



Tropentag 2010
ETH Zurich, September 14 - 16, 2010
Conference on International Research on Food Security, Natural
Resource Management and Rural Development

Enhancement of possibilities for farmers in the coffee region of Colombia supported on bamboo forest managing

Camargo^a, Juan Carlos, Oscar Marino Mosquera^a, Jaime Niño^a, Hector Quintero^a, Edison Henao^a and Alexander Rodriguez^b

a Professor Technological University of Pereira, La Julita, Pereira , Colombia. Email jupipe@utp.edu.co

b Researcher Technological University of Pereira, La Julita, Pereira , Colombia

Introduction

The Guadua (*Guadua angustifolia* Kunth) is the most important woody bamboo species of tropical countries in South America. In the coffee region of Colombia, forests are highly fragmented and dominated by this bamboo species; however these forests represent an important alternative for farmers as a complement of agriculture or livestock (Londoño 1998, Camargo 2006).

During several decades, bamboo forests have provided raw material for different application such as structures, handicrafts and fences. In addition, these forests fulfil relevant ecological functions because of high biodiversity, habitat for fauna, soil protection, CO₂ fixed and water regulation (Camargo et al., 2010).

In the coffee region of Colombia a guadua is the more harvested species to obtain wood for different applications, it is evidenced in some reports which show that between 2000 and 2004 roughly 2,420,000 culms of guadua was logged from 2,557 ha (Moreno 2006). However, it represents that 91 % of guadua stands were not harvested in this period of time if we consider that during a recent inventory an estimated area of 28,000 ha covered by guadua has been identified in the coffee region alone (Kleinn and Morales 2006).

Currently, demand of guadua culms has increased due to some initiatives of rural enterprises aimed to develop bamboo products for local and international market (Held 2005). Therefore, high quality of bamboo culms is demanded by these enterprises. Quality depends on different factors which include silvicultural practices, the selection of mature culms, standardisation of culms and organization of farmers.

To contribute to the consolidation of alternatives for rural farmers in the coffee region of Colombia, the aim of this work was to optimise silvicultural practices by the promotion of a proper inventory and bamboo forest planning. In addition, the definition of culm quality by means of different approaches including physical and mechanical properties, lignin and starch content and developing a device which relates maturity and the transmission of sound waves.

Material and Methods

A group of nine farms were integrated in a proposal for consolidating a unit of forest management (UFM). For this area a guadua forest management plan was done. This plan included the mensuration of dendrometric variables of guadua culms as well as productivity evaluation within stands taking into account growth pattern and therefore some adjustments should be done for better estimates. In addition, frequency and intensity of harvest were defined considering estimates of mature culms.

Culm maturity which is associated with quality, was defined by marking culms after emerging, measuring physical and mechanical properties (compression strength, shear strength, hardness and density), lignin and starch content and developing a device which relates maturity and the transmission of sound waves. After defining the quality and also including information on dendrometrics features, culms were standardised according to range of values previously established. Farmer organising (UFM) included training and technical support as well as engages them with a forest certification process.

Results and Discussion

During the definition process of the UFM about 14 ha of guadua bamboo were inventoried. Each of the farm included in the UFM had small areas with bamboo forest which never have been used for commercial proposals. After a plan of bamboo forest management about 300 culms ha⁻¹ year⁻¹ can be harvested from the UFM, it is equivalent to 2700 culms per year. Thus, incomes associated to the culm selling are now generating a complement of other agricultural activities.

To guarantee the quality of culms harvested, with information on physical and mechanical properties it was defined that about 60 months after emerging the culms achieve the better strength and therefore can be used for structural applications. A similar behaviour was observed for most of the properties evaluated (Figure 1 and 2).

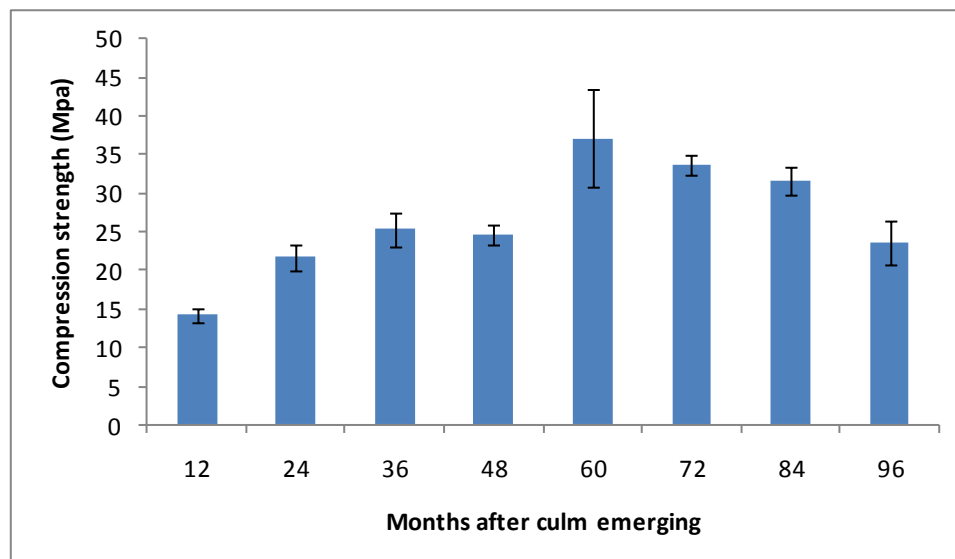


Figure 1. Average of compression strength (MPa) for *Guadua angustifolia* culms with different time after emerging. Vertical lines on the bars represent standard error.

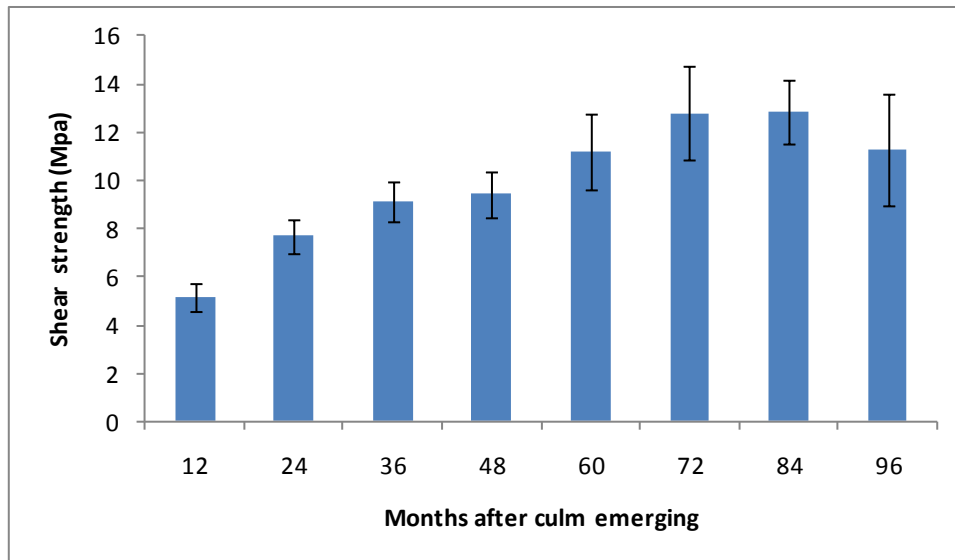


Figure 2. Average of Shear strength (MPa) for *Guadua angustifolia* culms with different time after emerging. Vertical lines on the bars represent standard error.

Determination of lignin content was conducted out according to TAPPI 222 (Tappi 2006). Values fluctuated between 15 and 32 % and did not show differences among culms sections assessed, besides it was not associated with changes according to culm maturity (Figure 3). Apparently, lignin content are not related with quality of culms because there was no found any tendency, therefore strength of the culms could be associated to structural arrange of fiber and of course to anatomy (Liese 2004) and not with the chemical content.

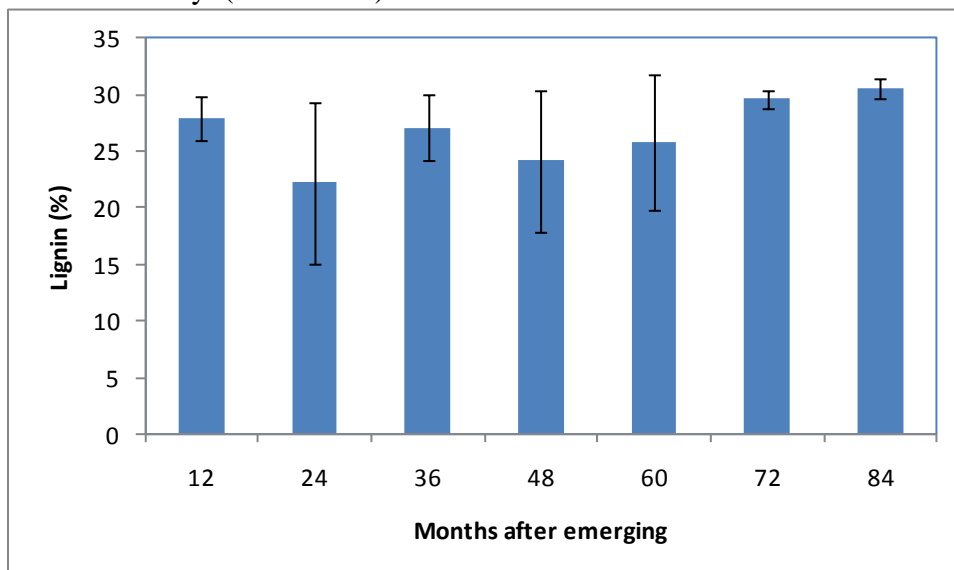


Figure 3. Average content of acid lignin (%) for *Guadua angustifolia* culms with different time after emerging. Vertical lines on the bars represent standard error.

A simple device which consist in a microphone, a hammer and a frequency lector, was developed and also used to find tendencies associated to culm maturity. After evaluation of the frequency spectrum obtained by means of the fast Fourier transform, it was observed an association between natural frequencies obtained in each culm and maturity. It is also an important result, because farmers could use the device to determine maturity (quality) without the previous process of marking. Hence, silvicultural management may possibly be easier and selection of culms with high quality could be achieved by farmers.

Conclusions and Outlook

Integration of farms with small areas under guadua (UFM) is interesting to improve the level of rural organisation and also to optimise the use of the land, because incomes might be generated from different products. Having better products because of their quality, it is important for increasing incomes and it is now possible because farmers know the time when the culms have the better strength and it also can contribute to standardisation of guadua products. Besides with a proper silvicultural practices and planning, the management of guadua forest is being optimised. As a consequence the management of guadua bamboo forest is contributing to consolidate alternatives for rural farmers in the coffee region of Colombia.

Acknowledges

The authors wish to thank to COLCIENCIAS for financing the Project: “Tecnología para definir la madurez del culmo de *Guadua angustifolia* kunth una contribución al desarrollo forestal del eje cafetero colombiano” (Contract No. 442-1-2008). This project has provided relevant information for this work. Also thanks go to the Technological University of Pereira for financing and supporting the development of this investigation. Finally, we want to express our gratitude to the owners of farms for permitting us to work in their properties.

References

- Camargo, J.C. 2006. Growth and productivity of the bamboo species *Guadua angustifolia* Kunth in the coffee region of Colombia. Cuvillier Verlag, Göttingen, Germany. 207pp
- Camargo, J.C., Rodriguez, JA., Dossman, M.A. 2010. Approach to adaptation strategies facing climate change effects on Colombian Andean Agroecosystems. In: Biodiversity and Climate Change: Adaptation of Land Use Systems. Sierke Verlag, Göttingen, Alemania. ISBNN: 978-3-86844-257-1. Pp: 113-118.
- Held, C. 2005. Promotion of innovations in forest based small and medium size enterprises of developing countries. An actor-oriented analysis of the Colombian bamboo sector. Zugl.:Freiburg, Uni., Diss, 2004. 223p.
- Kleinn C, Morales, D. 2006. An inventory of Guadua (*Guadua angustifolia*) bamboo in the Coffee Region of Colombia. European Journal of Forest Research 125 (4): 361-368.
- Liese, W. 2004. Structures of a bamboo culm affecting its utilisation. In: INBAR International Workshop “Bamboo Industrial Development” Xianning, China. November 12 of 2003. 8p
- Londoño, X. 1998. Evaluation of bamboo resources in Latin America. Final report No. 96-8300-01-4. International Network for Bamboo and Rattan.
- Moreno, R. D. 2006. Estadísticas Forestales para la Guadua en el Eje Cafetero Tolima Y Valle del Cauca. Proyecto Manejo Sostenible de Bosques en Colombia, Programa Ambiental de la Agencia de Cooperación Alemana GTZ, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Corporación Autónoma regional de Risaralda CARDER Pereira. 53p.
- TAPPI. 2006. T 222 om-06. Acid-insoluble lignin in wood and pulp. 5 p.