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Development of coconut plantation in Nigeria; Problems and prospects

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Abstract
Coconut (*Cocos nucifera*) is a popular member of the palm family Arecaceae which originated from Asia. It was imported into Nigeria during the colonization era. There are many varieties of coconut in the world with the West coast tall and the dwarf varieties being the two most common types. This review examined the problems and prospects of coconut plantation development in Nigeria. There is a large unexploited opportunity in the local and international market due to some problems that need urgent attention before the coconut resources in Nigeria fade away. The current state of coconut production and uses in Nigeria does not match up to its international counterpart and therefore there is a need to tap into the unlimited riches that the "tree of life" has to offer. On the 18th position on the world coconut production country index currently, Nigeria can only boast of 265,000 metric tonnes of coconut production, a country that is bestowed with an arable rainforest zone fertile for a crop that is non-indigenous to it. Thus, the nation has the chance to meet the increasing market demands globally.

Keywords: *Cocos nucifera*, prospect, production, indigenous and potentials

Introduction
Cocos nucifera L, (Coconut) is part of the plant species in the palm family, growing to 30 m tall and diameter up to 60-70 cm with 4-6 m long pinnate leaves, 60-90 cm long pinnae; and drops leaves stems, cleanly leaving the trunk smooth (Pradeep kumar *et al.,* 2008) [30]. It has been cultivated by man for 4000 years (Nair *et al.,* 2003) [24]. Though not indigenous to Nigeria, coconut grows well in places with a mean annual temperature of 25°C - 28°C and an annual rainfall of 200mm. (Uwubanmwen *et al.,* 2011) [38]. The coconut palm is one of the most important and useful palms in the world, it is an important crop in the agrarian economy of many countries of the world providing their basic needs. (Nair *et al.,* 2003) [24]. The coconut offers cultural and religious significance in different societies, especially in India, where it is used in performing Hindu rituals. In Hinduism, coconut trees form the basis of wedding and worship rituals, a coconut religion in Vietnam, and feature in the origin myths of certain societies. The falling nature of their mature fruit has led to a preoccupation with death by coconut. (Michaels, 2006) [22] *C. nucifera* is a plant with unique features providing a host of products and by-products with distinctive applications at home and in the industry both locally and commercially to meet the basic needs of man. Coconut is popularly known as the tree of life for its great benefits and uses derived from every part of the tree; from its roots up to its very leaves (Sukanya *et al.,* 2014) [37]. The low productivity of coconut plants in Nigeria is a result of poor management practices, high-density plantings in the groves, poor soil fertility management, inadequate application of organic and organic manure, and poor pest and diseases control (Uwubanmwen, *et al.,* 2011) [38]. Coconut plants grew along the sea coast and on plain grounds. However, great potentials exist for increasing coconut production and productivity in Nigeria, if the government and individuals can venture into the deliberate establishment and management of the beneficiary coconut plant (Nair *et al.,* 2003) [24].

Origin of Coconut in the World
The origin of the coconut palm is the subject of controversy; different authorities submit an Indo-Pacific origin either around Melanesia and Malesia or the Indian Ocean, while others see the origin in north-western South America (Perera *et al,* 2009). Literary evidence from *Ramayana* and Sri Lankan chronicles indicate that the coconut was present in the Indian subcontinent before the 1st century BCE (Roger & Matthew, 1998). One of the American botanists Orator F. Cook in is proposed theory in 1901 on the location and the origin of *Cocos nucifera* based on its current worldwide distribution. He hypothesized that the coconut originated in the Americas, based on his belief that American coconut Species populations predated European contact and because he considered pan-tropical distribution by ocean currents improbable (Orator Cook, 1901; Dowe & Smith, 2002) [28, 10].
Modern genetic studies have identified the centre of coconuts origin as being the region between Southwest Asia and Melanesia, where it shows the greatest genetic diversity. (Baudouin, & Lebrun, 2008; Gunn *et al.,* 2011) [6, 15].

The cultivation and distribution of coconut were closely tied to the early migrations of the Austronesian peoples who carried coconuts as canoe plants to islands they settled (Baudouin, & Lebrun, 2008; Gunn et al., 2011; Crowther et al., 2016) [6, 15, 9]. The similarities of the common names in the Austronesian region are evidence that the plant originated in the region. A study in 2011 identified two highly genetically differentiated subpopulations (Fig 1) of coconuts, one originating from Island Southeast Asia (the Pacific group) and the other from the southern margins of the Indian subcontinent (the Indo-Atlantic group) (Gunn *et al.*, 2011) [15].

The creation and establishment of the palm with its crown of leafy fronds were credited by Indian mythology to the sage Vishwamitra, to provide support for King Trishanku his friend when the latter was released from heaven by Indra for his misdeeds (Gandhi & Singh, 1989; Gupta, 1991) [14, 16]. In the Papua New Guinea area, botanists affirmed the origin of a coconut palm on basis of the occurrence of the nearest botanical relatives (Child, 1974) [8]. This was argued by Harries (1990) in Malaysia and stated that the distribution of coconut is a relic of Gondwanaland. Recent theory suggests it to be native to Malaysia, a bio-geographical region roughly defined as an area that includes Southeast Asia, Indonesia, Australia, New Guinea, and several Pacific Island groups. The Indian subcontinent and South Asia designated as the Hindustani centre, an important region of the diversity of crop plants among the eight centres, have been identified as secondary centres of origin of *Cocos nucifera* (Randhaswa, 1980) [31]. The plant is now widely distributed throughout Asia, Africa, Latin America, the Caribbean, and the Pacific region (FAO, 2011).

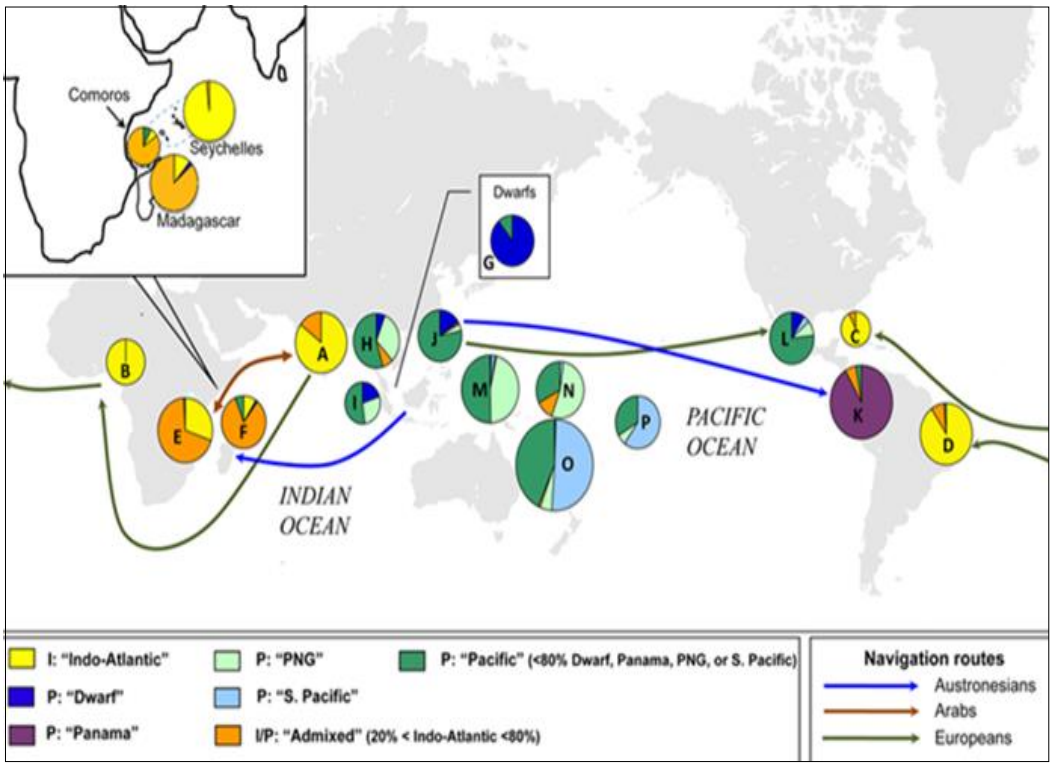

Fig 1: Geographical distributions of Indo-Atlantic and Pacific coconut subpopulations and their genetic composition (Gunn *et al.*, 2011)

History of Coconut in Nigeria

Coconut palm is known to grow under diverse types of climates as an exotic agricultural plant in Nigerian agriculture. It's majorly found along the sea coast and on plain grounds, the plant can float on the ocean for days and still germinate when beached because it possesses a husky exocarp. In Nigeria, the coconut palm is found mostly in the Southern States and in some marginal areas up to 10°N. Badagry local government area of Lagos is known to have the largest coconut plantation establishment in Nigeria. The first noted coconut plantation in Nigeria was established in 1876 by the Roman Catholic Mission in Badagry, Lagos State, and a good number of palms are found along the beach while most are found in homes and gardens. It can also be found along banks of small streams and stagnant pools of water in some northern states of Nigeria (Akpan, 1989). More than 90% of the nation's coconut belt is a continuation of the plantations or groves along the West African coast running from Cote d'Ivoire and southeast towards Ghana, Togo, and Benin to Lagos state in Nigeria. The cultivation of coconut is in scattered holdings and mostly in groves in the rainforest zone of Nigeria (Fig 2), so it is difficult to estimate the number of farmers that grow the crop. Presently, the total land area of about 36,000ha are under cultivation mostly in Lagos and Rivers states and an estimated 1.2million hectare of Nigeria land is suitable for coconut cultivation (NIFOR, 2008) [26].

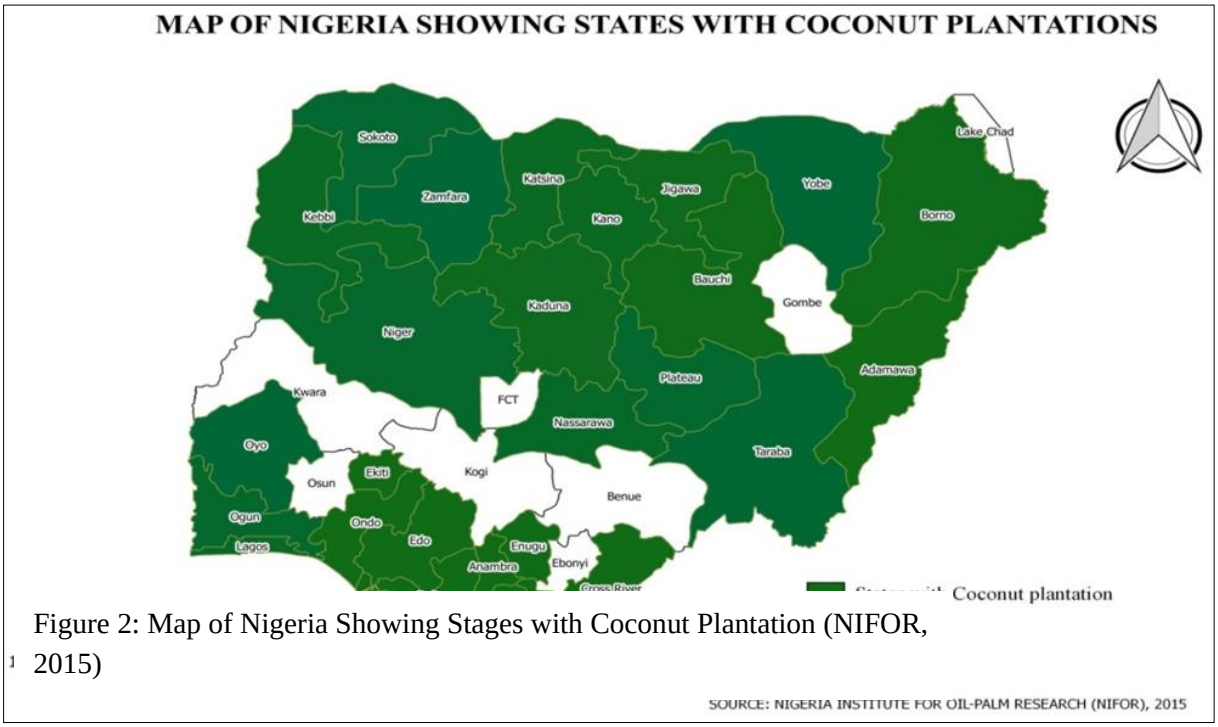

Figure 2: Map of Nigeria Showing Stages with Coconut Plantation (NIFOR, 2015)

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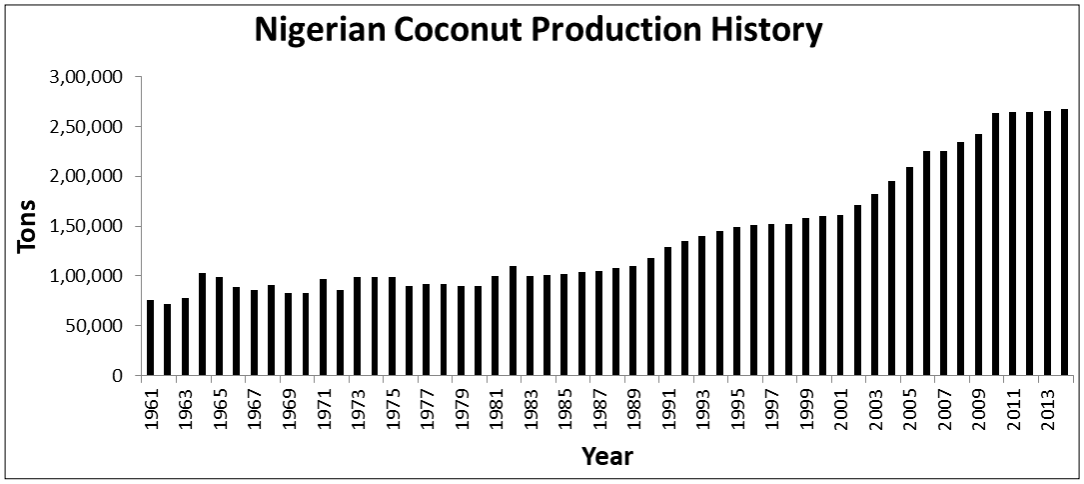

Fig 3: Nigeria Coconut production History (FAO, 2015)

The West African Tall (WAT) is the most extensively grown variety both as a plantation and compound crop. Traditionally, tall varieties are commercially cultivated and are usually known by the places where they are cultivated. They grow to a height of 15-18 meters and their life span expands up to 60 to 75 years (Nair *et al.,* 2003) [24]. Coconut production has been on the increase in Nigeria from 1961 to the year 2010 (Fig. 3), especially when compared with what the level of production should be, although the increase in population density must have increased the demand for more coconut and its by-products. As a result of this, there is a need for further investment into coconut production in Nigeria especially when one considers the fact that Nigeria has the 9th largest population in the world but is 19th in terms of coconut production in the world (FAO, 2015).

Social and Economic Importance of Coconut Trees Maintaining

The coconut palm provides a series of by-products such as fibre, charcoal, handicrafts, vinegar, alcohol, sugar, and planks for furniture, roofing, and fuel among others, contributing significantly to the economic and social importance of the people who used them for specific needs.

Copra derived from the dried meat of the seed is the chief product of coconut oil as seen in (Fig. 4.) which is used for making soap, shampoo, cosmetics, cooking oils, and margarine. Shredded copra is used in cakes, pies, candies, curries, and sweets. For centuries coconut oil has been known as well raw material in cosmetic industries in the production of hair and skincare products. Its moisturizing and softening properties are exploited in many kinds of creams and lotions today. From the 19th century until 1960, copra became the most important source of vegetable oil in international markets as oil was used in the production of soaps, candles, and explosives (Ahuja *et al.,* 2014) [3].

Fig 4: Coconut fruit with coconut oil (Wikipedia, 2020)

Fig 5: Fresh heart of Palm (Wikipedia, 2020)

Coconut flower cluster on incision provides a sweet juice which when fresh and not fermented is served as food in different parts of the word, especially the island nation in the central tropical Pacific Ocean. When left, it ferments quickly into a beer with an alcohol content of up to 8%, called toddy in India and Sri Lanka; Tuba in Philippines and Mexico; and Luwak in Indonesia and Malaysia. In Nigeria, today is also called coconut palm wine (Sekar & Mariappan, 2007) [34]. Alcohol is, however, a ubiquitous part of men's social gatherings, where beer and toddy are consumed in great quantities (Sekar & Mariappan, 2007) [34]. Coconut toddy is believed to be good for health, particularly for eyesight, and also serves as a sedative. It is also a mild laxative relieving constipation. In some cases, it can be prescribed as a tonic for those recovering from diseases such as chickenpox (Khanna, 1985) [20].

The apical buds of adult plants are edible and are known as heart-of-palm (Fig. 5.) considered a rare delicacy. Harvesting this kills the tree and it's normally used in salads. The vegetative parts of coconut trees are been employed in thatch construction by builders in every part of the world (Fig. 6.). The leave of this plant can be used to woven different materials to meet the different needs of man such as baskets, mats, skewers, and the green leaves are stripped away, leaving the veins which are tied together to form a broom or brush. (Sensarma, 1989). The husk fibre is combed out and sold as coir (Fig. 7), a material for making rope and coconut matting. Coir dust is an excellent substitute for peat moss in potting soils. Coconut husk is used as a fertilizer for indigenous populations. The vascular strands have been used for weaving into ropes and dry individual strands for brooms; yarns are woven together to make fishing nets, bags, and mats. The water inside a young green coconut should not be confused with coconut milk or cream produced from coconut meat. The consumption of coconut water is very common and directly served from the fruit as a drink by cracking a small hole on top because of the benefits its offers to humans. Young Coconut Juice (YCJ) is a well-supplied medicine chest and is used in folk healing for several ailments: relieving fevers, headaches, stomach disorders, diarrhoea, and dysentery (Mittre, 1991) [23]. YCJ is high in minerals, particular calcium (bones), magnesium (heart), and potassium (muscles), however, is also considered a good source of energy for man because of is rich in a full range of B vitamins, except B6 and B12 (Mittre, 1991) [23].

Coconut oil can be converted into electricity through a chemical process; it can also be processed into bio-diesel using standard procedures that are used in the conversion of other vegetable oils into bio-diesel (Ahuja, Ahuja, & Ahuja, 2014) [3]. Coconut oil is used in medication (Khanna, 1985) [20]. Ahuja, Ahuja, & Ahuja, (2014) [3] disused that studies have indicated that the people who used the coconut oil daily have a higher metabolic rate and retained a lean body mass and research on the health benefits of coconut has shown that populations in Polynesia and Sri Lanka where coconuts are consumed in large quantities do not suffer from high rates of heart

disease and serum cholesterol. Coconut oil is mixed with pulses to control insect attacks on pulses during storage (Ahuja, & Ahuja, 2008) [2].

The white, fleshy part of the nut is edible and used fresh or dried (desiccated) in cooking Nutmeat of immature coconuts is like custard in flavour and consistency, and is eaten or scraped and squeezed through cloth to yield a 'cream' or 'milk' used in various foods (Ahuja, Ahuja, & Ahuja, 2014) [3]. Sensarma (1989) [35] wrote that coconuts are extensively used in Hindu religious rites and form an essential element of rituals and festivities. Coconuts are usually offered to the gods, and coconut is smashed on the ground or some object as part of an initiation or inauguration of building projects, facilities, ships, the use of a new vehicle, bridge, etc. Even in areas where the coconut palm does not grow, no prayer or offering is complete till coconut is offered.

Fig 6: Houses built with Coconut Leaves (thatch)

Fig 7: A close-up view of coir fibre

The coconut shells are used on a large scale by the local communities in the production of some based utensils such as cups, bowls, bottles, lamps, buckles, and ornaments. The coconut shell can be consumed to generate heat when burned directly as fuel. This is also a means of limiting the consumption of forest trees. The coconut palm grows mainly in Southeast Asia and Central America. The total planted area with coconut palms is estimated as 12 million ha, of which more than 90% grow in Asia (APCC 1998). In some parts of the tropics, coconut wood has been traditionally used for building less-used materials. Throughout the copra-producing regions of the world, there is increasing interest in the utilization of wood from over-matured coconut trees (Killmann & Fink, 1996) [21]. Indonesia, the Philippines, and India are the major producer's coconut wood (Adkins *et al.*, 2006) [1]. Coconut wood is of high density and its strength properties show that it can be used as an alternative timber (Owoyemi & Akinwamide, 2020) [29]

Cultivation of Coconut Plantation

Twenty-two states in Nigeria are mostly known for the production of coconut were about 70 per cent of national output comes from, Akwa Ibom, Delta, Edo, Ekiti, Ogun, Ondo, Oyo, Rivers and Taraba. Despite the huge development, this local production by subsistence farmers can only supply about 20 per cent of n0ational demand (Isaac, 2021) [42]. The most threatening part of coconut development in Nigeria is cultivation. For the nation to have enough coconut to meet its increasing market demand there is a need for a sustainable source of the coconut palm. Coconuts are propagated exclusively from seed and thrive on a different range of soils as long as they are drained and aerated with a pH between 4.3 and 8.0. The control of the disease in coconut production is reliant on good sanitation practices and the use of appropriate systemic for pests' control.

Steps involved in the cultivation of coconut plantation according to John, 1970 are:

1. Selection of mother plant
2. Selection of seed nuts
3. Harvest and preservation of seed nuts
4. Preparation of seedlings for nursery planting
5. Planting of seedlings in the nursery
6. Maintenance of seedlings at the nursery
7. Selection of best seedlings
8. Preparation of land for planting
9. Planting at the plantation
10. Care of young plantation
11. Maintenance of mature plantation
12. Harvesting

Problems of Coconut Production in Nigeria

In Nigeria, the ever-increasing demand for coconut has outgrown the production capacity of the country. Coconut products in circulation are majorly imported as the demand shifted in the 1990s (Ruf et al., 2010) [33]. Nigerians go to plantations in Benin and Togo where they pay for coconuts to be gathered, de-husked, and then hauled to Nigeria. In the late 1990s, traders went as far as Côte d'Ivoire which had a coconut surplus, thanks to a hybrid coconut R&D program. But the hybrid varieties keep less well than the traditional coconut, called "Grand-Ouest African" (GOA), and from 2002 onwards Nigerian buyers turned massively to GOA coconuts grown in western Ghana (Ruf et al., 2010) [33].

The problems with coconut production in Nigeria are largely government-induced rather than environmental (Ruf et al., 2010) [33]. The challenges being faced by coconut producers are aggravated by inappropriate agricultural policies that have stifled agricultural potential. SA study of the coconut commodity chain in Nigeria shows that the sector is confronted with many constraints some of which include the inadequacy price of coconut and the competition with other oleaginous plants, an ageing coconut plantation, the impact of the coconut lethal yellowing disease, shortage of rainfall and temperature, demand for nuts towards Nigerian markets and the weak instruction an organization (Bene & Courbet, 2008) [7].

Another problem that has affected coconut production and all other agricultural products is import tariffs that have put fertilizer out of reach of small-scale producers thus leading to low yield and hard manual labour. The distribution and marketing of fertilizer are controlled by politicians who use it to amass wealth and patronages, in the end, genuine farmers are left out. Other problems facing coconut production generally include:

1. Poor market understanding across the industry
2. Reliant on mature markets for commodity products
3. Regions lack infrastructure for manufacturing and transport
4. Lack of finance
5. Lack of incentive to replant for future supply
6. An unproven image of being unhealthy to consume, being high in saturated fats
7. Domination of natural oil markets by lower-cost nut and vegetable oils from large scale production
8. Ageing tree's declining supply
9. Poor tree management promotes pests and disease
10. Changes in government policy
11. Rising quality standards of markets and competing countries. (NIFOR, 2008).

Production Opportunities in the International Market

Cocos nucifera is one of the most important sources of vegetable oil in the rural areas of the rainforest zones of West Africa and the world generally. The bulk of coconuts produced is for home consumption and local trading. As of 2004, the annual coconut production value according to FAO was 195,000MT, then Nigeria was in the 20 positions among the world's major coconut producing countries. By 2005 there was an increase in production from 195,000MT to 209,000MT. In 2006 Nigeria moved to the 19 positions in the world with an increased production value of 225,000MT i.e. 16000MT higher than the previous year. Then another increment by 500MT in 2007 bringing the production value to 225500MT. In 2008 Nigeria's production value increased from 225500MT in 2007 to 234000MT. (FAO, 2010). As of 2008, Indonesia was the highest producer of coconut followed by the Philippines and India with an annual production value of 19500000MT, 15319500MT, and 10894000MT respectively (FAO, 2010). In Africa, Tanzania is the highest producer of coconut and maintains

the 11 positions in the world, followed by Ghana and Mozambique producing 568499MT, 316300MT, and 265000MT respectively. Nigeria is the 5 major producers of coconut in Africa. Nigeria produced a total of 1088500MT of coconut between 2004 and 2008. In recent years, China, the USA, and the Netherlands United Kingdom are the major importer of coconut and its product, while the Philippines, Indonesia, and Brazil are the major exporters of coconut and its product (FAO, 2010).

The economy of several countries is based on the nut palm. Asia generates 5/6 of total production. On the American continent, Mexico has a moderate yield, while in Africa production is more limited (Eynard & Eynard, 1983) [11]. The production centres can be divided into four areas:

- **Southern Asia:** the rainfall Philippines, Indonesia (Java), India, Srï Lanka, Malaya.
- **Central and South America:** Mexico, Brazil, Florida, Jamaica, Honduras, and Cuba.
- **Oceania:** Fiji Islands, New Guinea, New Caledonia, Salomon Islands, and Samòa.
- **Southern Africa:** Mozambique, Tanzania, Madagascar.

In 2009, world production was 54,716,444 tons of fruits. (FAO, 2010). The US alone annually imports 190 million pounds of oil and more than 650 million pounds of copra (Simonetti, 1990) [36].

Recent Developments

Coconut is a commodity lot of economic, medicinal and nutritional value and the market for it in Nigeria is enormous. Currently, the local supply can only meet about 20% of the demand, hence there's a need to urgently address the short supply (Izuaka, 2021) [18].

Coconut plants are fondly referred to as the "tree of life" for their important role in smallholders' livelihoods, serving as a direct and stable source of cash income, nutrition, and materials (Warner, 2007). The stems of the coconut tree are mainly converted into wood products in small-scale operations, often in very rough form as a result of its conversion process because of its density variations, high density, and ash content.

Many of the coconuts plantations (Fig. 8) in Nigeria are ageing and have started to decline in their fruiting capacity; which has led to the burning of the senile trees (Fig. 9). Recent studies carried out at the Federal University of Technology Akure revealed that senile Coconut stem had comparable properties with conventional timber making it suitable for construction where high strength values are required thereby providing additional income to coconut farmers and preventing air pollution caused by burning (Owoyemi & Akinwamide, 2020) [29].

There is potential for Nigeria to make major contributions to the economic and industrial development of the nation, especially with the wild range of industrial applications of most products like Coconut (Nigeria Agriculture, 2018; Izuaka, 2021) [18]. Coconut is not indigenous to Nigeria, she is blessed with the "tree of life" which could be harnessed for industrial development through which the quality and standard of living of the people can be improved (Olabiran, 2012) [27].

In Nigeria, the Minister of State Industry Trade & Investment advised coconut farmers and the government to harness the global potential market for coconut in the country, which is more than $6 billion. Therefore, Nigeria must produce more to increase its market share, and the best strategy is to start the cultivation of the commodity for improved yield with the engagement of different strategies by farmers and the government (Izuaka, 2021) [18].

Fig 8: Coconut Plantation at Bolorunduro, Akure North, Nigeria (Owoyemi & Akinwamide, 2020) [29]

Fig 9: Coconut Plantation undergoing burning at Bolorunduro, Akure North, Nigeria (Akinwamide, 2020) [29]

Conclusion

The coconut plant has various uses that when tapped into can serve as a source of formidable income to the country's GDP, although the production of coconut is on the increase in Nigeria, there is a need to produce more due to the high population of coconut consumer in Nigeria. Coconut was imported to Nigeria several years back and one will think that there should be an increase in plantation size and income generated from it, but studies have shown that apart from the coastal and tropical regions of the country, coconut plantations are hardly found anywhere else. Most of the ones available have outgrown the purpose of plantation and now they are been cut down, burned up, or left to decay. Coconut trees occupy a pre-eminent position in the Nigerian economy in employing a large number of people living in the coconut belt if special consideration is given to its cultivation and management.

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