the country's economy. A review of the sector depicts a gloomy picture. Performance is reflected in environmental degradation, mounting food deficits, and decline in both GDP and export earnings, while retail food prices and import bills have been increasing. These effects have further impoverished the smallholder farmers, locking them into a poverty web. The Government must seek to establish agricultural strategies which promote political stability, self reliance, public participation, sustained production and environmental security.

Participatory research is needed so that the options may be relevant and appropriate to the intended beneficiaries. Production activity increase will depend on farmers' access to appropriate knowledge and technology. Farmers cannot expend cultivated land without causing further land degradation, deforestation and loss of biodiversity. Research and development (R&D) is thus essential to achieve sustainable expansion of yield of existing cropping land. Research should focus on sustainable productivity gains and reduced risk on small farms, emphasizing not only staple food crops and livestock but reducing post harvest losses, better use of plant nutrient and producing high-value products.

### **Integrated nutrient management**

Sustainable soil nutrient-enhancing strategies involve the wise use and management of inorganic and organic nutrient sources in ecologically sound production systems (Janssen 1993). The primary goal of integrated nutrient management (INM) is to combine traditional and

improved methods of nutrient management into ecologically sound and economically viable farming systems that utilize available organic and inorganic sources of nutrients in a judicious and efficient way. Integrated nutrient management optimizes all aspects of nutrient cycling. It attempts to achieve tight nutrient cycling with synchrony between nutrient demand by the crop and nutrient release in the soil, while minimizing losses through leaching, runoff, volatilization and immobilization.

The agro-ecological approach to agricultural research has focused on meeting the needs of small-scale farmers in less favoured areas. The approach is aimed to reduce the amount of external inputs that farmers must use. It relies heavily on available farm labour and organic materials as well as knowledge on improved knowledge and farm management. The use of locally available materials such as crop residues, farm manure, and compost to improve soil fertility is an important part of this approach.

### **Green Manure Crops and Intercropping**

Timely applications of organic materials with a low C/N ratio, such as green manure and compost, could synchronize nutrient release with plant demand and minimize the amount of inorganic fertilizer needed to sustain high crop yields for short-cycle crops such as maize, rice, and soybean, all of which have a high nutrient demand. Fast-growing leguminous species such as mucuna (*Mucuna utilis* Wall. Ex Wight) and kudzu (*Pueraria phseoloides* (Roxb.) Bent, can be especially useful as cover crops for erosion control, weed suppression and for soil fertility restoration (Wilson *et al.* 1982). Leguminous green manures and cover crops are able to:

- Enrich the soil with biologically fixed N;
- Conserve and recycle soil mineral nutrients;
- Provide ground cover to minimize soil erosion, and
- Require little or no cash input.

However, additional labor is required for timely establishment, maintenance and incorporation of the green manure crop. In the forest zones with bimodal rainfall distribution, it is possible to intercrop a slow-growing legume (e.g. Sesbania) with a food crop (e.g. maize) in the first season, and allow full growth of the legume in the second season to be incorporated as green manure in the first season of the following year (Balasubramanian and Blaise 1993).

## CONCLUSION

It should be noted that farmers are prospering most in regions where they are best able to compete in the market- regions with good infrastructure and marketing and distribution systems for higher value, perishable foods. There is the need to focus attention on high-value agriculture which should not be left to the market alone. Dr Seck, *Director General, Africa Rice Center (WARDA)* said “giving seed, fertilizer to farmers at affordable prices, availability of modern but inexpensive technologies, large tracts of land and mechanization of African agriculture will enhance food production” reported by Neondo, 2008.

According to Neondo (2008), to make agriculture productive and the basis for thriving economies and widespread income generation for more than 70 percent of people in Africa who rely on agriculture for their livelihoods and food security, governments and funding agencies must make consistent and increased investments in agricultural research for development, in effective markets, in value-adding industries, and in decentralized access by farmers to information and new technologies that give high returns without environmental damage.

In the medium- and long-term, Dr Seck said tax on all critical inputs, on-farm cost-saving agricultural machinery and equipments and post-harvest technologies for all players along the rice supply chain need to be reduced.

Agricultural growth and poverty alleviation are likely to benefit the environment. Agricultural development, poverty reduction and environmental sustainability are likely to go hand in hand when agricultural development is broad-based, market-driven, participatory and decentralized and driven by appropriate technology change that enhanced productivity. Agricultural researches must pay greater attention to sustainability, to resource-poor areas, and to the role of property rights and collective action in farmers' adoption of technologies and resource management practices.

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