ANATOMICAL VARIATION IN THE WALL THICKNESS OF WOOD FIBRES OF RUBBER (*HEVEA BRASILIENSIS*(KUNTH) MUEL ARG) GROWN IN SOUTH EASTERN NIGERIA

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ABSTRACT

The wall thickness of wood fibres of rubber (Hevea brasiliensis) grown and tapped for latex in south eastern Nigeria were investigated to determine anatomical variation. The rubber trees which were overmature for tapping and keeping were sampled in hierarchical order of plantations, bud classes, trees, discs, cardinal directions and radii, based on the fixed effects model of a nested design. Wood samples obtained at different positions to the grain were macerated in equal volumes of hydrogen peroxide and glacial acetic acid and investigated on visopan microscope. The wall thickness of the fibres was not significant (p>0.05) in all the main effects. The mean wall thickness of the fibres was 6.42mu which may be due to tapping intensity of the trees.

INTRODUCTION

The establishment of rubber (*Hevea brasiliensis)* plantations followed the discovery of the crop by Christopher Colombus and other Spanish explorers in the 18th Century (Ramli,et al 1999). In West Africa, rubber cultivation was revolutionalised due to the interest of European rubber traders who encouraged the establishment of large plantations of the crop in their colonies inorder to cope with the high demand for rubber latex for the use of their automobile industries (ICNR 2003). Mature rubber trees are 20-30 meters high with relatively slim and smooth trunk. Generally the trees take between 5-10 years to reach maturity, with the trunk reaching about 500mm circumference at 1 meter height, the stage when tapping could be started.

IRRDB (2003) reported that rubber trees undertake biosynthesis for conversion of nutrients from the soil and organic photosynthates into rubber latex which passes through capillary vessels in the soft bark which is subsequently tapped as latex. Tapping of rubber trees takes up to a period of 25-30 years by which time the cost of tapping and maintenance becomes greater than the marginal revenue from latex sales, then the spent trees are felled and burnt or left to decay as waste while the area is prepared for replanting of new stock.

ANFP (2006) reported that the current demand of Nigeria for wood is about 80-88 million m^3, and it is projected to be over 9544 8700m^3 by the year 2010 where supply will be about 68292700m^3 showing a deficit of about 2715600m^3. By 2020 the projected demand for wood would be about 180 million m^3. Limited utilization of rubber wood generated during clear felling of spent stock, in the form of fuel, charcoal and furniture has been reported by Ramli,et al

(1995) . However intensive investigation of the anatomical variation in wall thickness of the rubber wood fibres is being undertaken to explore the possibility of industrial utilization as an alternative source of timber/pulp wood.

MATERIALS AND METHODS

Abia Rubber plantations Amaeke Abam which is the study area is located in Arochukwu Local Government Area of Abia state in South Eastern Nigeria. It occupies about 300 hectares and lies towards the northern limit of the low land rain forest zone of Nigeria. The topography of the plantation is undulating with steep slopes and elevations. The plantation was established in 1956 and intensively managed for tapping of latex. The spent part of the plantation with uneconomic latex yield and ready for clear felling and replacement was sampled for the study. The data collection procedure was based on the fixed effects model of a nested design which involved the effect of: two (2) plantations, two (2) bud classes (unbudded and budded)/plantation, four (4) trees/bud class, four (4) disc/tree, four (4) cardinal directions (north, south, east and west)/tree, and five (5) ring-blocks/ cardinal direction. In all a total of 64 discs and 1536 ring-blocks were sampled in the oblique sequence from 16 trees. Wood slivers parallel to the grain were obtained from each ring-block and macerated in a mixture of equal volumes of hydrogen peroxide and glacial acetic acid, at 150°C for 1 hour. The separated wood fibres washed free from liquor were mounted on slides, stained with phloroglucinol and concentrated hydrochloric acid to dehydrate the slide, and projected on the visopan microscope where the wall thicknesses of 30 randomly selected fibres were measured from each slide. The data were recorded and transformed using arc sine transformation for statistical analysis, based on fixed effects model of nested design.

RESULTS

The analysis of variance results were not significant ($p>0.05$) on any of the main effects namely: plantations, bud classes, trees, cardinal directions and their interactions. The wall thickness of fibres was 6.33 and 6.51 m*u* in plantations 1 and 2 respectively (Fig:1.0). This may be related to maturity of plantations producing fibres with similar wall thicknesses. The unbudded and budded trees/plantation produced wall thicknesses of fibres with 6.46 and 6.39 m*u* (Fig:2.0), showing that budding effect did not change the constitution of fibre wall thicknesses. The trees effect was also not significant, the mean values for the 4 trees/bud class was 6.31, 6.44, 6.25 and 6.68 m*u* (Fig:3.0) and 6.41, 6.40, 6.57 and 6.31 m*u* respectively in the Northern, Southern, Eastern and Western directions of sampled trees (Fig:4.0). This result may be related to the impact of tapping intensity on the trees which commenced at the early stage of the trees to maturity. The intensive tapping of trees accelerated the physiological conversion of most photosynthates produced during biosynthesis to latex instead of storage in the fibres for wall thickening. Thus very thin wall thicknesses of 6.42 m*u* of the fibres on average were produced. This results negates previous studies like Denne and Dodd (1980), Akachuku (1981) and Aderigbigbe (1991) among others, on different tree species which may be related to the variation in species and management practices of such plantations.

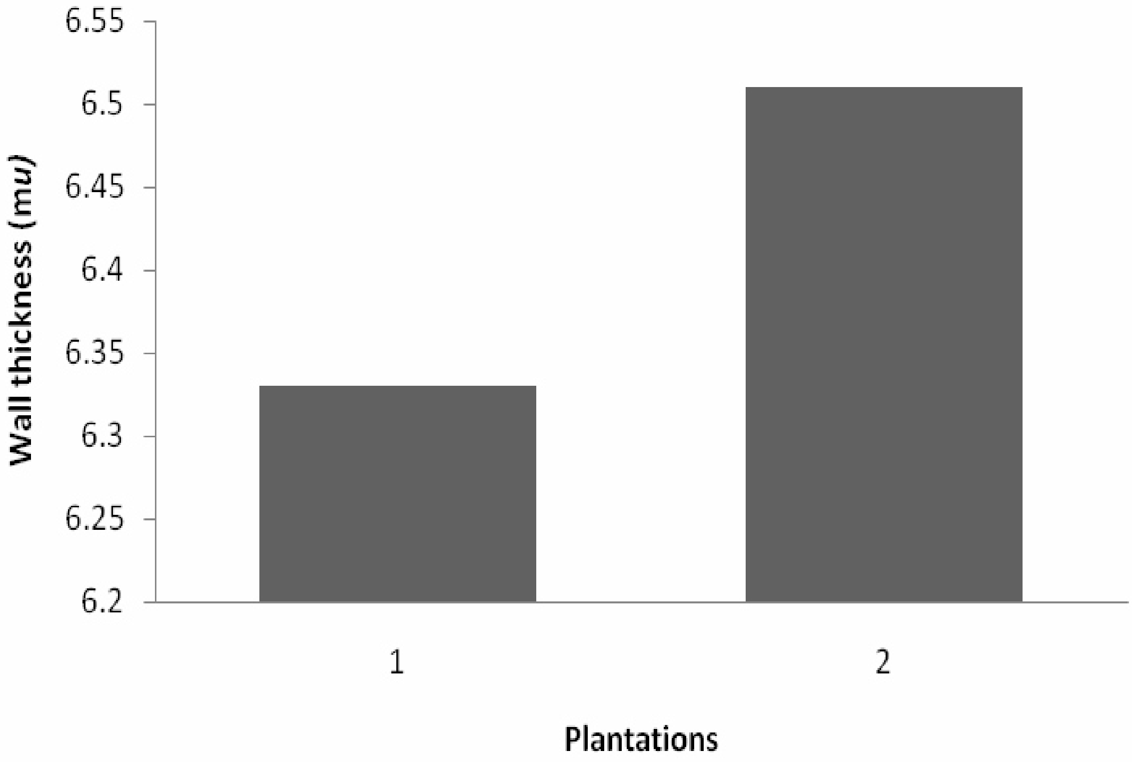

Fig 1.0: Wall thickness of wood fibres(m*u*) in plantations 1 and 2

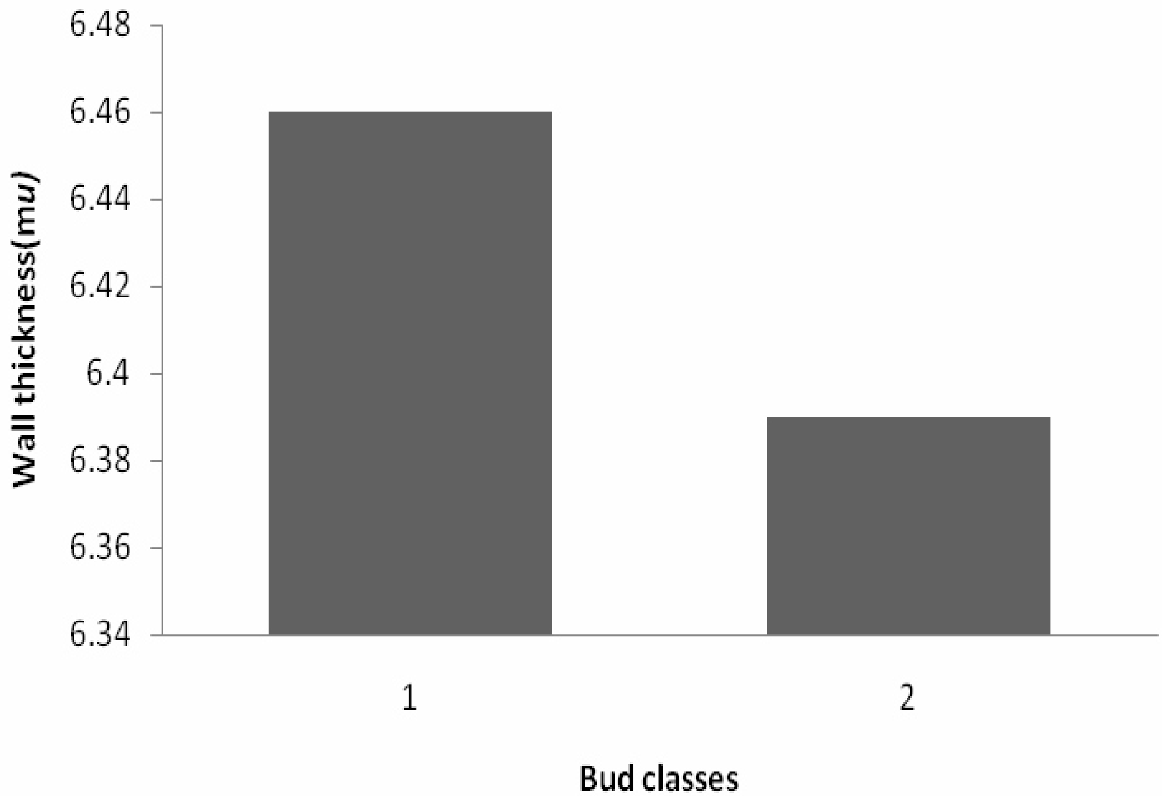

Fig 2.0: Wall thickness of wood fibres(in m*u*) in 2 bud classes (unbudded (1) and budded (2)trees)/plantation

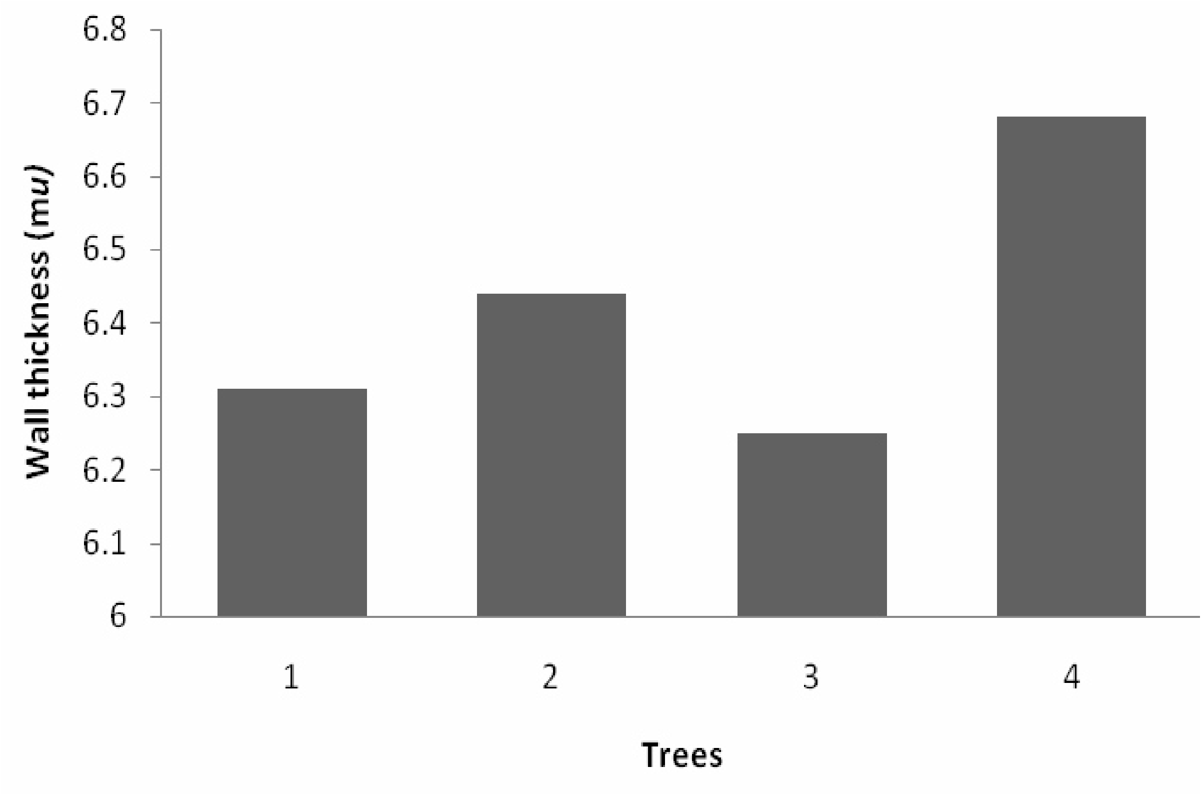

Fig 3.0: Wall thickness of wood fibres (m*u*) in 4 trees/bud class

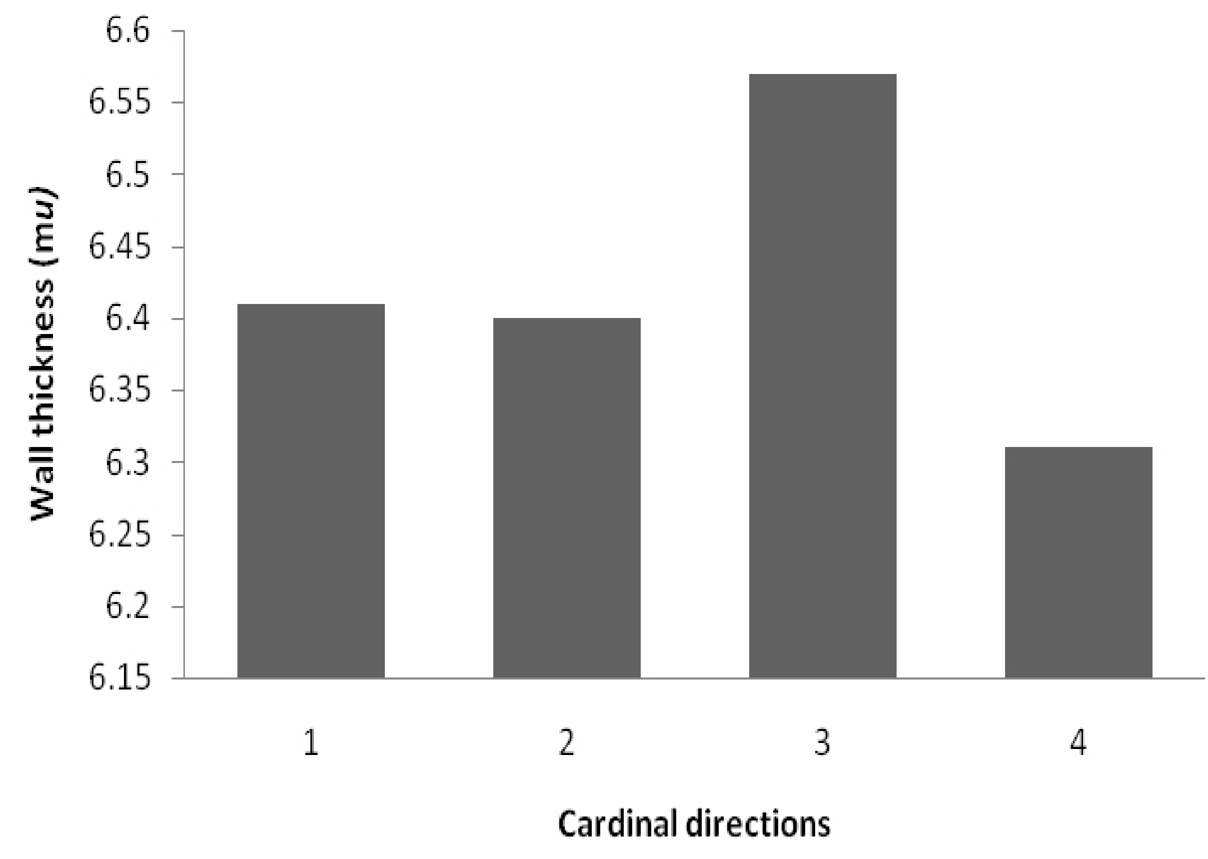

Fig 4.0: Wall thickness of wood fibres(in m*u*) in 4 cardinal directions (north (1) south (2) east(3) and west (4)/tree

CONCLUSION

The study showed uniformity in cell wall constitution of the rubber wood fibres among all the main effects (plantations, bud classes, tress, ring blocks and cardinal directions) of trees. The mean wall thickness was 6.42 m*u* among the trees in the plantations, indicating that tapping intensity may have intensified the continuous conversion of cellulose to latex during biosynthesis than cell wall formation. The wall thickness of rubber wood fibres could produce high fibre yield for pulp and paper production when used with the pulp of corniferous species. Though research is needed for cost effective removal of residual latex in the wood so as not to compromise the quality of the resulting pulp and paper produced from the rubber wood. The rubber wood can be used in the production of low to medium density wood products and panels because of the thin cell wall thickness of the fibres. For production of high density solid wood products from rubber trees, Latex-Timber Clones may be used in development of new stock and less intensive tapping regimes should be adopted to enable the trees deposit some of the cellulose in its cell walls instead of consistent conversion to latex for tapping.

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