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# TRADITIONAL STEPS OF PALM OIL (*Elaeis guineensis*) PRODUCTION IN NIGERIA.

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## ABSTRACT

This review examines the local steps that are involved in the palm oil production in Nigeria, which includes; harvesting palm fruits from palm trees, collecting the bunches of palm fruits to a spot, splitting the palm fruits bunches into smaller pieces known as spikelets, removal of palm fruits from spikelets, boiling of the palm fruits to soften its mesocarp, removal and grinding the palm fruits mesocarp from its endocarp, separation of palm oil from other constituents, heating the crude palm oil to obtain refined palm oil, packaging the palm oil in various sizes of sealed containers such as plastic container. Local technique of palm oil production is cheap and readily available, but it comes with poor yield. However, modern technique (the use of machine) is expensive, though, but it makes the process easier and faster, and enhances commercial palm oil production.

**Keywords:** *Endocarp, Mesocarp, Palm fruits, Palm fruits bunch, Palm oil palm tree, Spikelets*.

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## INTRODUCTION

Palm oil is an important oil extracted from the ripe mesocarp of the palm fruits produced by oil palm (Elaeis guineensis). Palm oil has its origin in West Africa, specifically, Guinea. Some years back, it has been an economic pillar of some countries such as South-East Asia, Papua New Guinea, and Central and West Africa, while it has also had partial economic support in tropical Latin America. Apart from its application in cooking, palm oil has gained international recognition even in non-food applications. Palm oil has been recently employed as an important material in the production of biofuels (Teoh, 2010). Of course, biodiesel could be produced through other sources, such as rapeseed and soybean oil. However, palm oil as a particular source has numerous advantages over other sources (Basiron, 2002; Mekhilef *et al.*, 2011).

Palm oil fruit belongs to the class of fruit called 'drupe'. Several numbers of palm fruits are usually attached in a bunch. Due to its importance, many countries of the world now engage in palm oil production. Among the five leading countries when it comes to the production of palm oil are Indonesia, Malaysia, Thailand, Colombia, and Nigeria (Mba *et al.*, 2015).

Palm oil is obtained from the mesocarp of the oil palm fruits (*Elaeis guineensis*), its major constituent is glycerides. However, it also contains small quantities of non-glyceride components which include; free fatty acids, trace metals, moisture and impurities, and minor components (Nagendran *et al.*, 2000). The minor elements present in crude palm oil is approximately 1% which includes; carotenoids, triterpenes, tocopherols, sterols, terpenic, phospholipids, gtycolipids, aliphatic hydrocarbons, and other trace elements (Goh *et al.*, 1985). The characteristic orange-red color of palm oil is due to an element known as Carotenes. Carotenes and tocopherols are responsible for the stability and nutritional value of the oil. The quality standard of palm oil seems to be measured by carotenes, tocopherols, and other minor elements (S. H. Goh *et al.*, 1985).

The palm oil sector is expected to be a sector that will potentially revive Nigeria's economy after many years of abandonment due to the discovery of crude oil (Gharleghi & Chan, 2013). It is hoped that the palm oil sector will diversify the economy and save the country from the havoc caused by the constant use of crude oil, especially the environmental hazard caused by the release of carbon monoxide into the environment.

Palm oil is one of the most important and useful products among the various products supplied by palm trees. Palm tree is a perennial crop, and the highest oil-producing plant (Sambanthamurthi *et al.*, 2000). The importance of palm oil cannot be overemphasized. Palm oil is used for our soup preparation as it is a good source of vitamin E and carotenoids, it could also be used to produce local soap, it is a source of income to farmers, and also serves as a foreign exchange to a nation. Apart from the use of palm oil as a biofuel, it is also widely used for food products, cosmetics, and engine lubricants (Tan *et al.*, 2009). Aside from its remarkable fatty acid composition, palm oil is one of the most important oils among frying oils (Mba *et al.*, 2015). Palm oil farming is a productive endeavor in terms of empowering rural communities, fostering economic growth, and improving the livelihood of people in rural areas (Syahza *et al.*, 2020). Palm oil production is a very strong pillar of a nation's socio-economy development (Ahmad *et al.*, 2020).

Despite having numerous benefits, palm oil production is associated with few negative impacts (Hosseini & Wahid, 2015). Among the negative impacts the palm oil production processes impose on the environment are; the release of pollutants during the production, deforestation, and destruction of animal habitat for palm fruit plantations. The high demand rate for palm oil has consequently increased the rate of its production, and consequently increased environmental hazards, there is therefore a need to devise a means of preserving our forests as well as safeguarding our environment, even as we intensify efforts in commercial palm oil production (Saswattecha *et al.*, 2015).

There are various techniques for producing palm oil. These techniques are grouped into two main categories; traditional technique (human power) and technological technique (machines). The traditional means is a palm oil production method that mainly uses human efforts. It is cheap and always readily available. It is however associated with some shortcomings such as; low quantity and quality products, human fatigue, impurities, and others (Taiwo *et al.*, 2000). Technology method on the other hand is a palm oil production technique where the production is achieved mainly with the use of a machine. It makes work easier and faster, and enhances commercialization of palm oil (Anyaoha *et al.*, 2018). However, technology means is capital-intensive and also generates pollution. Technology means is simply the best when purity and commercial production are prioritized. It is quite unfortunate that a larger percentage of Nigerian palm oil producers are smallholder farmers who constantly embrace traditional methods. Consequently, this leads to low productivity that could not meet the exportation demand.

**FACTORS THAT HINDER THE PRODUCTION OF PALM OIL IN LARGE QUANTITY**

Despite the hope, the palm oil sub-sector has for Nigeria's economy, some factors limit its intended efficiency in Nigeria's economy. Among factors that might impede its viability are; the use of crude tools, poor yield fruits, poor infrastructural facilities, predominance of small-holder farmers, over-reliance on crude oil, land tenure system, and poor credit facilities (Ikuenobe, 2009).

The quantity and quality of palm oil production in Nigeria are low due to some hindering factors. Among the major factors that are responsible for the low level and inefficient palm oil production in Nigeria are the high cost of labor, poor transportation system (including bad roads), poor power supply, poor water availability, and inadequate credit facilities (Olagunju, 2008). In addition to the above factors, one could say political instability and inappropriate government policy also constitute significant hindrances to the production of palm oil in large quantities and excellent quality.

The traditional method is predominantly employed in palm oil production in Nigeria, as a result, the production remains low. Apart from this hindrance, the process is usually very tedious and laborious compared to the mechanized method (Nwalieji and Ojike, 2018). As much as palm oil is of great importance to man, its production demands some tedious processes. This review will go a long way in helping us to simplify the various traditional steps that are involved in the production of palm oil.

It is always obvious when the palm tree bears matured and ripe palm fruits; the obvious red color of the palm fruits is a very good indication of their ripening. In a situation where the palm tree is too tall that the bunch of palm fruits is

out of reach to the sight, there would be some fallen ripe palm fruits at its base, indicating there are ripe palm fruits on it (Sinambela, 2020).

**TRADITIONAL STEPS OF PALM OIL PRODUCTION**

The production of palm oil starts from palm fruits, and they cannot exist without palm trees. Palm tree bears palm fruits, and they are processed to produce palm oil. This implies that whenever palm oil is to be produced, the start point is usually from the parent, known as the palm tree. It should be noted that only ripe palm fruits are harvested for the production of palm oil as harvesting unripe palm fruits would amount to a waste of resources. It is very easy to identify the palm trees that are bearing ripe palm fruits; the reddish-orange coloration of the oil palm fruits shows their ripeness. When palm fruits get ripe, the farmer finds out by looking on top of the palm trees or keeping eyes on the ground for the falling of a few palm fruits. In most cases, the ripeness of oil palm fruits is defined by referencing the number of detached oil palm fruits from the oil palm bunch right there on the oil palm tree, the most common standard is when ten detached oil palm fruits are sighted on the ground (Mat Sharif *et al.*, 2017).

**STEP ONE: HARVESTING PALM FRUIT BUNCHES FROM OIL PALM TREE**

The moment the ripeness of palm fruits is confirmed, then the farmer commences the harvesting of oil palm bunches on the oil palm tree. This process is usually cumbersome and tedious, especially when the oil palm tree is tall (Ayodeji Oyedeji *et al.*, 2020). However, for shorter oil palm trees, the process is very much easier. Farmer can harvest palm fruits from shorter oil palm trees with his cutlass while he is standing on the ground. This is not possible in the case of tall palm trees, as the farmer or his hired man has to climb the palm tree. This part is the most difficult in the entire process; it is not only risky but also strength-demanding (Nair *et al.*, 2018). Local technicality and physical strength are required to climb palm trees (Hudzari *et al.*, 2020).

The farmer or harvester makes a local belt from a very soft palm tree frond. He puts this local belt around the palm tree, right at its base. He belts himself with the palm tree and properly locks the belt at his back. The belting is done in such a way that there is an allowance of about half a meter between him and the palm tree so he can relax his back on the belt as he climbs. He uses his two hands to move the belt up in a stepwise manner and also moves his two legs accordingly. He cuts off the old palm tree fronds with his axe until he gets to the ripened palm fruits bunch. He then cuts off the stalk of the bunch that is attached to the palm tree body. The falling of palm fruits bunch is usually accompanied by a loud sound. On falling, some palm fruits get scattered in different directions. After he has cut off all the bunches of palm fruits, the farmer/harvester descends from the top of the palm tree in reverse direction of how he climbed. He uses his cutlass to cut the fronds into pieces and clear the ground so that the palm fruit bunches and scattered palm fruits are visible for pickup.

**Figure 1**: Cutting of palm fruits bunch on a short palm tree

**Source**: Goh *et al.* (2016)

**Figure 2**: Cutting of palm fruits bunch on a tall palm tree

**Source**: Aderemi *et al.* (2020)

**STEP TWO: GATHER ALL PALM FRUIT BUNCHES TO A CENTRAL POINT.**

For an easier process, all the bunches of palm fruits are conveyed to a particular central point. For the farmer's convenience, a cool place with shade is usually preferred. The farmer can carry each of the oil palm bunches on his/her head at a designated central point or use a head-pan to convey them. Maximum care must be taken by the farmer when he carries the bunch of oil palm on his/her head as the bunch of sharp thorns could cause injuries. It is recommended the farmer uses a very efficient material (such as clothing) to insulate his hand and head against the thorny bunch. However, a wheelbarrow can also be used to perform the same function. A wheelbarrow will be easier and more comfortable as compared to other means, but it might not be available to many of Nigeria's oil palm producers, since the majority of them are smallholder farmers.

**Figure 3**: Gathering of palm fruit bunches to a central point

**Source**: Bakewell-stone (2022)

**STEP THREE: SPLITTING OFF THE BUNCH OF PALM FRUITS INTO SMALLER PIECES (SPIKELETS).**

The farmer uses his axe to carefully split each of the bunches of palm fruits from their stalks into smaller pieces known as palm fruit spikelets. Extra care must be taken at this stage because the sharp axe could mistakenly cut off the farmer's hand if adequate care is not taken.

**Figure 4**: Splitting of palm fruit bunch into smaller pieces known as palm fruit spikelets

**Source:** Che Rahmat *et al.* (2018)

**STEP FOUR: REMOVAL OF PALM FRUITS FROM SPIKELETS**

Palm fruits are strongly attached to their respective spikelets which makes them not easily detached. For the palm fruits to be easily detached from their spikelets, they are allowed to remain in that spot for two days (Onu *et al.*, 2022). This will weaken the bond that exists between the palm fruits and the spikelets. After this, some palm fruits will detach on their own, while others will easily be removed from their respective spikelets. Care must always be taken at this stage as the spikelets have needle-like pointed branches which could cause injury to human hands if not carefully handled. After the palm fruits have been properly separated from the thorn-like spikelets, they are put inside a local basket or sack bag for easy conveyance to the next stage.

**Figure 5**: Separation of palm fruits from the spikelets

**Source:** Aderemi *et al.* (2020)

**STEP FIVE: BOILING (STERILIZING) OF THE PALM FRUITS**

This stage involves boiling the palm fruits to soften their mesocarps. This is done by simply putting the palm fruits inside a drum, putting some water inside the drum, and then subjecting it to extensive heat for about two hours. The heat is usually generated with firewood. To avoid heat loss to the surroundings, it is necessary to cover the drum properly. It is important to ensure the palm fruits are well-boiled to ease the next step.

**Figure 6**: Boiling of palm fruits

**Source**: Morakinyo & Bamgboye (2017)

**STEP SIX: REMOVAL AND GRINDING (POUNDING AND MACERATION) OF THE PALM FRUITS MESOCARP FROM ITS ENDOCARP**

After the proper boiling of the palm fruits, the bond between the mesocarp and endocarp becomes so weak that they easily get separated on the application of little pressure. The mesocarp part of palm fruits constitutes the palm oil and other fibrous materials, while the endocarp part contains the palm kernel and its shell. Mesocarp is the most important part of palm fruit in palm oil production. The separation of the mesocarp from the endocarp involves the application of mechanical energy only to the outer mesocarp. This is achieved by either traditional methods or mechanical means. Some years back, a larger percentage of Nigerian palm oil producers employed the traditional method, using either their legs (matching on the boiled palm fruits) or mortar and pestle (Onu *et al.*, 2022) (Adebo GM *et al.*, 2015). The gradual emergence of technology at this stage has not only been a great relief to some farmers but also enhanced their production per unit of time (Wondi *et al.*, 2021).

**Figure 7**: Traditional method (the use of leg) of grinding palm fruits to remove mesocarp from endocarp

**Source:** Nyanjou (2008)

**Figure 8**: Mechanical method of removing palm fruits mesocarp from endocarp.

**Source**: Morakinyo & Bamgboye (2017)

**STEP SEVEN: SEPARATION OF PALM OIL FROM OTHER CONSTITUENTS**

This involves the separation of palm oil from other items such as; fibers and palm kernels. This could be achieved by either traditional method (manual technique) or mechanically through the use of hydraulic or screw press, unfortunately, it is not readily available to the larger number of palm oil producers in Nigeria. It is capital-intensive and also generates both air and noise pollution when in use. However, the use of machines will promote the commercial production of palm oil and relieve humans of stress. On the other hand, the traditional method is not only readily available but also cheap, it does not involve the use of fuel, and it is easily done without noise pollution. However, it is labor intensive, there is a tendency to have some impurities in the final products, which also hinders palm oil commercialization (Taiwo *et al.*, 2000).

For the traditional method, a circular shallow concreted hole is made, some water is put inside this hole and the macerated mass is poured inside this concreted hole. The mixture is properly stirred by someone inside the hole as she (mostly done by women) uses her hands and legs for a homogenous mixture ( ). Being the lightest among all the constituents, palm oil floats on water, and hence, it is easily collected into a drum. Though the main interest is to produce palm oil, there are still some other valuable items that are automatically produced alongside palm oil. So, other valuable items present need to be processed and collected as well. The system is left with water, fibers, and palm kernels. Fibers are easily collected since they are less dense than palm kernels. Palm kernels are collected last, being the densest.

**Figure 9**: Local way of separating palm oil from other constituents

**Source**: Morakinyo & Bamgboye (2017)

**STEP EIGHT: HEATING THE CRUDE PALM OIL TO GET REFINED ONE**

This stage involves heating the crude oil palm to remove residual water and get the refined oil palm (Abebe Assefa, 2022). The crude palm oil is put inside a drum and heated extensively. The heat is locally generated by firewood. The electrical method could however be used to generate the heat which would make the operation easier and faster, but this is not available to the larger percentage of the palm oil producers in Nigeria (Adebo GM *et al.*, 2015). After about two hours of heating, the refined palm oil is separated from the other items such as water and other impurities on top. About forty-five minutes should be allowed for the refined palm oil to cool before putting it inside plastic containers.

**Figure 10**: Obtaining refined palm oil from heating of crude palm oil

**Source**: Adejo *et al.* (2019)

**STEP NINE: PACKAGING OF PALM OIL**

Packaging is a very essential part of production processes since it presents the beauty of the product in its physical form. After the palm oil has been finally produced, appropriate storage and packaging are necessary to prevent it from wastage and contamination (Ojo *et al.*, 2014). Having successfully produced palm oil, it is essential to allow it to cool and afterward, package it in the desired well-sealed and covered container such as a plastic keg of various sizes or drum (Nkpa *et al.*, 1990) and ready for the market.

## CONCLUSION

Palm oil could be produced either by manual technique (human efforts) or technological technique (the use of machines). The manual method is predominant among smallholder farmers; it is cheap and always readily available. It is, however, very rigorous, laborious, yields poor quality, low quantity output, and tasking. On the contrary, technological means of producing palm oil are easier, faster, and lead to high productivity. Whichever technique is

adopted, palm oil production involves sequential steps. The importance of palm oil cannot be overemphasized; it is used as a biodiesel material, in food cooking, as a lubricant, in soap making, in frying, etc. To meet up with its various demands in Nigeria, there is a need to commercialize the production of palm oil, by completely shifting from manual technique to mechanical means.

## CONFLICT OF INTEREST

The authors of this article do not have conflict whatsoever; be it in writing or financial contribution.

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