

Study on Within-tree Variation in Wood Properties of

***Melia azedarach* Planted in Northern Vietnam**

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Abbreviations

- BD: Basic density (g/cm^3)
- DMOE_{log}: Dynamic modulus of elasticity of log (GPa)
- E_d : Dynamic modulus of elasticity of clear specimen (GPa)
- FL: Fiber length (mm)
- FLI: Fiber length increment (%)
- GRW: Growth ring width (mm)
- MFA: Microfibril angle ($^\circ$)
- MOE: Modulus of elasticity (GPa)
- MOR: Modulus of rupture (MPa)
- SG: Specific gravity in air-dry condition
- V_L : Acoustic wave velocity (m/s)
- WD: Wood density in air-dry condition (g/cm^3)
- α_R : Radial shrinkage (%)
- α_T : Tangential shrinkage (%)
- α_T/α_R : Tangential/radial shrinkage ratio
- ρ : Green density of log (kg/m^3)

CHAPTER 1

Introduction

All forests fulfil a range of roles and provide a variety of goods and services. The roles fulfilled by planted forests are diverse and the goods and services produced include the production of industrial wood, fuel wood, non-wood forest goods (eg. animal fodder, apiculture, essential oils, tan bark, cork, latex, and food) and conservation, carbon sequestration, recreation (eg. hunting, fishing, and hiking), erosion control, and rehabilitation of degraded lands, including landscape and amenity enhancement. For countries with a low forest cover, the only way to obtain the multiple benefits from forests, is creating new forests, mainly through planting.

Global planted forest area increased from 1990 to 2015 from 167.5 million ha to 277.9 million ha with the increase varying by region and climate domain (Payn et al. 2015). Together with global trend, Vietnam's planted forest area increased considerably from 1985 with 0.58 million ha to 2016 with 4.13 million ha (Table 1.1) (Ministry of Agriculture and Rural Development of Vietnam 2017). Large areas of plantation do not only supply material for pulp and paper production but also play an important role in the protection of environment by reducing greenhouse gas and helping to reduce poverty in rural areas (Kim 2009). Besides, with the decrease in the available wood resources and the increase in wood processing costs have led to a significant interest in timber production from plantation. For timber plantation, the current wood is under-utilised and poorly managed. Therefore, there is a need for effective and sustainable utilization of the plantation forests in order to prevent further decline of timber sources and improve quality of timber products. One of the ways of sustainably utilizing wood resources is to study on wood properties.

Wood is a highly variable material due to its biological origin (Zobel and Van Buijtenen 1989). For a given species, the within-tree variation is further partitioned into variation from pith to bark (radial variation) and variation with position along the stem (axial variation). The large variability of

wood characteristics makes it difficult to precisely predict its performance and therefore to efficiently process and utilize the material. On the other hand, the variability means that this material has potential for genetic improvement and diverse end uses (Zobel and Van Buijtenen 1989, Koga and Zang 2004). Therefore, a better understanding of the wood variability within tree is of value to both wood quality improvement and efficient wood processing and utilization.