

NEW MARKETABLE GHANAIAN TIMBER SPECIES FOR FURNITURE AND CONSTRUCTION

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Properties of selected 'pink star' timber species have been studied and the species categorized into three usage groups: building and general construction, heavy construction as well as furniture and decorative works.

Results of studies on the properties of the selected species as well as field trials indicate that most of them are suitable alternatives to the over-used traditional species. The present stocking levels of the species also indicate a bright future of sustained supply.

As the traditional species become scarcer, engineers and wood specifiers are encouraged to utilize these species, as recommended in this paper, to broaden the species base for products manufacture and sustain the dwindling resource base of the traditional commercial species.

Key words: *Ghanaian timbers.*

The timber production area of Ghana's forest, which is about 1.2 million ha., is fast declining in size and productivity partly due to unecological logging practices and over utilization of the main traditional species. This state of the forest has therefore resulted in the adoption of more strict control on timber exploitation, which is undoubtedly expected to affect both the furniture and the construction industries.

The current annual allowable cut (AAC) of 1.0 million cubic meters, from the 32 main traditional timber species, comprise of 500,000 m³ from reserved forest and 500,000 m³ from off-reserves (Ministry of Lands and Forestry, 1996). With the recent expansion of the timber processing and the construction industries in Ghana, as a result of the prevailing buoyant domestic economy, the allocated AAC seems insufficient and indicates a gloomy future for raw material supply to the local wood processing industries.

Ghana, however, has considerable wealth in tropical hardwood species. It is on record that about 680 different tree species exist in the Ghanaian forest (Hall and Swaine, 1981), out of which 420 trees

attain timber sizes and are of potential economic value. About 126 of the existing species are also said to occur in sufficient volumes to be considered exploitable as raw material base for the timber industry (Ghartey, 1989).

Most of the 32 main traditional timber species are now very scarce. Fifteen of them are already rated as scarlet star species (i.e. species which are being seriously over-exploited and some of them almost to the point of commercial extinction). *Pericopsis elata* (Afromosia), *Milicia excelsa* (Odum), *Khaya* spp. (Mahogany) and *Entandrophragma angolensis* (Edinam), for example, have been subjected to more than 1300 %, 800 %, 900 % and 600 % exploitation respectively, and there have been significant decreases in the cut since 1989 (Ministry of Lands and Forestry, 1996; Ghana Forestry Department, 1994). Seventeen other traditional species have also been rated as red species (i.e. species whose current rate of exploitation present significant danger of economic extinction). Among the Ghana Forestry Department's list of commercial species, however, are also 37 pink star species or lesser-used species (LUS), which have very low levels

of exploitation compared to the resource and therefore of great potential as commercial species of the future (Ministry of Lands and Forestry, 1996; Ghana Forestry Department, 1994).

A more prudent way of ensuring sustainable timber supply to the furniture and construction industries, therefore, is to shift attention to the pink star species. By so doing, the pressure on the over-utilized traditional timber species may be reduced and the natural balance of species in the forest ensured.

Some causes of over-utilization of the traditional species in Ghana

A critical examination of the past and present usage of timber in Ghana shows its highly selective nature, dominated by a small number of preferred timbers. A reluctance to use a great variety of timbers, especially the lesser-used species, may be attributed to several factors among which are:

Traditional marketing practice

The traditional marketing practice in Ghana has been such that timber is sold by

species. Only well known species like Odum are sold for construction whilst the Khaya and the Entandrophragma species are sold for furniture. Species whose characteristics are well known are those commonly available on the market. The construction industry in Ghana also has high requirements for timber quality and performance.

Lack of guidance on selection for a purpose

There seems to be a general lack of guidance in Ghana on selection for a purpose from among the many timbers with promising characteristics. Even though the foremost concern of the end user should be a product and not a material, information required on property requirements and comparative performance of different timbers for a purpose, until recently, had been few and scattered.

Familiar species

Engineers, wood specifiers and end users have been holding fast to the few preferred species in Ghana because they are sure of their technical suitability in terms of mechanical properties, durability characteristics, wood stability in service and woodworking characteristics and their sustained availability in the required dimensions on the market.

Risk involved

There is lack of readiness on the part of lumber producers and sellers on the local market to take investment risk of producing and selling lumber of the pink star species or LUS in large volumes. This is due to the fact that wood specifiers or users usually request for only the traditional species. As a result, there has been non-availability of the pink star species or LUS in sufficient and sustained

volumes and in the required dimensions on the local markets to warrant intensive utilization in the furniture and construction industries. This trend therefore results in over-utilization of the preferred species.

Effects of over-utilization of the few traditional species

The over-dependence of the furniture and construction industries on the Mahoganies, Entandrophragmas and the Milicias do not only result in the destruction of the forest of the future, but also in exorbitant prices of timber. Cost of the final product such as furniture, building, etc. also increase beyond the reach of the average person.

Promotion of selected timber species for furniture and construction

The Forestry Research Institute of Ghana (FORIG) and the Timber Export Development Board (TEDB), in their collaborative research and promotional efforts, have studied the properties and possible end-uses of the following species for promotion to the local furniture and construction industries.

Denya
(*Cylicodiscus gabunensis*)
Danta
(*Nesogordonia papaverifera*)
Essia
(*Petersianthus macrocarpus*)
Wawabima
(*Sterculia spp.*)
Esa
(*Celtis spp.*)
Ofram
(*Terminalia superba*)
Potrodom
(*Erythrophleum sauaveolens*)
Avodire
(*Turreathus africanus*)
Ananta
(*Cynometra ananta*)
Ayan
(*Distemonanthus benthamianus*)
Awimfosamina
(*Albizia spp.*)
Chenchen
(*Antiaris toxicaria*)
Ceiba
(*Ceiba pentandra*)

Availability and stocking levels of the selected species

Exploitation levels of selected pink star species (1989 - 1993)			
Species	Total Stocking (trees)	Annual quota (trees)	5 year mean % exploitation
Denya	207,200	5780	2 %
Danta	134,400	3360	38 %
Essia	304,000	7600	4 %
Wawabima	66,400	1660	16 %
Esa	604,800	15120	4 %
Ofram	465,200	11630	31 %
Potrodom	50,500	1270	10 %
Avodire	165,600	4140	14 %
Ananta	126,400	3160	4 %
Ayan	50,400	1260	62 %*
Albizia	68,400	1710	78 %*
Chenchen	347,600	8690	41 %*
Ceiba	317,600	7940	70 %*

Source: Ghana Forestry Department, 1994.

* Those Red Star Species with high stocking level or low exploitation levels and still considered exploitable.

The selection of the species was based on the extent of availability in the forest as shown in the Table. It can be seen from Table that stocking levels are very high and the 5 years (1989-1993) mean percentage exploitation of the selected species indicates a bright future of sustained supply of the species (Ghana Forestry Department, 1994).

Property requirements for utilization of timber

Properties required in wood for a particular purpose such as furniture and construction need to be defined before a choice of timber is made. Through experience from field and research work, the following property requirements for furniture and decorative products as well as for construction are defined.

Furniture and Decorative timbers

For the manufacture of furniture and decorative products, the following wood properties are required.

- Attractive natural wood colour or enhanced wood colour
- Satisfactory machining properties - the wood should saw easily, plane well with smooth finish, drill and shape easily, sand well and take polish and stain satisfactorily
 - Movement in service should be moderate or low
 - High or moderate wood durability or treatable wood species
 - Moderate wood density is preferred

Building and General Construction

The important properties required in wood for purposes such as roof trusses, door and window frames and panel doors are

- High mechanical properties
- High or moderate durability or treatable wood species
- High to medium dimensional stability
- Satisfactory woodworking properties e.g. sawing, planing, boring, nailing, etc. (especially for panel doors)
- Attractive appearance (i.e. wood colour and grains) for polished panel doors

Heavy Construction

The important properties required in wood for purposes such as railway sleepers, bridges, industrial floors, etc. are :

- High durability or amenability to treatment
- High density and mechanical properties
- High dimensional stability

Export data on the selected species

Ghana's timber export trade has been dominated by the preferred traditional species for a very long time. However, recent export statistics on timber and timber products indicate that the pink star species are gradually coming up. The 1996 timber export statistics (Forest Products Inspection Bureau, 1996) indicate that all the selected species were exported from Ghana in one form or the other. Although their share of the total volume of wood products exported from Ghana in 1996 was small, it indicated a promising future for the pink star species or LUS. The Table indicates that the selected species were exported from Ghana in the form of lumber (kiln- and air-dried), veneer, mouldings, furniture parts, boules, flooring and profile boards.

Export products and volumes from selected timber species from Ghana in 1996

Value-added products	Timber species	Quantity exported
Lumber	Ofram, Ayan, Awiemfosamina, Wawabima, Denya, Danta, Esa, Ananta, Potrodom, Chenchen, Avodire, Ceiba, Essia	18,886.94 m ³ (7.0 %)
Sliced veneer	Ofram, Awiemfosamina, Avodire, Ceiba	280,139.67 m ² (0.6 %)
Rotary veneer	Ofram, Wawabima, Esa, Chenchen, Essia, Ceiba	20,942.94 m ³ (82 %)
Boules	Ofram, Ayan	3,215.20 m ³ (9.0 %)
Mouldings	Ofram, Esa, Danta, Ceiba	558.82 m ³ (6.0 %)
Furniture parts	Avodire, Chenchen	86.40 m ³ (6.0 %)
Flooring	Esa	27.76 m ³ (0.8 %)
Profile boards	Avodire	0.77 m ³ (0.4 %)

* Figures in brackets are proportions (in percentage) of the total quantity of the particular product exported in 1996.

Properties of the selected species

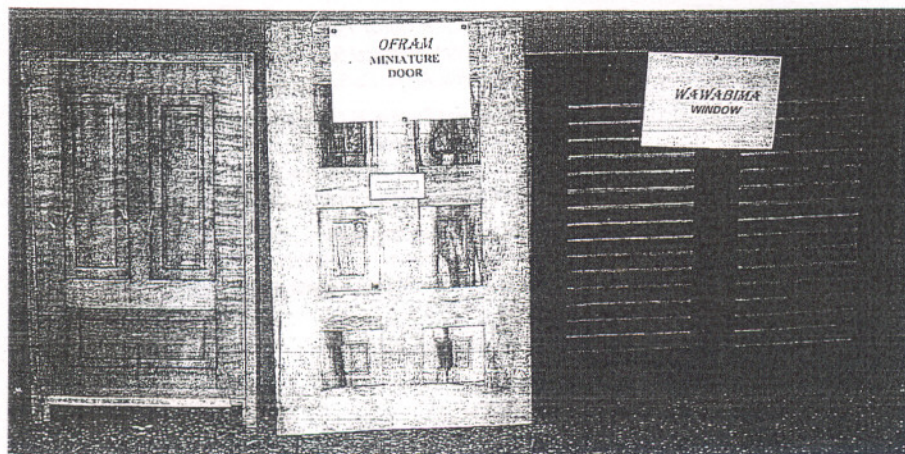
Strength properties of the selected timber species as reported in this paper were determined in accordance with the American Society for Testing and Materials (ASTM) Specification D143-52 (1979), using a 5000 kg Universal wood testing machine on small clear specimens. The machining properties were also determined in accordance with ASTM D143-52 (1970) and D 1666-64 (1978). All the tests were done using randomly sampled wood from three ecological forest zones in Ghana. The other wood properties reported in this paper were assessed through field trials and actual utilization of timber of the selected species. A summary of the important wood properties of the selected timber species are presented in tables 1, 2 and 3. Properties of *Milicia excelsa* (Odum), the most commonly used traditional timber species for construction in Ghana (Addae-Mensah et al. 1989) have also been included in Table 2 for comparison. The species have been categorized into three main usage groups for which they are being promoted: building and general construction, heavy construction as well as furniture manufacture.

Table 1

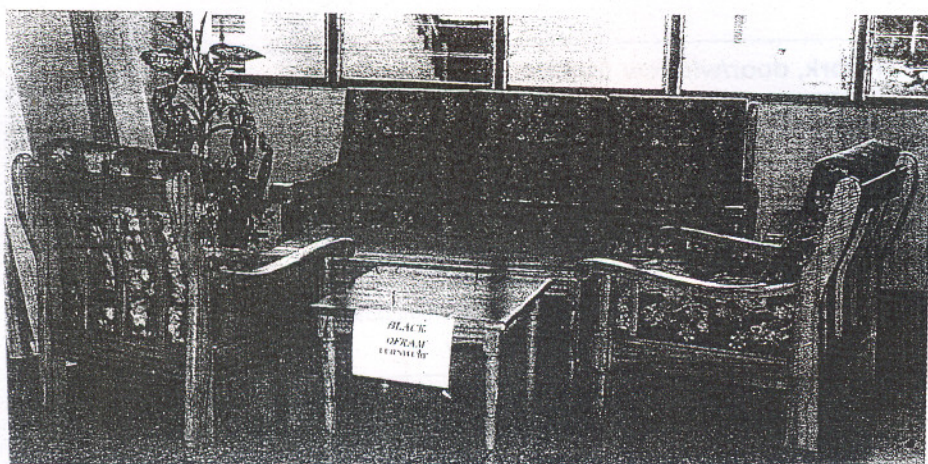
Furniture and decorative timbers e.g. high quality interior joinery, fittings, mouldings, etc.					
	Appearance	Machining properties	Movement in service	Durability	Wood density
Avodire	Creamy or pale yellow darkening to golden yellow. Fine grained	Satisfactory Planes well and smoothly Drills well Glues well Polishes well Fastening easy	Low movement in service. Very stable	Low but treatment with approved prophylactic chemical easy. Polishing with polyurethane finishes reduces danger. Require rapid processing to avoid staining	Medium heavy
Ofram	Attractive pale yellowish white with dark streak. Straight grain Medium texture	Satisfactory Planes well and smoothly Moderate drilling Glues well Fastens satisfactorily Polishes well Dries easily but care needed to avoid stain	Low	Low durability but treatable	Medium heavy
Esa	Yellowish white colour Fine textured, straight grained	Satisfactory Planes well and smoothly Very good drilling Glues well Fastens well but sometimes with pre-boring Polishes and stains well Filler required	Medium	Low but treatable Attacked by sapstain fungi and borers Use Busan 1009 on Pyrenex for remedial treatment Rapid processing to avoid staining	Heavy
Essia	Reddish brown Fine textured Unpleasant smell when fresh	Satisfactory Planes well and smoothly Very good drilling Glues well Polishes well Fastening easy Careful drying to avoid defects	Medium	Moderately durable to durable	Heavy
Ceiba	Creamy white Fairly coarse grain Soft and low strength	Satisfactory Planes well and smoothly Careful drilling to avoid fibre tearing Glues well Fastens satisfactorily Polishes and stains well Dries easily but care needed to avoid stain	Medium	Low durability but treatable Attacked by sapstain fungi and borers Use Busan 1009 on Pyrenex for remedial treatment Rapid processing to avoid staining	Very low
Chenchen	Greyish white colour Coarse textured Straight grained	Satisfactory Planes well and smoothly Very good drilling Glues well Fastens well Polishes and stains well	Medium	Low but treatable Attacked by sapstain fungi and borers Use Busan 1009 on Pyrenex for remedial treatment Rapid processing to avoid staining	Medium

Construction timbers : Structural work, door/window frames, panel doors, etc.

	Density (12% m.c) kg/m ³	Mechanical properties N/mm ²	Natural durability or treatability	Dimensional stability	Woodworking properties	Appearance
Essia	Heavy 800	Stronger than Odum Bending strength 132 Comp. strength 72 MOE 13,700	Moderately durable to durable	Medium	Satisfactory Saws easily Planes well and smoothly Fastening easy	Attractive reddish brown colour Rotten cabbage odour when fresh but disappears when dry
Wawabima	Heavy 760	Stronger than Odum Bending strength 127 Comp. strength 66 MOE 14,000	Moderately durable	Low under extreme weather Quarter sawn lumber stable	Satisfactory Saws easily Planes well and smoothly Moderate fastening properties	Brown colour
Esa	Heavy 740	Stronger than Odum Bending strength 104 Comp. strength 60 MOE 12,700	Non-durable but treatable with approved preservatives	Medium stability	Satisfactory Saws easily with little blunting Planes well and smoothly Moderate fastening properties	Attractive yellowish white colour
Danta	Heavy 740	Stronger than Odum Bending strength 137 Comp. strength 65 MOE 12,700	Moderately durable to durable	Medium stability	Satisfactory Saws easily Planes well and smoothly Pre-boring necessary	Attractive fine grained redwood
Odum	Heavy 650	Comp. strength 52 MOE 10,000	Moderately durable to durable	Medium	Satisfactory Saws easily Planes well and smoothly Fastening easy	Structural work Roofing Doors Windows
Albizia	Heavy 700	Stronger than Odum Bending strength 102 Comp. strength 59 MOE 11,577	Durable	Stable	Satisfactory Saws easily Planes well and smoothly Good fastening properties	Roofing Door/Window frames Panel doors
Ayan	Medium heavy 670	Stronger than Odum Bending Strength 118 Comp. Strength 63 MOE 12,700	Moderately durable	Stable	Satisfactory Saws easily Planes well and smoothly Good fastening properties	Roofing Door/window frames



Window manufactured from
Wawabima and prototype doors from
Esa and Ofram timber species



◀ Furniture manufactured from Ofram timber species

Table 3

Timber for heavy construction eg. railway sleepers, bridges, industrial floors, etc.

Species	Wood density (12% m.c.) kg/m ³	Mechanical properties N/mm ²	Natural durability or treatability	Dimensional stability	Woodworking properties
Denya	Very heavy 950	High strength Bending strength 137 Comp. strength 82 MOE 16,600	Very durable and resistant to attack	Medium stability	Sawing and fastening difficult Bores well but with difficulty Dries quickly but with care
Potrodom	Very heavy 900	High strength Bending strength 122 Comp. strength 66 MOE 20,000	Very durable	High	Sawing and processing difficult except with special saws. Nails satisfactorily. Slow drying Abrasive resistant
Ananta	Very heavy 950	High strength	Very durable	Moderate	Tough exterior timber saws well but with high blunting requires pre-boring for fixing

Conclusion

results of the studies on properties of selected timber species indicate that many of them are good substitutes for the over-used traditional species. What is needed, however, is action on the part of foresters and wood specifiers to utilize the new species for the purposes suggested in this study. With the stocking levels of the new species assured, a rational way to increase production in the growing timber and construction industries is to substitute the new species which have been found to be good substitutes for the over-used traditional species.

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