# Evaluation of growth stresses in living trees of *Corymbia citriodora* Hill & Johnson *(Eucalyptus citriodora* Hook*)* by determining the Longitudinal Residual Strain

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## Introduction

According to Padua (2009), methods or non-destructive tests are important tools for evaluating the properties of wood, as are techniques to qualify the material without compromising its future use. Thus, the methods provide a saving of time and costs in the preparation of the samples, unlike destructive sampling.

Currently forest research organizations are used for nondestructive evaluations (HANSEN, 2000). According Ross, Brashaw and Pellerin (1998 cited by Couto, 2011 and FLÓREZ, 2012), the non-destructive evaluation can be defined as the science of identifying the physical and mechanical properties of a part of a material without affecting the usability end.

In addition to cost savings, the non-destructive tests also have great utility for species where vegetative propagation is unreliable (Raymond, 2002 cited by Padua, 2009).

According to Lima (2004), cited by Flórez (2012), among the methods considered non-destructive or semidestrutivos for measuring deformations associated to the growth stresses are developed by the CIRAD-Forêt (BAILLÈRES; DURAND, 2000), which consists of measuring, with the aid of a dial indicator, the deformation experienced in the central area between two pins fixed to 45 mm apart along the grain, the surface of the trunk without bark.

The strain measurements are carried out by releasing tension and drive pins process. For this, it made a hole with a drill of 20 mm in diameter (Lisbon, 1993 LIMA, 2004, cited by FLOREZ, 2012).

These stresses may vary in intensity and can be tensile or compressive depending on the location within the xylem and its direction of operation: longitudinal, tangential and radial (STERN, 2002 cited by TRUGILHO et al., 2006).

## Material and Methods

Eight trees of *Corymbia citriodora*, from the campus of the Rio de Janeiro Rural Federal University (UFRRJ), Seropédica/RJ were chosen randomly. In each tree the following measurements were taken: DBH, bark thickness, tree height and the LRS in four different positions around the trunk (north, south, east and west). The LRS were measured in DBH with the aid of the extensometer. For install the extensometer is necessary to remove the bark forming a square of 15cm x 15cm on the tree trunk. From this, for performing each measurement, inside this panel are fixed two metal pins at a distance of 45mm from each other and with the aid of a hand drill a hole was made between the pins, thus the growth stresses were released, thus enabling the measurement of the strain gauge through the LRS.

## Results and Discussion

Residual Longitudinal Deformation (LRS) average was observed at 0,081mm. In the analysis of variance (ANOVA) had a p value of 0,2007, so the average between 4 LRS (measured in directions north, south, east and west) are equivalent.

Gonçalves (2007) obtained in their research the average value of longitudinal residual strain (LRS) for *Eucalyptus citriodora* and *Eucalyptus urophylla*, respectively, 0.106 and 0.092 mm. Lima (2004), in *Eucalyptus* spp clones. LRS observed an average of 0.079 mm and

Trugilho et al. (2006) of 0.093 mm in *Eucalyptus* clones. Therefore, the results of this study are within the range of values reported in the literature. It is observed that the most of the LRS values there is a negative correlation with variables DBH and height as the variable thickness of the bark has a low positive correlation to DRL.

Gonçalves (2007) noted in his research a negative and significant correlation between LRS and height to *Eucalyptus urophylla*. According to Beltrame (2010), the longitudinal residual strains showed significant correlations with the bark thickness. According Muneri et al. (2000), there are significant positive correlations of LRS to the height and diameter of *Eucalyptus cloeziana* trees.

Thus, it is observed how distinct is the LRS interactions with the growth characteristics of one species to another.

## Conclusions

- The longitudinal residual strain average observed was 0.081 mm;
- The longitudinal residual strain measured in the four directions (north, south, east and west) does not differ statistically;
- There is a negative correlation between height and LRS and a positive correlation between LRS and the bark thickness.

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