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ECO STRUCTURES OF PANEL TYPE AND TIMBER OBTAINED FROM YOUNG STEMS RESULTED FROM FOREST THINNING

DUMITRASCU, R[amona] E[lena] & BADESCU, L[oredana] A[nne] - M[arie]

Abstract: *Wood resources from the forest thinning operations are currently neglected for use in furniture manufacturing industry. In this paper is proposed a way of use them, in accordance with strategy of sustainable development for Romania. This study contributes to the development of knowledge on the efficient use and at superior level of all forest resources, implicitly the young trunks resulted from thinning. Results show that these resources may represent a new source of raw material for furniture industry.*
Key words: *sustainable development, young stem, thinning, eco structures, timber*

1. INTRODUCTION

Wood is one of the most important renewable resources with long cycle, upon which over the time have developed multiple manufacturing activities, that have generated an extremely wide range of products.

Therefore, increasing demands of wood material of national and international markets favored the irrational exploitation of natural forests.

Over-exploitation of renewable natural resources is today one of the factors that negatively influence capacity to support and bio-productive capacity of natural capital of Romania.

In this sense, at forest level, one of the main current strategic directions upon which Romania has to mobilize efforts in accordance with the objectives and policies agreed with the European Union is: *rational and efficient use of all forest resources*. (Ministry of Environment and Sustainable Development, 2009).

Periodically, during a calendar year, in the forest environment are executed operations of thinning forest.

In general, their purpose is to contribute more actively to increasing the productive and protective value of forest cultivated. (Bowyer, J. et al., 2003).

The trunks harvested in this way, presents in generally, shape defects and therefore are less used at a higher level. These are, however, an important base of raw material.

According to data provided by *Romsilva – National Forestry Association from Romania* - at 2009 level, the secondary wood material harvested through cleaning and thinning was of approximately 19% of the total wood material harvested. (Romsilva, 2009).

Also in 2009, through cleaning and thinning operations were harvested 15.20% softwoods of total softwoods harvested; 13.53% beech of total beech harvested; 31.29% various hardwoods and 28.61% various soft wood species.

Total percentage of trunks harvested from the thinning operation is expected to increase by about 3% in 2010 compared to 2009.

Considering the fact that this wood resource somewhat neglected in the industrial environment, represent a significant percentage from forest, implicitly is imposed finding some ways to use at the higher level, in accordance with the requirements of sustainable development for Romania.

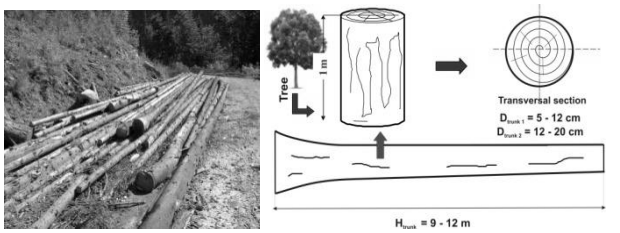

Fig. 1. Young trunks dimensions resulted from thinning forest and the area from they were harvested

Therefore, in this paper it is proposes a way to use the young trunks harvested from forest thinning operations. Thus, we have analyzed the wood material behavior cut into timber and wood material behavior embedded into eco structures of panel type.

2. MATERIALS AND METHODS

For doing this study were harvested trunks of beech (*Fagus sylvatica L.*), maple (*Acer platanoides L.*) and spruce (*Picea abies K.*) resulted from thinning forest (thinning of first order). Trunks origin was: Zarnesti production unit, geomorphologic region Southern Carpathians - Taga Mountains. (Fig.1) Relief unit characteristic: slope.

The forest production unit have an altitude between 800 m - 1640 m and the average annual temperature is + 4 ^{0}C.

The rainfalls have an annual average value by the 1000 mm (Marin et al., 2004).

From this forest production unit were taken trees with heights of up to 12 m and diameters between 5 and 20 cm. In fig.1 are presented the dimensional characteristics of trees studied. They have been cut on the trunk height from the meter in meter. Cutting was carried out after approx. 4 months from harvest, during which time the trunks have been dried in naturally, not artificially.

The trunks humidity in the moment of cutting, measured with *Extech* - the digital moisture meter with contact, was 50 ± 2 %. Were analyzed the wood material behavior cut into timber and wood material behavior cut into prisms/lamella and embedded in the eco-structures of panel type. In this sense, were cut from each species, 4 logs of 1 m into timber and 4 logs of 1 m into wooden lamella / prisms.

Cutting logs was done using a circular saw of rip. Saw blade diameter was by 320 mm Ø.

The scheme for obtaining of pieces of timber at thickness established experimentally by 20 mm and respectively 30 mm is represented in Figure 2. The timber was kept at a relative humidity of 55 ± 3% and room temperature of 23 ± 2 ^{0}C.

Evolution of the timber behavior was studied during 6 months from cutting. Wooden lamella cut from the second series of logs had dimensions established of 40*300*20 mm and respectively 40*60*20 mm.

In fig.3 is shown the way in which were cut wooden lamella / prisms, the shape and their dimensions.

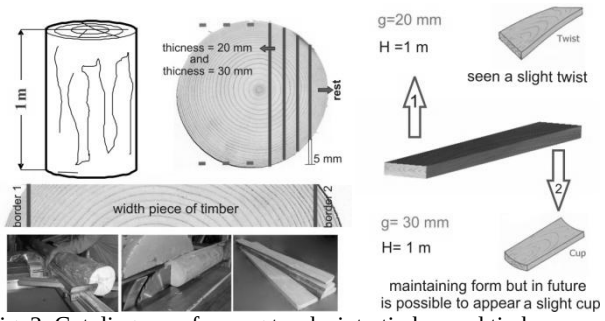

Fig. 2. Cut diagram of young trunks into timber and timber behavior over time

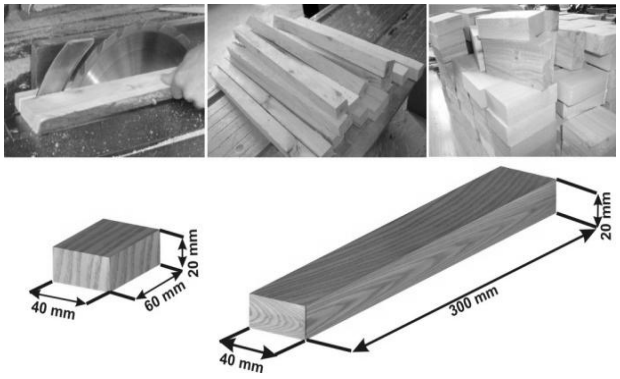

Fig. 3. The shape and dimensions of wood lamella/prisms

Were designed eco structures for two types of joints: eco structures of panel type with edge joint and eco structures of panel type with trapezoidal finger joint.

Glued panels edge to edge were performed in laboratory conditions, in the *Faculty of Wood Industry*.

Joining elements was performed after 3 days of cutting, during which no dimensional changes were observed. Humidity samples in moment of joint was 15 ± 2 %, and the room temperature 20 ± 2 ^{0}C. Has been used a device of clamping with mechanical screws which is in endow the *Laboratory of eco-design and utilization of secondary wood resources*.

For joint of wood pieces was used a PUR-pre-polymer type *Jowapur* 685.32 with a time of pressing at 20 ^{0}C of 75 - 120 minutes. Panels obtained through trapezoidal finger joint on width, were made in industrial system, in the production unit *Sezar Forest* (Sezar Forest SRL, 2010). It was used a type D3 adhesive according to EN 204. Time of pressing at 20 ^{0}C it was for approximately 3 hours. Panels were kept at a relative humidity of 55 ± 3% and room temperature of 23 ± 2 ^{0}C.

Evolution of the panels behavior was studied in one year. It should be noted that in none of the cases were not monitored clamping force. Wood material used had defects of structure as nodes; abnormal coloration as blue rot (at spruce), abnormal coloration of yellowish - reddish to brown (at beech).

3. RESULTS AND DISSCUTIONS

In following the experimental study performed on young trunks cut in timber were observed: in first 6 weeks after cutting were not reported defects: as deformation.

After six months timber with thick of 20 mm had presented an easy twist having maximum arrow ranging between 1-2 mm. The timber with thick by 30 mm, maintained its shape, but while is possible to appear a slight cup. (Fig. 2)

Taking into account the humidity from the moment when the logs were cut into timber, we can say that a cutting to 15 -20% moisture can remove in a proportion of about 60% the shape modification.

In following the experimental study performed on young trunks cut into lamella/prisms and embedded in eco structures of panel

Fig. 4. Types of innovative eco structures

type were observed: panels obtained on an experimental way by the combination of spruce with maple using edge jointing technique, had no cracks and had good dimensional stability.(Fig.4, a) Panels obtained by the same technique, but from beech wood has small cracks of 1-3 mm, on the wood ray direction and in the joint area. (Fig.4, b) An influence in this sense had and the inevitable existence of abnormal coloration of yellowish - reddish to brown often found in beech wood.

Eco structures obtained by trapezoidal finger joint, in width, are by their structure very more resistant and they also had good dimensional stability. (Fig.4, c)

Eco structures of panel type from fig. 4 (a, c) may represent a new product for small furniture design.

4. CONCLUSION

Regarding to the use of trunks from forest thinning as timber in industrial environment: it should be noted that a great importance, among other issues, has trunk humidity when is cut. Recommended humidity is 15-20%. If one takes into account for this aspect, the cutting young trunk into timber may be a potential product on national and international markets.

Also, potential products obtained from young trunks resulted from forest thinning are and eco structures of panel type. Types of eco structures that are designed in this study are intended for the design of small furniture pieces. Depending on the destination of innovative product it can choose the type of joint (edge joint or trapezoidal finger joint). These types of trunks could be used as an alternative to wood of normal trunk. (Dumitrascu, 2009).

The abnormal colorations, that are inevitable for this type of material, offer a very aesthetic aspect for the product and they does not change, in general, wood resistance. Given the preliminary results of this experimental phase, by use this type of wood, namely young trunks, it can register: increasing industrialization degree and use at higher level, according to the sustainable development strategy for Romania, for a category of wood neglected in the furniture design; promoting an environment conducive to life; stimulating curiosity for the use of unconventional resources in different technological processes.

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