

# **THE GLOBAL ECONOMIC CRISIS AND SUSTAINABLE RENEWABLE NATURAL RESOURCES MANAGEMENT**

Proceedings of the 33rd Annual Conference  
of the Forestry Association of Nigeria  
held in Benin City, Edo State, Nigeria.

25th - 29th October, 2010

Edited by  
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## SUITABILITY OF *CHRYSOPHYLLUM ALBIDUM* WOOD FOR FABRICATION OF HOWE TRUSS FOR USE IN SIMPLE ROOF SYSTEMS

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### Abstract

*Chrysophyllum albidum* being fruit tree still has dearth of information about its wood properties. Its use for making roof truss components have become fashionable in low cost building in emerging areas of Akinyele Local Government, Ibadan, Oyo State, Nigeria because of its abundance. This study was initiated to investigate the suitability of *C. albidum* wood for Howe truss fabrication. A survey was conducted to obtain on the application status of *C. albidum* wood in the study location. Structured questionnaire, oral interview and on-spot assessment were used to collect data while simple descriptive statistical tools were used for the data analysis. 10-meter-span Howe-truss was designed but scaled down to 2-meter for prototype production. Six prototypes were fabricated using *C. albidum* wood bought from a plank market in the area. The deflection characteristics of the fabricated truss was investigated under three points loading system using dial-gauge. Modified Howe truss was predominantly used in low cost building in the emerging areas of Akinyele Local Government that were hitherto villages. About 90.1% of such houses combined *C. albidum* wood with other available wood species to make its roof trusses. *C. albidum* wood was relevant for its availability and cost. The gusset plate made from 6.5mm structurally graded plywood was used at the joint with 8d nail as fastener. The fabricated Howe truss weighs 1.2KN. A load of 2.2KN (about triple of the design load) was only able to cause maximum of 3.3mm deflection as against maximum tolerable deflection of 6.6mm. The test result indicates suitability of *C. albidum* wood for Howe truss production despite it been perishable when used in contact with soil.

**Keywords:** - *C. albidum* Wood, Howe Truss, Design, Fabrication,

### Introduction

Shelter is one of the three basic needs of man while roof, walls and foundation are its main components. Roof has been described by Mijinyawa (2002) as the most important of the three components of shelter in that it serves as protection against rain, sun radiation and other harsh environmental conditions. Wood has been consistently used in truss construction from more than 1000 years when it was used for making the trusses in Basilica of St. Paul in Rome (Whitaker and Lindley, 1979). Wood, unlike other alternative building materials, is an organic material that can be used in its natural state (Parker, 1967). Lucas *et al* (2002) observed that wood has advantage of been used in round form especially in the

construction of trusses used in rural building. If wood has endeared itself to the early users because of ready availability, flexibility and cost advantage have made it more relevant for truss making nowadays.

Increase in human population has directly led to increase in the demand for wood to satisfy various end uses. Massive exploitation of commercially known wood species in Nigeria has made their lumber to be scarce and costly. There have been attempts to commercialize many more less utilised wood species as it was belief to be the main weapon against the scarcity and escalating cost of the already known wood species (Lucas, 1983). In Ibadan, the rural-urban drift has resulted in the conversion of more farm land to residential settlement and has facilitated the use of wood from available trees for constructional purposes. Trees found on the hitherto farm lands were often felled, processed and used in situ, especially for truss fabrication in Akinyele Local Government Area (LGA) of Ibadan. Some of these available trees were known for their fruit bearing capabilities. The availability and cost of obtaining these alternate wood species, mostly of un-known properties, may have informed their trial usage for making roof components. Adewole (2002) noted that the use of wood for truss fabrication arises from the idea of using the available material rather than from the determination of its suitability for such purposes.

Most of the houses occupying farm land in emerging areas of Akinyele Local Government Area consists of simple roof trusses. Faherty and MacMillan, (1999) observed that simple truss are commonly found in rural settings and semi urban areas and are made using ordinary lumber of sizes 2x4" or 2x6". Roof consists of trusses, roofing sheets and ceilings and truss takes up to 80% of the entire roof cost (Whitaker and Lindley, 1979). Since cost is central in deciding issues when erecting building, reducing cost of truss by using suitable but lesser known wood species that are relatively cheap will drastically reduce overall cost of roof. Dearth of information on the suitability of most of the fruit trees that were currently been used for truss fabrication made it expedient to evaluate the truss produced from such. Giant star apple also known as *Chrysophyllum albidum* was abundant in Akinyele LGA (Ajíbí, 2008) and there were evidences that *C. albidum* is a major fruit tree employed in production of trusses used in the simple houses in the emerging settlements in the study area.

Therefore a study to investigate the suitability of *C. albidum* wood for fabricating Howe type of truss used in low-cost housing type found in the emerging settlements of Akinyele Local Government Area of Ibadan, Oyo State, Nigeria would provide the necessary guide to its utilization for the purpose.

## Finding and Discussions

Investigation shows that the use of wood from fruit trees, especially *C. albidum* has commenced in the study area. There were evidences of its use for producing furniture, and building components especially roof trusses.

However there were indications that the use for these purposes was a new trend and was more likely to be restricted to the emerging settlements. Because only from about 53% of what could be described as tenement buildings at the study location, reportedly built between 5 to 10 years, was there evidence of use of *C. albidum* wood (Figure 1). Although about 35% of the owners interviewed attested to using the

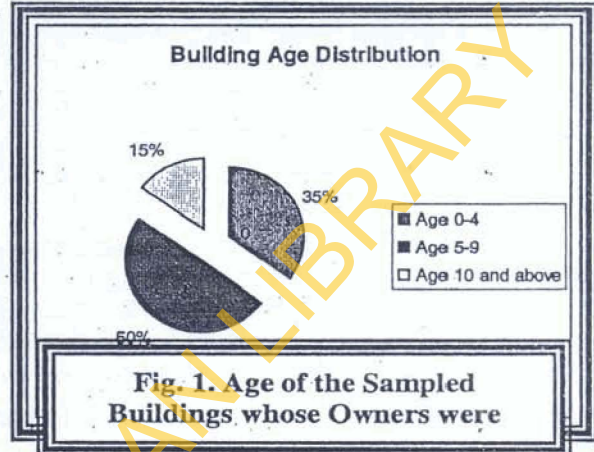


Fig. 1. Age of the Sampled Buildings whose Owners were

wood of *C. albidum* in combination with other fruit trees harvested from their plot to produce their roof truss. *Kola nitida* was another popular fruit trees which its wood has found relevance in the

area and the chief reasons were availability and cost. The wood of *C. albidum* was available in seven out of the ten plank markets visited and the trade name given to it was "omon" wood. The closer the

Load (N)	Deflection (mm)					Deflection (mm)
	Truss A	Truss B	Truss C	Truss D	Truss E	
270	0.30	0.25	0.35	0.35	0.25	0.30
540	0.45	0.40	0.45	0.45	0.40	0.43
810	0.90	0.85	0.85	0.85	0.90	0.87
1080	1.35	1.30	1.30	1.35	1.30	1.32
1350	1.95	1.95	1.90	1.95	1.90	1.93
1620	2.40	2.45	2.45	2.45	2.40	2.43
1890	2.85	2.80	2.80	2.85	2.80	2.82
2160	3.20	3.25	3.30	3.25	3.25	3.25

plank market is to the new area of the emerging settlement, the higher the chance of getting the "omon" wood. Most of the building owners where it was used were self-employed and were either artisan or engaged in jobs that do not give regular income. They could therefore be categorized as low-income earners. About 90% of the respondents who uses the wood species do not apply any form of treatment before use. Truss makers in the area that were interview express reservation on the performance of *C. albidum* wood for lack of experience. The highest educational level of the roof truss fabricators interviewed was

first stage City and Guide. Most of them acquired fabrication experience through apprenticeship and have no knowledge of different roof truss systems. Engineering principles were often neglected when putting the truss member together. Modified

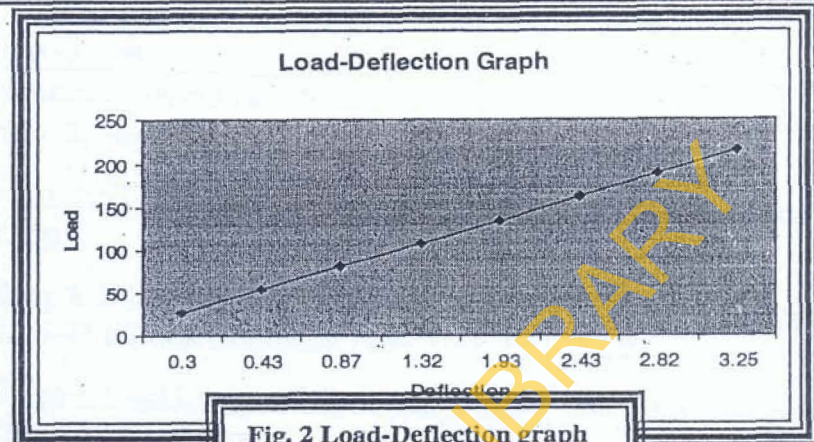


Fig. 2 Load-Deflection graph for five Prototype Tested

Howe truss seems to be popular in the low cost housing system that was predominant in the area. Result of the deflection test and curve were presented in Table 1 and Figure 2 respectively. The test result indicated that the bottom chord could withstand about triple of the design load without attaining the failure point.

### Conclusion and Recommendation

This study had established that the use of *C. albidum* wood in the fabrication of Howe type of roof truss employed in tenement (or simple buildings), mostly owned by low income earners in emerging settlements in Akinyele Local Government Area of Ibadan, Oyo State, Nigeria, has recently commenced. Availability and low cost of processing was the main reason for use. The study confirms the suitability of *C. albidum* wood for roof truss fabrication. However users of the wood should ensure that engineering principle was not jettison and members treated before use. More elaborate study of *C. albidum* wood in relation to utilization is recommended to be able to determine its full capacity for various end uses.

### References

- Adewole, A.N. 2002. "Design and Fabrication of a Two-Meter Span of a 4-Web Pratt Truss Using *Psidium Guajava* (Guava) Wood" An M.Sc. Thesis from the Department of Agricultural Engineering, University of Ibadan, Nigeria. 100pp
- Ajibi B.A. 2008. "Determination Of Some Wood Properties Of *Chrysophyllum Albidum* Tree Grown In Akinyele Local Government Area Of Ibadan" A B.Sc. Thesis from the Department of Agricultural Engineering, University of Ibadan, Nigeria 60pp



- American Institute of Timber Construction, 1974.** 2nd Edition. Timber Construction Manual: AITC 102-72. Englewood, Colorado.
- ASTM, 1974** Annual Book of ASTM standard: Part 22 ELBS and Longman Practice CP 112, UK 1025pp
- Faherty, K.F. and MacMillan, T.J. 1999.** Wood Engineering and Construction Handbook 3rd Edition. McGraw-Hill Book Company, New York. Pp114-123.
- Harry Parker, M.S. 1967.** Simplified Design of Structural Timber. 2nd Edition. John Wiley and Sons Inc., London 215pp
- Lucas E.B, 1983** "Factors Preventing Wider Commercialization of Nigerian Tree" Forest Product Journal. 33(5): 64-68
- Lucas E., Olorunnisola O. and Adewole N. 2006** "Preliminary Evaluation of Guava (*Psidium guajava* L.) Tree Branches for Truss Fabrication in Nigeria". Agricultural Engineering International: the CIGR Ejournal. Manuscript BC 05 010. Vol. VIII. May, 2006.
- Mijinyawa Y. 2002** Farm Structures . Aluclemheghe Publishers, Ibadan, Oyo state, Nigeria, 119pp
- Nigerian Code of Practice, 1973.** NCP 2: The Use of Timber in Construction. Federal Ministry of Industry, Lagos. 80pp
- Nigerite Limited. 1990.** Products Technical Data. Published by Nigerite, Lagos. Nigeria. 35pp
- Whitaker, J.H. and Lindley F. 1979** Agricultural Buildings and Structures. Resting publishing Co. Reston