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UTILIZATION OF OIL PALM WASTES IN SOUTH WESTERN NIGERIA

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ABSTRACT

A survey involving the use of questionnaires and personal communication during field visits was undertaken in Ekiti, Ogun, Ondo, Osun and Oyo states of Nigeria to ascertain the level of utilization of the inedible portions of oil palm products often referred to as wastes. Items identified as wastes and their present uses include trunk for bridges and roof trusses; fronds and leaves for brooms, thatching of roofs and fences, staking of creeping and climbing plants, weaving of baskets and cages and cordage materials; fruit bunches for black soap production; kernel shells for soil erosion control and furnace fuel; and mill effluents for sludge cake used as fuel. A substantial amount of these wastes are unutilized which has resulted in their constituting nuisance in plantations and mill sites. Incineration is the only disposal method employed to create space for other activities. It is recommended that the use of these wastes be popularized among urban dwellers to create market for them. Fruit harvesting and conversion of the trunk are tedious; hence the development of appropriate technology for improved efficiency required.

KEYWORDS: *Oil palm trunk, oil palm waste, empty fruit bunches, palm fronds woven baskets, oil palm trunk bridges*

1. INTRODUCTION

The oil palm is a tall straight branchless trunk tree with leaves clustered at the top. The clustered leaves called the fronds are about 3 to 4 meters long and pinately divided into leaflets. The formation of the oil palm trunk or stem commences at about 3 years after transplanting to the field and maximum height is attained at about 10 years. At full maturity the stem attains a height of up to 30 meters and the diameter of up to 75cm (Hudson *et al* 1968, Yayock *et al* 1998).

Although there are divergent opinions as to the origin of the oil palm, on the basis of archeological, historical and linguistic evidences, most authorities accept the tropical rain forest of West Africa as the centre of origin of the oil palm (Zeven, 1965; Rees, 1965; Jacquemard 1988 and Purseglove 1992). The tree grows well in the forests of equatorial tropics of Africa, Southeast Asia and America. The main oil palm belt of West Africa runs through the southern latitudes of Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, and Nigeria to Cameroon.

The oil palm is often described as the prince of the plant kingdom because virtually every part of it has an economic value. It plays an important role in the agricultural and economic sectors of those countries where it is found. The three primary products of processing i.e. palm oil, kernel and kernel oil are export products and industrial raw materials, which have resulted in the establishment of industries and generation of employment and foreign exchange earning. Besides these primary products, there are a number of inedible components of the oil palm tree, which are often referred to as wastes because of their relatively less known and actual utilization. Efforts have therefore been made by researchers to effectively utilize these wastes.

Chan *et al* (1981) investigated the nutrient contents of the trunk, empty fruit bunches, shells and fibres and concluded that these materials could be used as mulch and nutrient sources to improve the soil structure, and better soil and water conservation. Tomimura *et al* (1996) produced medium density fibreboard using fibrous strands from the oil palm trunk. In terms of density and bending strength, the manufactured product met the Japanese standard. Cement-bonded particleboard of flakes from oil palm trunk have also been manufactured and tested for bending and tensile strength. The results obtained were within the specifications for Malaysian standard for wood-cement board (Rahim *et al* 1995). From physical and chemical analysis of the oil palm trunk, Yusoff *et al* (1984) concluded that the oil palm trunk is a potential source of raw material for pulp and paper production. Gurtino *et al* (1995) reported the successful use of a mixture of empty fruit bunches and *Pinus merkussi* pulp for the production of kraft and printing papers while their use in the production of thin and medium thickness medium density fibre and particle boards has also been reported by Ceasar *et al* (1996).

The potential of the fronds as component for animal feed has also been investigated. It was observed from voluntary feed intake and digestibility trials with bulls that the nutritive value of the frond was as much as that of rice straw while it has also been successfully used as a substitute for tropical grass to feed ruminants. It was recommended that as much as 30% and 50% of total feed could be replaced with the frond for beef and dairy cattle respectively. (Abu-Hassan *et al* 1996. Ishida *et al* 1996).

Ogedengbe and Olawale (1983) reported on the potentials of activated palm kernel shells for water treatment as it is capable of removing taste, colour, turbidity, acidity and iron from bad water and render it fit for human consumption. Mijinyawa and Okedokun (1999) tested concrete cubes in which part of the coarse aggregates was replaced with palm kernel shells and obtained compressive strength within the limits specified by CP 110: Structural Use of Concrete for lightweight concrete.

The oil palm is found in many parts of Nigeria with a larger concentration in the southern part of the country either as wild growing or in established plantations. It provides employment for the rural populace either as palm oil processors or palm wine tapers. The survey report presented here was undertaken to find out the present uses of the oil palm wastes in south-western Nigeria and their potentials for other uses.

2. METHODOLOGY

This survey was carried out in south-western Nigeria comprising Ekiti, Ogun, Ondo, Osun and Oyo states. A total of 250 locations were visited. These locations included oil palm farms (45%), processing centres (30%), craft centres (15%) and villages (10%) spread across the area. Information gathering was through questionnaires, which sought for information on acquisition and ownership of plantations, type of wastes generated, utilization of wastes, durability of items manufactured from wastes, labour supply and problems experienced. The questionnaires were administered to individuals and groups of smallholder farmers who own palm trees and processors, crafts men, blacksmiths and other artisans who use the products as raw materials. Additional items of information were gathered through personal communication, observation and photographic records during field visits.

3. RESULTS AND DISCUSSION

The results of the survey are summarized in Tables 1 and 2 and Plates 1 to 5. The inedible products from the tree which are generated at various stages between harvesting at the field and when the primary products are obtained at the mill or processing centre can be grouped into palm fronds with leaves, empty fruit bunches, mill effluent; palm kernel shells and the trunk.

The palm fronds are field wastes and product of pruning during transplanting and in an attempt to reach the fruit bunches for harvesting. The leaf ribs are used for broom making, the frond is used as a stake for creeping and climbing plants, its barks are split into strands for weaving cages, baskets and trays/sieves while the core serves as cordage material. The frond with leaves is used as thatching material for roofs and fencing.

The palm kernel shell results from the cracking of the nut in an attempt to extract the soft kernel. It has been used in filling potholes and control of water erosion with encouraging results. Some blacksmiths have found it useful as furnace fuel but the amount used is very minimal compared to the production because of the availability of wood charcoal in the rural areas where the waste is generated.

Empty fruit bunches are the left-over after the fruits have been removed for processing. They are burnt to produce ash, which is a raw material for black soap making. Mill effluents are obtained at the clarification stage of the palm oil production. This entails the separation of the crude palm oil into sludge, water and pure oil. The sludge, which comprises essentially of fibres is compressed to reduce the liquid content and pasted on the wall to dry as sludge cake and used as fuel.

The trunk in log forms is used in bridges and when converted it can be used for roof trusses. The material is durable and during the survey, some roof trusses made from oil palm trunk which have been in use for between 20 and 40 years were identified and showed no sign of physical or structural deterioration. Both men and women provide labour in the oil palm industry. The men are mainly involved in the harvesting and palm wine tapping while the women are more in the processing for the extraction of palm oil, palm kernel and palm kernel oil. Although there are a few established plantations, most of the existing palm trees are not planted-but grew naturally and only inherited by the owners of such cultivated and uncultivated farmlands. In most cases replacement of old ones is achieved through natural dispersal. Harvesting is mainly by the use of rope to climb and knife or axe to prune and cut the bunch, which is risky. Incidences of people falling off the tree and attack by snakes on top of the tree were reported. Besides, most of the fruits get scattered and much time is spent collecting them. Timber contractors and carpenters were interviewed on the extent of use of the trunk. Although they admitted the potentials of the trunk as a material for roof trusses but the patronage is low because of the difficulty in converting the trunk to appropriate dimensions for use. The material is very tough and blunts cutting tools quickly.

The durability of items manufactured from these wastes was also examined. Some of the structures considered are presented in Table 2.

Table 1: Utilization of Oil Palm Wastes in South Western Nigeria

Waste	Present uses
Palm fronds and leaves	The frond is used as stakes for climbing and creeping plants. The core of the frond provides cordage material while the bark when split to strands provides raw materials for weaving baskets, cages and trays/sieves. The frond with leaves is used as thatching material for roof and fencing. Leaves midribs are used for broom making
Oil palm trunk	In log form, it is used in bridges while if converted can be used in roof trusses.
Empty fruit bunches	Burnt to provide ash for black soap making
Mill effluent	Compressed to sludge cake and used for fuel
Palm kernel shells	Fuel for blacksmith furnace, filling of potholes and erosion control

Table 2: Durability of Some Structures Made from Oil Palm Wastes

Structure	Average age of those seen	Remarks
Roof trusses made from oil palm trunk	20 to 40 years	No sign of deterioration including attack by insects
Bridges made from oil palm logs	4 to 8 years	Most of them are still in good condition and occasionally only one out of about ten logs making up the bridge may need replacement.
Tents/sheds and yard fences made from palm fronds and leaves	1 to 3 years	Some distorted by wind, over drying and decay resulting in thinning out which may require the addition of more materials
Baskets and cages	6 to 9 months	Baskets used for the transportation of perishable crops are always wet which results in fast deterioration of the structure while those for chicken deteriorate because of the droppings which necessitates either regular soaking in water to clean or striking on a hard surface to remove the droppings both of which results in deterioration of the structure.
Trays and sieves woven from the bark of the frond	3 to 5 years	These last so long because in most cases they are used in dry environment

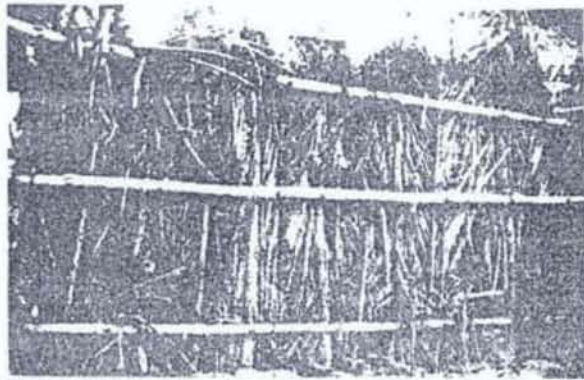


Plate 1: Palm Frond and Leaves Used for Fencing

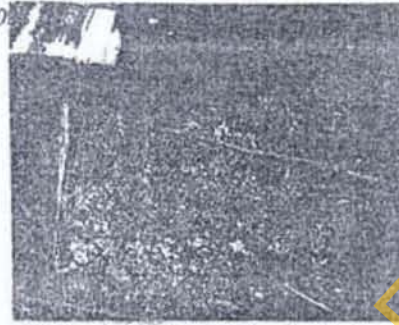


Plate 2: Sludge Cake Pasted on the Wall to Dry for Use as Fuel

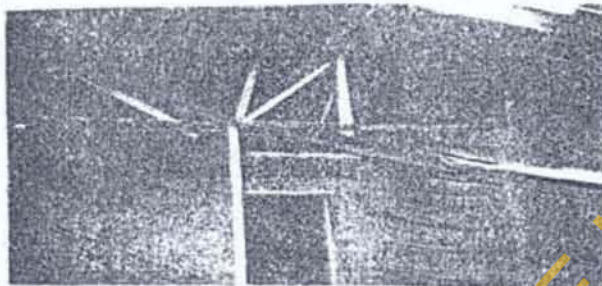


Plate 3: Roof Trusses Made from Oil Palm Trunk

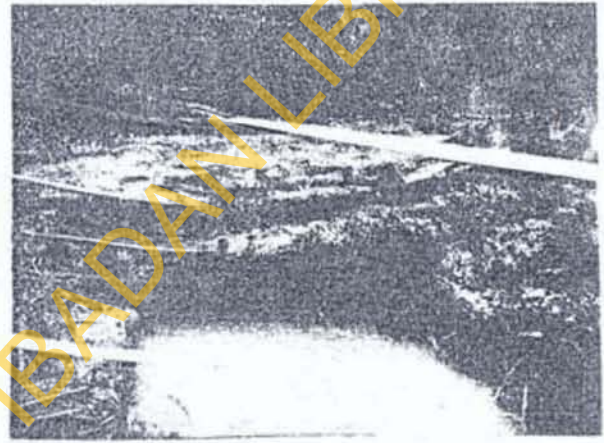


Plate 4: Oil Palm Trunk Used as Bridging Material

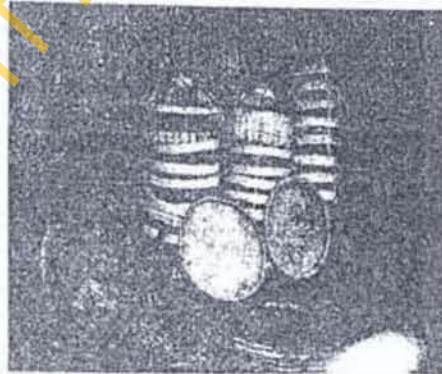


Plate 5: Baskets and Trays Woven from the Bark of the Frond

Potential of Oil Palm Wastes

From literatures and information gathered during this study, oil palm wastes have great potentials for use in the following areas: The trunk and frond can be reduced to chips for the manufacture of particleboards while they could also be pulped, bleached and blended with wood pulp to produce various grades of paper and paper products.

As a bulk material, palm kernel shells have a high porosity and is suitable for soil erosion control. It is also a good substitute for coarse aggregates for lightweight concrete. The trunk is available and adequate to aid movement over obstructions such as gullies, streams and rivers, and ensure effective evacuation of farm produce from the remote rural areas to urban centres. The trunk when converted can be used as beams and columns in the construction of various structures for both crop storage and animal shelters. The frond is suitable for roofing. This is an advantage considering the poor economy of the rural community and competition for the conventional building materials.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

The oil palm wastes found in south western Nigeria and their present utilization are palm frond and leaves for roofing and fencing, stakes, weaving and cordage materials and for brooms; empty fruit bunches burnt to produce ash for black soap; palm kernel shells as fuel for blacksmith furnace and erosion control, oil palm trunk for bridges and roof trusses and mill effluents used as fuel. The relatively low demand for their use create a disposal problem as they are heaped on site competing for space needed for other activities. Incineration is the main disposal method, which pollutes the air creating environmental hazard. These wastes present a potential for use as raw materials for paper and particle industry, erosion control, substitute for coarse aggregates for concrete and construction of farm structures.

4.2 Recommendations

The present underutilization of these wastes such as the shells for erosion control is partly due to lack of awareness. There should be adequate dissemination of information on these wastes among the urban populace for effective patronage. The trunk is a good source of materials for roof trusses the present use of which is limited by the bottlenecks associated with the conversion. There is need to develop appropriate technologies to overcome this difficulty.

Local research efforts on the utilization of these wastes for the production of paper and particleboards and other areas of use should be intensified so that these abundant natural resources can be profitably harnessed. The various engineering properties of these wastes should be studied and published as such information will guide their selection for application as possible construction materials.

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