# Potential for Utilisation of *Borsassus aethiopum* (Fan Palm) in Construction in Ghana

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Borassus aethiopum *is a non-timber tree which grows in the transitional and savanna zone of Ghana and the sub-region. Its superior strength properties and level of present utilization call for its promotion for several applications in construction.*

*This paper discusses the tree and its distribution, its strength and woodworking characteristics as well as the present areas of utilization and problems encountered in its use due to its extreme hardness. It also puts up a case for further research and promotion of the* Borassus aethiopum *wood*

## Introduction

With the growing concern among environmentalists and the general public about the steady decline of the tropical rainforest, the need to manage forests on sustainable basis becomes very urgent with each passing day. As "Green Clubs" and environmentalists continue to lobby for boycott of tropical timbers, some producing countries are systematically implementing sustainable forest management policy. However, the threat of desertification as a result of the southwards drift of the Sahara desert is causing a lot of concern among the general public. Factors attributable to this problem have been identified mainly as uncontrolled bush fires and illegal logging activities in the savanna and transitional zones mainly to provide timber for construction and fuelwood for domestic and commercial needs.

In order to solve the problem of scarcity of timber for construction activities in the non-forest transitional and savanna areas, the need to utilize non-timber trees becomes more urgent. Borassus aethiopum (Fan Palm) is one of the non-timber trees which grow in the transitional and savanna zones of Ghana as well as the West African sub-region, with potential to provide an alternative construction material in place of the tropical timber in areas where it grows.

This paper discusses the tree and its distribution, the strength and woodworking properties and the present as well as potential end-uses. It also puts up a case for its promotion for several applications in construction in Ghana and the West African sub-region. Other Ghanaian names of the tree are, Ago beam, Desert palm and Makube.

## The tree, its distribution and its timber

The tree of Borassus aethiopum which belongs to the palmaceae family is found mainly in the transitional and savanna zones of Ghana and the West African sub-region It may also be found in marshy areas and by stream sides in the savanna areas. The tree is said to be distributed throughout West Africa and as far as Southern Africa (Irvine, 1961).

The tree grows to about 80 ft height and 6 ft girth. The tree also swells at the top after several years of existence. Older wood of Borassus aethiopum is dark in colour, with the outer base being the hardest. It has a very fibrous structure.

## Seasoning, Durability and Preservation Characteristics

The wood of *Borassus aethiopum* air seasons satisfacto-

rily but rather slowly. It is very durable and resistant to sea water, termites and fungi attack. It is extremely resistant to preservative treatment.

### Sawing and woodworking properties

The fresh wood is difficult to cut in the transverse direction, especially the outer wood. It is however, easily split into long beams usually referred to as "ago beams" as soon as the tree is felled and in fresh condition. The tree can be sawn with a chain saw or circular benchsaw with carbide- or stellite-tipped saw. The wood is difficult to work with both hand and machine tools. It is also very difficult to nail due to its hardness and tends to split during nailing.

## Mechanical properties of the wood

The wood *Borassus aethiopum* is very strong and is comparable to *Milicia excelsa* (Odum) in bending and compressive strengths. It is however weaker in hardness, shear and cleavage compared with Odum. A preliminary test on *Borassus aethiopum* gave results presented in Table 1. The strength properties of Odum is included in the Table for comparison.

### Finishing characteristics

The wood takes polish well and saws well, planes smoothly but tends to severely dull knives.

## Possible Areas of Utilisation

The wood is suitable for purposes where strength, durability and stability are required. In construction, the wood may be used in the following areas.

### Wattle and daub buildings

The wood of Borassus aethiopum is commonly used in Wattle and Daub construction in several towns and villages in the transitional and savanna zones of Ghana. Wattle and Daub construction is a form of lateritic construction employing timber framework or timber reinforcement of vertical and horizontal strips crossing each other and tied together with creepers usually *Hippocratea africana* also called "noto" in the Ashanti region of Ghana, or *Hippocratea rowlandi* also called "nfea" or cane. Over this famework, wet mud is applied. Borassus is commonly used for the framework because of its high durability and resistance to attack by termites which usually destroy the timber framework. Wattle and daub buildings which employ Borassus for the framework can last for several years and at the end of its useful life, the framework may still be found to be intact (Ayarkwa, 1985).

Table 1
Mechanical Properties of *Borassus aethiopum* and *Milicia excelsa*

| Species Name | Moisture Content % | Density kg/m$^3$ | Bending Strength | | Compressive Strength N/mm2 | Shear Strength N/mm2 |
|---|---|---|---|---|---|---|
| | | | MOR N/mm2 | MOE N/mm2 | | |
| *Borassus aethiopum* | 12 | 670 | 104 | 11,300 | 58 | 7.8 |
| *Milicia excelsa* | 12 | 652 | 86 | 10,041 | 52 | 13 |

### Roof construction

The wood of Borassus is also commonly employed in roof construction in towns and villages in the transitional and savanna zones of Ghana, especially in the Ejura and Sekyedumasi areas. It is common practice to use Borassus for the roof structure of Wattle and Daub and Atakpame (Mud) buildings. The wood is used for wall plates, rafters, ridge beams and as king posts.

### Beams and lintels

Due to its superior bending properties, the wood of Borassus which is easily split into long beams (Ago beams)

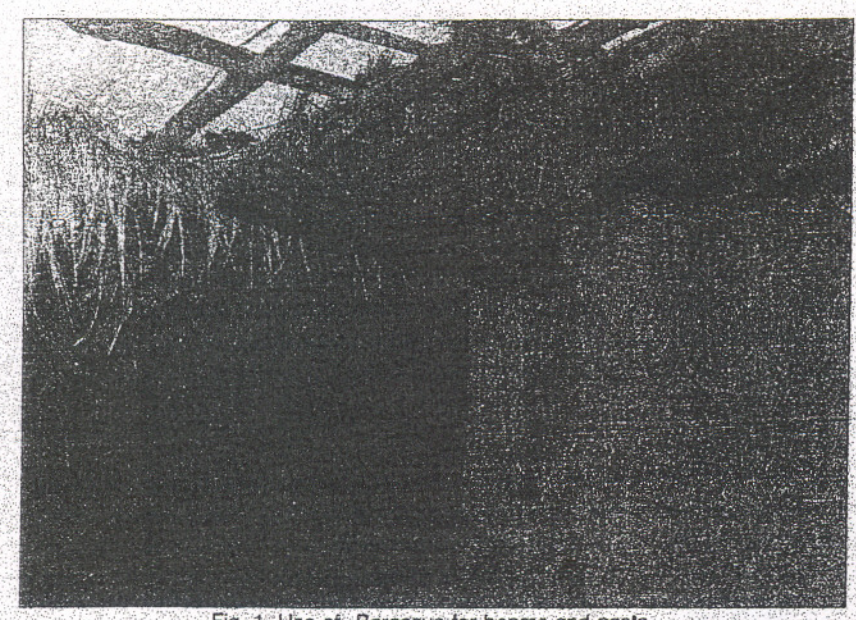

Fig. 1. Use of Borassus for beams and posts

are commonly used as ridge beams, eave beams, wall plates and lintels in Atakpame and Wattle and Daub buildings. ( refer fig 1)

Posts and columns

In construction in the transitional and savanna zones of Ghana, Borassus is commonly used for posts due to its high compressive and bending strengths. The most impressive use is as columns on verandas in classroom blocks in which case the whole stem is sometimes used without being split into smaller pieces.

The wood is also commonly used for telegraph and electricity poles as well as for wharf piles. Its natural durability and resistance to attack by insects and sea water make it most suitable for these purposes.

Bridges

Whole stems are also commonly laid side by side across rivers and streams to serve as bridges. The long stem lengths and the high wood rigidity as well as the high natural durability of Borassus make it suitable for this purpose.

Reinforcement of concrete slabs

In developing countries, the high cost of steel as building material has motivated research for alternative cheaper and locally available material as substitute for steel in reinforced concrete. The suitability of *Borassus aethiopum* as a non-metalic reinforcement in concrete for use as one-way slabs has been investigated (Adetifa, 1986, 1990; Jimoh, 1991; Jomoh and Adetifa, 1993). These investigations have given satisfactory results with a factor of safety of 2 to 3 against collapse.

Fence posts

Due to its durability, sawn stems of *Borassus aethiopum* are commonly used for fence posts in the transitional zone where the rearing of animals is a common practice. The posts are inserted in dug holes at constant intervals and barbed wires or chicken mesh nailed against them. (refer to fig.2.)

## Problems encountered in the use of Borassus

Method of jointing

Traditionally, the main method of jointing is by cutting a groove or a square hole in one of the members to be joined together, into which the other member sits and later tying the two members together with a string. In other cases,

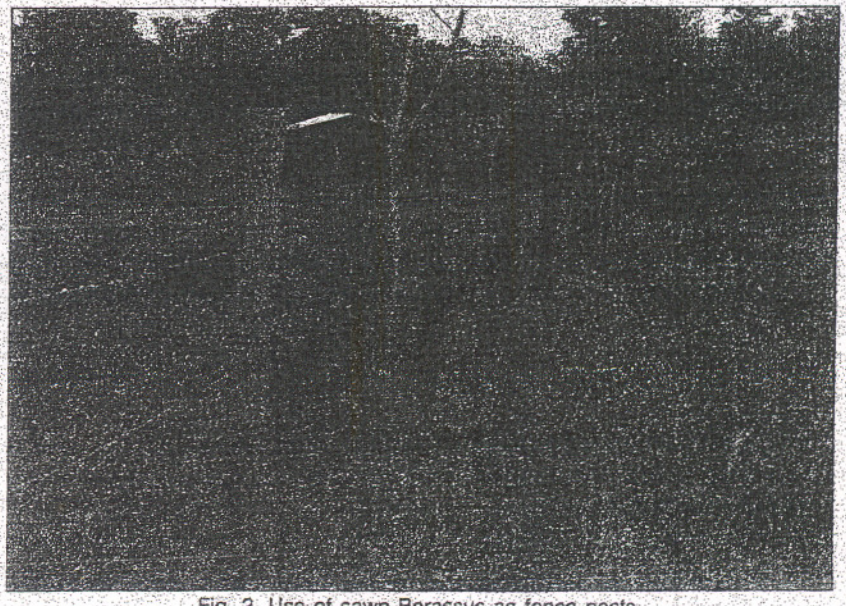

Fig. 2. Use of sawn Borassus as fence posts

members are just tied together with strings without cutting any groove. These methods of jointing are due to the extreme hardness of the outer wood and the high possibility of the wood splitting during nailing. Nailing, screwing and other conventional methods of jointing are difficult in wood of Borassus. Research is presently planned to investigate into appropriate methods of jointing, taking a cue from methods presently being used by the local people.

### Conversion method

Splitting is the main method of conversion of Borassus. Dried stems of the tree are known to be very difficult to split. However freshly felled stems can be split easily by the local people employing their own local technologies. With the advent of modern machines such as chain saws, dried stems should be easier to saw into required dimensions. Circular bench saws with carbide-tipped saws or bandsaws with stellite-tipped blades may also prove capable to saw Borassus.

### Woodworking problems

It has been observed that the wood is difficult to machine with both hand and machine tools. The use of wear resistant metal knives such as diamond knives, which are now easily obtained, may overcome this difficulty.

## Other possible end-uses

### Parquet floors

The extreme hardness and high cleavage resistance of the Borassus wood give an indication that it may be suitable for the manufacture of parquet floor panels for high traffic floors such as warehouse, industrial or factory floors. The high resistance of the wood against salts indicates suitability for food and chemical factory floor panels.

### Railway sleepers

The high durability and high resistance of the Borassus wood against termite attack coupled with its superior strength properties indicate suitability for railway sleepers.

## The need to promote the use of Borassus

The variable areas of utilization and the great potential for use of the Borassus wood call for intensification of research towards improving the present usage and solving the difficult problems encountered in its use. The wood can then be seriously promoted for the end-uses elaborated above as well as for other possible end-uses to increase the present benefits derived by the low income people living in the transitional and savanna zones. It is by so doing that the current pressure on fast depleting tropical and some savanna timber species can be reduced and economic benefits derived from the Borassus wood.

## Conclusion

The promising wood characteristics and possible end-uses indicate a bright future for the Borassus wood. However, research aimed at improving current level of utilization and solving the difficult problems associated with the wood's extreme hardness should be undertaken. Promotional activities should then be embarked upon and this way, potential economic benefits of the species can be derived by the people living in the transitional and savanna region of Ghana and the sub-region in general.

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