ABSTRACT

Disertation title "Research on Some factors of Deformation Treatment Technology of *Eucalyptus camandulensis* Dehn Sawn timber by Sawing method"

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I. INTRODUCTION

Laos PDR has a rich natural resources with large forest area. However, as of 2001, the forest cover reduced to only 41%. Therefore, Laos government has increased planting to reach forest cover of 47%. The main tree species for afforestation are *Acacia mangium*, *Acacia auriculiformis*, teak, *Eucalyptus* sp. There are 2 Eucalyptus species planting in Laos: white Eucalyptus **(***Eucalyptus camaldulensis* Dehn.**)** and red Eucalyptus **(***Eucalyptus urohlylla* Dehn.**)** covering of 80% of plantation forest area.

The white Eucalyptus timber is harvested for producing laminated timber, wooden furniture but the usage ratio is quite low. In Laos, for producing 1 m^3 laminated timber from this specie, it needs 6-6.5 m^3 of log which is about 2 times comparing to other timber species. The main reason is that after sawing and after drying, timber was deformed and excessive cracking which need to be eliminated. Nowadays, many solutions have been proposed, such as selecting varieties, standing dead trees, wood modification by microwave, glue, compressing ... or choose drying solution, however, there is no real high efficiency solution.

In order to reduce the recovery rate of eucalyptus wood material, it is necessary to have systematic research on the structure, physical and technological characteristics, especially the sawing technology. Recovery rate of wood materials is mainly due to deformation and cracking, which is mainly attributed to the sawing and drying stages. However, if the sawing is not good, although with good drying, sawn timber are still cracked and deformed.

Therefore, the finding of the causes and solutions for these disadvantages in the manufacturing of white Eucalyptus wooden products for export is very necessary which has both scientific and practical meanings. Enhance the economic value of Eucalyptus wood in particular and plantation timber in general; Thus contributing to stable social security. Especially helping businesses exploit, process and trade forest products in accordance with Directive No. 15 of the Prime Minister of the Lao People's Democratic Republic signed on May 13, 2016 on the prohibition of timber exploitation from natural forest, exports of logs and sawn timber in the whole country.

In order to solve part of the problem, the study on the sawing method to minimize the deformation and cracking of sawn timber is one of the current priorities, so the dissertation "**Research on Some factors of Deformation Treatment Technology of *Eucalyptus camandulensis* Dehn Sawn timber by Sawing method**" is the right direction, has scientific and practical significance.

II. OBJECTIVES, RESEARCH CONTENTS AND METHODOLOGY

2.1. Research objectives

2.1.1. Scientific objectives

- Determine the change in density, shrinkage ratio at different tree height, in radial direction for proper processing direction.
- Determine the relationship between sawing methods (cut-to-length method, sawing method and its sequence) and deformation (bent, crack) of *Eucalyptus camandulensis* before and after drying.

2.1.2. Practical objectives

Propose some sawing teachnological factors of *Eucalyptus camandulensis* in Laos to minimize the deformation, especially:

- The method of cut-to-length before sawing;
- Type of sawn timber, sawing method and sawing sequence

2.2. Research contents (Work package) and Methodology

In order to obtain these objectives above, we conduct the following work packages:

Work package	**Methodology**
1. Study on *Eucalyptus camandulensis* properties	Review the literature about *Eucalyptus camandulensis* in the world and Laos
2. Determine the change of density at different height and toward the radial direction.	Determine the wood density at different height and toward radial direction using following standards: ISO 4471:1982; TCVN 8044:2009; TCVN 8048-2 : 2009
3. Determine the shrinkage ratio (Longitudinal, rasial and tangential) along the tree height and radial direction	Determine the shrinkage ratio along the tree height and radial direction using following standards: ISO 4471:1982; TCVN 8044:2009; TCVN 8048-13 : 2009
4. Determine the relationship between sawing method and deformation (bent and crack)	Using experimental method combining with data analysis, synthesize and expert methods
5. Propose some sawing technological factors to minimize the deformation,	Using analysis, synthesize and expert methods

III. RESULTS AND DISCUSSIONS

3.1. The significance of the research:

- ***Scientific meanings***

  + Adding scientific basics about *Eucalyptus camandulensis* timber

+ Adding scientific basics about sawmilling technology of *Eucalyptus camandulensis* timber.

- ***Practical meanings***

Having designed saw-set up (Cut-to-length diagram, sawing method and sawing sequence) for *Eucalyptus camandulensis* timber with reducing deformation of sawn timber.

3.2. **New academic and theoretical distributions of the thesis**

- About academic distributions

Adding documents for research and teaching at undergraduate and graduate students in the fields of wood technology.

- About theoretical aspects

1) Adding scientific basic on *Eucalyptus camandulensis* timber:

   + Having established changing rule of the density, shrinkage ratio (radial, tangent, radial and longitudinal) in two directions: from inner to outer and from stump to top of tree;
   + Having established relationship between deformation of *Eucalyptus camandulensis* sawn timber and its longitudinal direction shrinkage ratio.

2) Adding scientific basic on sawmilling technology of *Eucalyptus camandulensis*:

   + Having established relationship between deformation of *Eucalyptus camandulensis* sawn timber and its cut-to-length and sawing methods;
   + Having explained reasons that result deformation of *Eucalyptus camandulensis* sawn timber and base on which suitable sawing method for reducing the deformation is selected.

- New arguments drawn from the research results of the thesis

Having designed a suitable Saw-set up for sawing *Eucalyptus camandulensis* timber: Cut-to-length Diagram, sawing Method and sawing Sequence. The saw-set up that was applied in Laos reducing deformation of *Eucalyptus camandulensis sawn* timber about 20-30%.

3.3. Main results

1) Having changing rule of density and shrinkage ratio (radial, tangential and longitudinal) in two directions: from inner to outer and from bottom to top of tree;
2) Having established relationship between deformation of *Eucalyptus camandulensis* sawn timber and its longitudinal direction shrinkage ratio
3) Having established relationship between deformation of *Eucalyptus camandulensis* sawn timber and its cut-to-length and sawing methods;
4) Having designed a suitable Saw-set up for sawing *Eucalyptus camandulensis* timber: Cut-to-length Diagram, sawing Method and sawing Sequence

IV. CONCLUSSION

1) Changing of density from inner to outer and from stump to top of tree is small. In *Eucalyptus camandulensis* timber; there is a big changing of shrinkage ratio, from bottom to top of tree, especially in longitudinal direction about 6-10 times bigger than normal wood and from inner to outer the changing is small.
2) *Eucalyptus camandulensis* sawn timber has deformation both after sawing and after drying.
3) Sawing method and deformation of sawn timber have a close relationship, especially, it is clear with species that have big shrinkage ratio changing along stem.
4) Select suitable sawing methods shown in thesis results will rduce deformation of the sawn timber.