# BEHAVIOR OF STRENGH AND STIFFNESS IN SEEDLINGS AND IN LOGS OF EUCALYPTUS CLONES

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**Abstract**

Anticipate the knowledge of wood properties using tests in earliest ages is very important for the forest sector. So, we need to find properties that, measured in early ages, can be used in prediction models of trees properties. The objective of this research was to analyze if strength and stiffness, obtained in seedlings, are different in different clones and if this differences are maintaining in trees during the years, until the cutting age. Using the data obtained so far, we verify that there are statistical differences in strength and stiffness obtained in seedlings from different clones. This result is important to make these properties candidates to be used in prediction models. We expect that the differentiation obtained in seedlings remain up to 6 years old that is the cutting age of the trees.

*Key words: tension in seedlings, modulus of rupture, modulus of elasticity.*

## Introduction

Nowadays the forest sector are searching for tools to anticipate the knowledge of wood properties expected from their forests. This anticipation is important because can minimize investments, directing wood process to specific use of the wood. Research is developing by Nondestructive Testing Laboratory (LabEND), College of Agricultural Engineering (FEAGRI) in partnership with International Paper, to determine model to correlate proprieties, able to be measured in seedlings or in early age trees, which can be used to predict properties of trees at cutting age. Two of these parameters are the strength and the stiffness of wood.

The objective of this research was to analyze the behavior of strength and stiffness, obtained in tension tests of seedlings (3 months) from three different clones (IPB07, IPB02 and VT04). The results will be compared with strength and stiffness obtained in bending tests of logs cut from trees of these clones in ages from 12 months to 72 months (cutting age).

## Results and Discussion

The Young Modulus in tension (ET), obtained in seedlings of the 3 clones tested, was approximately 6 to 18% of the expected value for mature wood of *Eucalyptus* (12 to 18 GPa)2. For the rupture in tension (ft), the seedlings shows values from 10 to 50% of the expected for mature wood (70 to 150 MPa)2. The variability was very high, but there are statistically difference between clones using ft and ET (Table 1). This result indicate the possibility to use this test in seedlings, to separate clones by strength and stiffness. The results are also coherent with density of the clones: IPB07 = 340 kg.m-3;IPB02 = 350 kg.m-3 and VT04 = 280 kg.m-3.

**Table 1. Results of rupture (ft) and modulus of elasticity (ET) obtained in tension tests in seedlings**

| Clones | ft (MPa) | ET (MPa) |
|---|---|---|
| **IPB07** | 26(35%)[a] | 2241 (60%)[a] |
| **IPB02** | 22 (34%)[a] | 2112 (70%)[a] |
| **VT04** | 17 (35%)[b] | 1091 (57%)[b] |

*Values in brackets are the coefficient of variation. Same letter indicating values statistically equivalente

We expect that the differentiation obtained in seedlings remain up to 6 years old (cutting age of the trees). We cannot discuss this now, because the tests in logs are still in progress. The young plant have a very high strength and stiffness, because the configuration is nearest the basic structure of wood – cellulose, hemicellulose and Lignin; which can be as stiff and strong as manufactured polymers2. However, as the tree grows increase in diameter, but the wood structure do not have the same properties2. The logs tested yet showed values in the range 4 to 6 MPa for fm and 0.6 to 1.1 GPa for EM.

## Conclusions

There are statistical differences in strength and stiffness obtained in seedlings from different clones. We expect that the differentiation obtained in seedlings remain up to 6 years old, that is the cutting age of the trees.

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