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Abstract

Nigeria is passing through a period of rapid population and economic growth and food supply has not kept pace with population growth. A shortage of horticultural produce, especially fruits, is often very acute due to the effects of climate change that has both beneficial and detrimental impacts on fruit production. A high demand for fruit, which is increasing, is as a result of the contribution which fruit make to the nutritional needs of the population and the rapidly improving standard of living. Fruit production is also important to the socio economic livelihood of the poor people in alleviating their poverty. Therefore, this analysis of the physical effects of climate change on fruit production in Nigeria is a necessary endeavour. This study was carried out to review the challenges from a socioeconomic point of view and analyse the effects on the livelihoods of farmers in Nigeria. This paper also highlights the effects of global warming and the factors that directly connect climate change and fruit production in Nigeria.

Keywords: Climate Change, Fruit Production, Global Warming, Food Security, Sustainable Agriculture

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Introduction

Production of tropical fruits is now assuming a greater dimension than ever before, and the world production and trade in tropical fruits is expected to expand over the next decade. Developing countries account for 98% of the total production of tropical fruits, while the developed countries account for the remainder (FAO 2006). International trade in tropical fruits is estimated at over $75 billion annually. USAID (2009) also reported that developed countries account for 80% of the world import trade. Citrus, Mango, pineapple, papaw (*Carica papaya)* and avocado are the dominant tropical fruit varieties produced worldwide, and they account for approximately 75% of global fresh tropical fruit production. World production of major tropical fruit is expected to reach 62 million tonnes by 2010 (FAO 2006). Asia and the Pacific regions will continue to be the major producing areas (56%), followed by Latin America and the Caribbean (32%) and Africa (11%); the USA, Europe and the Oceania account for the remaining (1%). Papaw ((*C. papaya)* production worldwide is expected to reach 12.4 million tonnes in 2010, with about 65% produced in Latin America and the Caribbean, and 9.7% in Africa.

Nigeria is rated among the seven largest producers of major tropical fruits. Other leading countries are India, Brazil, Mexico, Thailand, Philippines and Indonesia. Nigeria has been recognized as the 3rd largest producer of papaw globally, with forecast production of 951,000 tonnes, or about 8% of global output, in 2010. Nigeria is also rated as number 8 among the top 20-world mango producing countries (USAID 2009), Citrus fruits are the most important fruit crop in international trade in terms of value. Total annual production of citrus worldwide was estimated at over 105 million tonnes in the period 2000 to 2004. Oranges constitute the bulk of citrus fruit production, accounting for more than 50% of global production of citrus in 2004. The main citrus fruit producing countries are Brazil, the Mediterranean countries, USA and China (USAID 2009).

The national output, area under cultivation of some major tropical fruits grown in Nigeria, and the percentage of their share of world production is shown in Table 2. Despite a lack of encouragement as to large scale production of tropical fruits in the country, Nigeria still occupies 8th position in the world ranking of mango producing countries as at 2002 (Sulaimon and Salua, 2007). This is instructive as it suggests the potential for tropical fruits in Nigeria. The main producing states in the country include Benue, Jigawa, Plateau, Yobe, Kebbi, Niger, Kaduna, Kano, Bauchi, Sokoto, Adamawa, Taraba and FCT. Nigeria ranks first in small citrus production; the country indeed produces 3% of total world citrus output between 2000 and 2004. This ranks the country ninth, thereby making it a major producer of citrus (UNCTAD, 2005).

Contribution of Fruit Crops to National Food Security

More than half of all employment in Nigeria depends on agriculture. However, 90% of agricultural produce comes from small rain-fed farms of a few hectares, constrained by poor infrastructure and little access to credit. Many of these farms are unable to meet their own subsistence requirements, exposing families to volatile prices in the markets. The Ministry of Agriculture has estimated that 65% of the population is food insecure (Source?). The proportion of children below the age of five, who are underweight, has fallen only slightly from 36% in 1990 to 29% in 2005. (Omole 2004) .

“Africa's native fruits are a largely untapped resource that could combat malnutrition and boost environmental stability and rural development in Africa”, says a new report from the Agriculture Research Council of Nigeria (ARCN, 2011) African science institutes, policymakers, nongovernmental organizations, and individuals could all use modern horticultural knowledge and scientific research to bring these "lost crops", such as baobab, marula, and butter fruit, to their full potential.. Today, tropical fruit production in Africa is dominated by species such as banana, pineapple, and papaya, introduced from Asia and the Americas. Because these and other crops arrived on the continent centuries ago, already improved through horticultural selection and breeding, they increasingly displaced the traditional species that had fed Africans for thousands of years. The imported species also received the support of colonial powers who wanted familiar crops that were profitable to grow. Therefore indigenous fruits continued their downward spiral of dwindling cultivation and knowledge. With renewed scientific and institutional support, however, Africa's native fruits could make a much greater contribution to nutrition and economic development, the news report (Nigerian Guardian News Paper Monday 11 May, 2010) says. Fruit trees also offer long-term benefits by improving the stability of the environment, while others are harvested from the wild. An example is Aizen. Giving more people with few other food resources access to this wild fruit, which grows in high climatic condition, could reduce malnutrition and mortality, the report says. The fruits are a good source of vitamins A and C, calcium, and some minerals, while the seeds are high in protein and zinc. This large, resilient Saharan shrub also shows promise as a way to protect sloping land, stabilize dunes, and create windbreaks.

Review of some fruits and their economic importance in Nigeria

Mango

Mangoes account for approximately 50 per cent of all tropical fruits produced worldwide. The Food and Agriculture Organization of the United Nations estimates worldwide production of mangoes at more than 23 million tonnes in 2001, with 12 million tonnes produced annually (FAO, 2003). India (12 million tonnes) accounts for almost half of the world production, followed by China (3 million tons), Pakistan (2.25 million tons), Mexico (1.5 million tons) and Thailand (1.35 million tons). The aggregate production of 10 countries is responsible for roughly 80% of the entire world mango production, (FAO, 2003).Area put into cultivation of Mangoes in Nigeria is approximately 126,500 Hectares and is grown successfully under a wide range of soil and climatic conditions (FAO, 2003).

Pineapple

In 2001, Nigeria produced 14.220 metric tonnes of pineapple, which is about6% of the total world production, taking the lead as the highest producer of pineapple in Africa (Fawole, 2008). Fresh pineapples, he said, are often expensive as the tropical fruit is delicate and difficult to ship, noting that it can ripen after harvest, but required certain temperatures for this process to occur. The (FAO 2005) warned that like bananas, pineapples are chill-sensitive and should not be stored in the refrigerator. Current production figures show that Nigeria is the 6th largest producer of pineapple in the world and if current production and marketing trends are encouraged, commercial production for export and local consumption will be enhanced (FAO 2005).

Shea Nut

The West African annual production of shea nut in years of high yield is estimated at about 600,000 metric tonnes of dry nuts based on traded volume. These estimates are however less than actual production since the quantities of nuts not collected from the wild and those consumed locally are excluded from these estimates (CBN 1998). Nigeria accounts for over 50% of the West African production of Shea nut. The production level, which was recorded as 373,000 metric tonnes for dry nuts in 1997 had remained stable since 1991. The revenue earned from shea nut during 1995 (N3.580b) was higher than those earned from soybeans (N3.120b), cottonseed (N2.156b) and sesame seed (N3.480b) during the same year (CBN 1998). The shea tree is a crop of great potential and with improved technologies and popularization, the present level of production will definitely be surpassed.

Uses

Shea has multiple uses. The fruit contains a sweet edible fleshy pulp or mesocarp, which is locally consumed like mangoes and other wild seasonal fruits. The butter extracted from the kernels is the main economic product of the shea. It is a mixture of fats and latex. It is locally used in traditional medicines and cosmetics. Its medicinal uses include protection of the skin against harsh weather, wound healing, cure of superficia*l* skin irritations and sore muscles. These uses have long been recognized by pharmacologists and nutritional chemists in Europe. Export trade in Shea was developed during colonial times. It is used in the manufacture of moisturizers, creams, shampoos and soaps. The high linoleic acid content of shea butter makes it an ideal remedy for dry skin, dermatitis, sunburn, redness, chapping and eczema. Shea butter has similarities to cocoa butter, and it is used as a substitute for cocoa butter in the manufacture of chocolates and pastries (NIFOR 2011).

Citrus

About 98% of the world's tropical fruit production during the last decade (1990 - 2000) came from the developing countries. Nigeria accounted for about 20 % of the statistics from Africa. In spite of considerable constraints and challenges, FAO 2004 and 2006 statistics ranked Nigeria 4th in citrus production (1.2 million MT), 11th for plantains (0.5 million MT), 3rd and 6th for guava and mangoes, and papaya, respectively.

Climate change and Vegetation of Nigerian Savannah

Nigeria's climate is characterized by extreme humid weather conditions in the forest southern region and extreme dry conditions in the savannah region of the north. Nigeria is divided into ultra humid, very humid, humid, sub-humid, plateau, mountain, dry humid and semi-arid ecological zones. The annual rainfall ranges from in excess of 2000mm in the ultra humid region down to 200-400mm in the semi-arid zone of the north. Similarly, the mean monthly maximum temperature ranges from 40°C in the semi-arid down to 31°C in the plateau zone. The mean monthly minimum temperature range is lowest in the mountain zone at 5°C compared to 23°C in the ultra humid climate zone. The delineation of the Guinea Savanna Zone from the other two climate zones in the Savannah region is based on the mean annual rainfall as well as the severity of the dry season (Federal Ministry of Environment, 2004). The extent of drought conditions in this zone has caused both temporary and permanent damage to the ecosystem. During extended dry periods, the stress on the land is increased for both humans and the crops, which have left the environment into a precarious state. The trend in the drought induced by climate change is further aggravated by anthropogenic factors such as over-grazing and over-exploitation of marginal lands. (Okorie, 2003)

Other factors include deforestation and poor irrigation practices that are influenced by changes in population and socio-economic conditions (Federal Ministry of Environment, 2004). Be that as it may, Nyong, *et al.,* (2005) has contended that the blame on overgrazing practices of the local population for desertification may not be absolutely true. Rather, the real problem in this zone is climate change, which has resulted in a steady decline in rainfall in the Sahel region of Africa since 1960s. The trend and pattern of rainfall for 22 stations located within the GSSZ of Nigeria for a 6 decades period shows that there have been significant reduction in rainfall received over the years (Fasona and Omojola 2005). It is therefore clear from the figures in table 4 that for most stations located in the upper Sudan and Sahel zone of Nigeria, the deviation of rainfall from the grand mean is negative. Worst affected are Nguru, Maiduguri and Katsina areas that are located in the interior of the Sahel zone.

Effect of Global Warming on Fruit Production on Nigeria

Climate is an important factor of agricultural productivity. The fundamental role of agriculture in human welfare and concern has been expressed by many organizations including the potential effects of climate change on agricultural

productivity. Interest in this matter has motivated a substantial body of research on climate change.
Nigeria is facing more severe and devastating environmental threats than have previously been experienced. These threats include erosion, land degradation, deforestation and climate variability and changes which could cause irreversible damage to terrestrial and marine ecosystems with consequent loss of production potential. About 40 percent of the world's arable land is degraded, and most of the degraded soils are found in the poorest countries, where deforestation, over exploitation and inappropriate land use practices compound the problem. About 70% of the crop land and 30% of the pasture land in Africa are affected by degradation and it is estimated that Africa accounts for about 3094 ha land degradation of the world (UNEP 2002).

Harsh, extreme climate events and unpredicted weather conditions are constant threats to fruit production in Nigeria, more frequent and intense droughts have been observed in the northern parts of the country. Flows in many African rivers have decreased by about 40% between 1970 and 2000, with grave implications for irrigation and energy generation (Niasse, 2005). As climate patterns change, also do the spatial distribution of agro-ecological zones. Changing climate patterns have also resulted in changes in habitats, distribution patterns of plants, diseases and pests which can have significant impacts on agriculture and fruit production.

Climatic Problem

Fruit production is highly sensitive to climate variability and weather extremes, such as drought, floods and severe storms. The forces that shape our climate are also critical to farm productivity. Human activity has already changed atmospheric characteristics such as the levels of carbon dioxide (CO_2) with consequent effects on temperature and rainfall. Scientific experts believe these trends will continue. While fruit production may benefit from a warmer climate, the increased potential for droughts, floods and heat waves will pose challenges for farmers. Additionally, changes in climate, water supply and soil moisture could make it less feasible to continue fruit production in certain regions. John (2007) indicate that increased frequency of heat stress, droughts and floods negatively affect fruit production beyond the impacts of mean climate change creating the possibility for disclosures with impacts that are larger, and occurring earlier, than predicted using changes in mean variables alone. This is especially the case for the subsistence sector at low latitudes. The climate variability and change also modify the risk of fires, pest and pathogen outbreaks, and negatively affecting food, fibre and forestry production (IPCC 2007).
Several factors directly connect climate change and fruit production.

- Temperature increase
- Change in rainfall amount and patterns of distribution
- Rising atmospheric concentrations of CO_2
- Pollution levels such as troposphere ozone
- Change in climatic variability and extreme events.

Most agricultural impact studies have considered the effects of one or two aspects of climate change on fruit production. Few, however, have considered the full set of anticipated shifts and their impact on agricultural production across the country.
An increase in average temperature can result to the following:

- Lengthen the growing season in regions with a relatively cool spring and fall
- Adversely affect fruit crops in regions where summer heat already limits production Increase soil evaporation rates
- Increase the severity of drought

Change in Rainfall Amount and Patterns of Distribution

Changes in rainfall can affect soil erosion rates and soil moisture, both of which are important for fruit production. The IPCC (2007) predicts that precipitation will increase in high latitudes, and decrease in most subtropical regions, some by as much as 20%, while regional precipitation will vary with the number of extreme precipitation events predicted to increase (IPCC, 2007).

Rising atmospheric concentration of CO_2:

Increasing atmospheric CO_2 levels, driven by emissions from human activities, can act as a fertilizer and enhance the growth of some fruits crops (IPCC, 2007). CO_2 can be one of a number limiting factors that, when increase can enhance crop growth. Other limiting factors include water and nutrient availability. While it is expected that CO_2 fertilization will have a positive impact on some fruit crops, other aspects of climate change (e.g. temperature and precipitation changes) may temper any beneficial CO_2 fertilization effect (IPCC, 2007).

Change in Climatic Variability and Extreme Events:

Changes in the frequency and severity of heat waves, drought, floods and hurricanes remain a key uncertainty in future climate change. Such changes are anticipated by global climate models but regional changes and the potential effects on agriculture are more difficult to forecast. Fruit crop responses in a changing climate reflect the interplay among three factors: rising temperatures, changing water resources, and increasing carbon dioxide concentrations. Warming generally causes plants that are below their optimum temperature to grow faster, with obvious benefits. For some plants, this can be compensated for by adjusting the planting date to avoid late season heat stress. For permanent fruit crops, this adjustment

in planting date is not available.

Some crops are particularly sensitive to high night time temperatures, which have been rising even faster than day time temperatures (IPCC 2007). Night time temperatures are especially critical to the reproductive phase of growth because warm nights increase the respiration rate and reduce the amount of carbon that is captured during the day by photosynthesis to be retained in the plant. Further, as temperatures continue to rise and drought periods increase, fruit crops will be more frequently exposed to temperatures at which pollination and fruit set process begin to fail and quality of fruit crops decreases.

Higher temperatures also cause plants to use more water to keep cool. This is one example of how the interplay between rising temperatures and water availability is critical to how plants respond to climate change. But fruits can suffer even under well-watered conditions if temperatures exceed the maximum level for pollen viability in a particularly species. Plants need adequate water to maintain their temperature within an optimal range. Water deficiency could result to heat stress in plant. In savannah agro-ecological zones, irrigation water is used to maintain plant growth when rainfall is deficient, as well as enhance productivity (both yield and quality). The second advantage of using irrigation is to prevent plant stress which is brought about by lack of soil water. With increasing demand and competition for fresh water supplies, the water needed for these crops will be increasingly limited. If water supply variability increases, it will affect plant growth and cause and reduced fruit yield and quality. The amount and timing of precipitation during the growing season are also critical, and will be affected by climate changes. Changes in season length are also important and affected crops differently.

Another adaptation strategy involves changing to crop varieties with improved tolerance to heat or drought, or those that are adapted to take advantage of a longer growing season. This is less likely to be cost-effective for perennial crops, for which changing varieties is extremely expensive and new planting take several years to reach maximum productivity. Even for annual crops, changing varieties is not always a low -cost option. Seen for new stress-tolerant varieties can be expensive, and new varieties often require investments in new planting equipment or require adjustment in a wide range of farming practices. In some cases, it is difficult to breed for genetic tolerance to elevated temperature or to identify an alternative variety that is adapted to the new climate and to local soils, practices, and market demands (Cumhur, 2008). Preliminary estimates of agricultural losses in Nigeria are around and 8 billion naira, IPCC (2007). One of the most pronounced effects of climate changes is the increase in heavy down pours. Precipitation has become less frequent but more intense, and this pattern is projected to continue across Nigeria. One consequence of excessive rainfall is delayed spring planting, which jeopardizes profits for farmers paid a premium for early season production of high value fruits crops such as water melon and pawpaw. IPCC (2007) observed that flooding caused severe erosion in some areas and also caused an increase in runoff and leaching of agricultural chemical in to surface water and ground water in Savanna agro-climatic zone

Another impact of heavy down pours is that wet conditions at harvest time results in reduced quality of many crops. Storms with heavy rainfall often are accompanied by wind gusts, and both strong winds and rain can flatten crops, causing significant damage. Fruit and vegetable crops are sensitive to even short-term minor stresses, and as such are particularly vulnerable to weather extremes. More rainfall concentrated into heavy down pours also increases the likelihood of water deficiencies at other times because of a reduction in rainfall frequency.

Abiodun, *et al.*, (2011) noted that drought frequency and seventy are projected to increase in the future over the Northern part of Nigeria particularly under higher emission scenarios. The author also observed that increased drought will be occurring at a time when crop water requirements are increasing due to rising temperatures. Water deficits are detrimental for all crops.

Mitigation Measures in Fruit Production

Agriculture is a major source of global green-house gas emissions, accounting for 13% of global anthropogenic emissions (OECD, 2009), particularly in relation to nitrous oxide and methane. Without abatement measures, emissions are likely to climb, among others due to population growth and changing food consumption patterns. Possible mitigation measures include a wide range of issues, such as improved farming techniques, minimum soil tillage, carbon sinks, conservation agriculture etc. However, many mitigation options entail additional costs to farmers, requiring cost-effective measures to be given the highest attention.

Innovation in Mitigating and Adaptation to Climate Change

- Investment in new crop varieties: To increase tolerance to water and heat stress will be essential. For example, the plant biotechnology sector can play a major part in helping to address the negative effects and consequences of climate change especially with respect to greenhouse gas reduction, crop adaptation and increases in yield. Innovation in the field of nitrogen and water use efficiency could also constitute important new tools for adaptation and mitigation.
- Plant nutrient/ fertilizers: Appropriate and responsible use of fertilizers can make a contribution to helping plants capture more carbon, fostering higher yield and slowing the decline of soil organic matter. The emissions originating from fertilizer use by farmers should be weighed against the net benefits of using fertilizer to increase agricultural productivity on the same amount of land, thus reducing change and increasing the carbon content in soils.
- Soil conservation: Conservation agriculture technologies such as minimal or zero tillage, made possible through the use of herbicides and herbicide tolerant biotech crops, and used in appropriate and carefully managed

situations, can prevent wind and water erosion and loss of soil moisture, improve soil biodiversity. This has the potential to increase soil fertility, and reduce carbon emissions. In addition, by limiting soil disturbance and promoting a permanent soil cover, conservation agriculture can contribute to limiting emissions from agriculture by increasing soil carbon content and preventing erosion.

- Extension: A key element in supporting agriculture's role is capacity building, dissemination of research knowledge and information. Extension can help farmers prepare for greater climate variability and uncertainty, create contingency measures to deal with exponential increasing risk and alleviate the consequences of climate change by providing advise on how to deal with droughts, floods, and other stresses. Extension can also help with the adoption of mitigation options.
- Public-Private-Partnerships (PPP): PPP can play a key role in mitigating climate change by helping local governments and private business combine and promote environmental sustainability, particularly in cases where available public funds and private financing are not sufficient to meet demand on their own. PPP's can help across the range of agronomic practices (conservation agriculture, conservative tillage, irrigation methods for saving water etc.) and in infrastructure improvements to markets.
- A wide variety of adaptive actions may be considered and adopted to reduce or overcome adverse effects of climate change on fruit production. At the farm level, options may include changing the timing of field operations, conserving soil moisture through appropriate tillage methods and improving irrigation efficiency.

A major adaptive response will be the breeding of heat and drought tolerant crop variety by utilizing genetic resources that may be better adapted to new climatic and atmospheric conditions. Collections of useful genetic resources are maintained in germplasm banks. These may be screened to find sources of resistance to new diseases and insects, tolerances to heat and water stress and better compatibility to new agricultural technologies. Crop varieties with high canopy index will reduce the irrigation water losses from the soil surface. Genetic manipulation may also help to exploit the beneficial effect of CO_2 fertilization on crop growth and water use. Adaptation measures also aim to reduce the impacts of global warming by adapting society and the economy to a warmer climate, based on the recognition that a certain amount of global warming will be inevitable, thus measures could be described as treating the symptoms like rising in temperature and sea levels, (ODI 2008).

Conclusion and Recommendations

Nigeria is blessed with both natural and human resources required to produce fruit crops that could sustain it population growth. Despite the availability of these resources, one billion dollars is still spent annually for the importation of fruit drinks that could ordinary be produce within the country. Global warming is recently been identified as one of the most important factor militating against fruit production in Nigeria. This paper has reviewed the key climatic factors that are hampering the production of fruit crops and several ways their impact could be ameliorated. Because of the important roles the fruit crops play in Nigeria economy, it is advisable that the government (local, state and federal) most come together to provide resource and fund that could be used to ameliorate the impact of climate change, if only the present Agricultural transformation agenda most work. Climate change is not just an environmental issue; it is indeed a development issue and if not tackled, could aggravate the degree of poverty, food insecurity, economic woes and ill-health of Nigerian. Researchers should focus on impacts of climate change on agriculture, disease patterns, and violent weather events, all of which impact Nigeria.

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Tables

Table1: Major Varieties of Fruits, the Ecological Zones and States grown in Nigeria

S/N	FRUIT	MAJOR VARIETIES GROWN	YIELD/ HA (TONNE	ECOLOGICAL ZONES GROWN	MAJOR STATES GROWN
1. .	Exotic Type • Mango	Tommy Atkins, Keitt, Maya, Irwin, Peter,	30-40	All ecological zones in Nigeria ranging from wet	Benue, Nasarawa, Plateau, Kaduna, Niger, Kogi, Bauchi, Gombe, Adamawa, Taraba, Yobe and Oyo States. Others Sokoto,
	• Citrus	Agege 1, Parson Brown, Umudike,	20-40	Rain, forest and Guinea savannah zones.	Benue, Nasarawa, Kogi, Kwara, Oyo, Ogun, Osun, Ekiti, Edo, Delta, Ebonyi, Abia, Imo, Kaduna and Taraba.
	• Banana\Pl	Paranta, Omini, Dwarf Cavendish,	20-45	Rainforest belt, low inland valleys (Fadamas) in	Edo, Delta, Rivers, Bayelsa, Cross River, Anambra, Imo, Abia, Oyo, Ogun, Ekiti, Lagos, Ondo, Osun and Kwara.
	• Pineapple	Smooth cayenne	50-60	Rainforest and derived savannah belts.	Edo, Delta, Rivers, Cross River, Bayelsa, Anambra, Imo, Abia, Oyo, Ogun, Lagos, Osun, Ondo, Ekiti, Kwara, Plateau,
	•Papaw (Carica	Homestead - CP, Sunrise solo Homestead -CG	30-35	Rainforest belt and part of the guinea savannah.	Edo, Delta, Rivers, Cross River, Bayelsa, Anambra, Imo, Abia, Oyo, Ogun, Lagos, Osun, Ondo, Ekiti, Kwara, Plateau,
	• Avocado	Mexican Guatemaltan West Indian, Booth	4.80	Rainforest and Guinea savannah belt	Edo, Rivers, Cross River, Imo, Anambra, Benue, Plateau, Kwara, Niger, Oyo, Ondo, and Bauchi
	• Guava	Rubby supreme, Supreme, Webber supreme,	12-15	Guinea savannah	AkwaIbom, Edo, Delta, Cross River, Anambra, Enugu, Imo, Abia, Benue, Borno, Yobe, Taraba, Kogi, Kwara, Plateau, Lagos,
2.	Indigenous Type *Irvingiag*	Sweet type (Sweet pulp) Bitter type (Bitter pulp)	25-60	Rainforest zone and derived savannah	Abia, Anambra, Enugu, Imo, Ebonyi, Akwa-Ibom, Cross River, Bayelsa, Delta, Edo, Lagos, Ondo, Oyo, Osun, and Ekiti.
	• *Chysophy llumalbid*	*C.subnudum, C.albidum, C aiayntaun.*	20-24	Rainforest zone.	Oyo, Ogun, Ekiti, Ondo, Anambra, Ebonyi, Enugu, and Adamawa.
	•*Dacryod esedulis*	Wild types	6-10	Rainforest/Savanna h	Abia, Anambra, Imo, Ebonyi, Enugu, Akwa-Ibom, Cross River, and Bayelsa

Source: Presidential Initiative on Tropical Fruits Production in Nigeria (2006)

Table 2: National Output of Some Major Tropical Fruits

S/N	CROP	AREA UNDER CULTIVATION (HA)	NATIONAL OUTPUT (TONNES)	WORLD OUTPUT (TONNES)	SHARE WORLD OUTPUT (%)
-1.	**Mango**	67,000	729,000	25,104,000	2.90
2.	**Pineapple**	359,200	881,000	13,739,000	0.64
3.	**Avocado Pear**	56,000	150,000	2,553,000	0.59
4.	**Papaya**	17,960	78,400	5,444,000	1.44
5.	**Citrus**	1,200,000	3,240,OUJ	61,094,000	4.10
6.	**Bananas**	167,000	2,000,000	97,772,000	2.04

Source: Presidential Initiative on Tropical Fruits Production in Nigeria (2006)

Table 3: Area affected by wind, deforestation and savannah forest fire 1990-2003

Indicator	Area Affected	
	1990- 1999	2000 - 2003
Wind Erosion	6,500,000ha/ann	9,000,000ha/ann
Deforestation	350,000ha/ann	400,000ha/ann
Savannah Forest Fire	100,000ha/ann	120,000ha/ann