WORKING PARTY ON LOGGING AND UTILIZATION OF POPLAR AND WILLOW WOOD
INDUSTRIALIZATION OF THE CHILEAN BASKET WILLOW

Marta I. Abalos Romero

The basket willow (Salix viminalis) is a well-known species in Chile for its qualities for the production of baskets, packaging and furniture. It has been cultivated since the colonial times, when the species was introduced from Spain. Since then, the cultivation of the species and the production of goods have been carried out in rural towns, particularly in Chimbarongo (VI Region), where 223 hectares of basket willow exist in 88 plantations, most of them the property of small farmers. About 1,200 small handicraft shops manufacture a great diversity of wicker goods that are sold mainly in the local market. Some of the problems for this activity are the lack of technological development, raw material and products without the necessary quality to reach better markets, as well as knowledge limited to creating handmade products of designs manufactured over decades. As a result, some 4,000 people linked to the cultivation and production of wicker products reach subsistence levels only.

The revaluation of natural and handmade products around the world and recognition of their contribution to rural development have stimulated the production of natural fibers in many countries. In Latin America, Chile has excellent climate and soil conditions for the cultivation of wicker and rattan which have similar properties. In that context and after verifying the existence of an important Asian demand for rattan products, both domestically and globally, the Instituto Forestal (INFOR), with the collaboration of other national institutions, began the project “Integral Development of the Cultivation and Industrialization of the Basket-willow” with the objective of strengthening the national wicker industry, improving the quality and looking for opportunities to export raw material and products, particularly furniture. A significant change was envisaged from small scale handicraft to a Chilean wicker industry.

This paper presents the main activities and results in the three areas of work addressed by the project. The first, related to the development of wicker cultivation, was to identify locations to establish cultivation, select the best species, establish appropriate forestry techniques, improve the post-crop process and formulate standards of quality to favour the domestic and international commercialization of the raw material. The second topic was aimed at the industrial development of wicker furniture with the generation of new products, processes and standards of quality. The third topic was dedicated to generation and promotion of commercial information to foster the competitiveness and quality of production.

Key Words: wicker, rattan, forestry, handmade and semi industrial products, designs, markets.

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STUDY OF THE QUALITY OF POPLAR WOOD FOR VENEER PEELING IN AN EXPERIMENTAL PLANTATION

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The study has two objectives. The first is to analyze the wood quality of 22 clones of poplar in an experimental plot in the municipal area of El Haro, Autonomous Community of La Rioja, Spain. This analysis was realized at two levels: study of growth and quality of different standing clones in a plot; and yield and quality of such clones as a function of rotary peeled veneer obtained. The second objective is to find a mathematical model which would explain the relationship between the standing volume classification of wood quality using standard UNE 1316-2 and the actual production of veneer.

It was concluded that, due to their excellent growth rates, inter-American clones Beaupre and Unal are interesting alternatives for poplar growers, as well as for industry, because of the better veneer quality obtained. For the classification of growing stock according to standard UNE 1316-2, and to forecast the percentage of quality veneer, it is necessary to continue studies since the results, even if they are promising, are not conclusive in this respect.

**Key Words:** poplar clones production, standing quality, quality and production of veneer, Beaupre and Unal clones.

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In Argentina, poplar plantations are mainly concentrated in Buenos Aires, Entre Ríos, Mendoza, Neuquén and Río Negro provinces, covering an area of over 50,000 hectares. Because of its importance, the E.E.A. Paraná Delta (INTA) has developed a genetic breeding program. First, the selection criteria for developing new commercial varieties were growth and resistance to diseases according to local grower and industry requirements. Nowadays, higher quality standards are requested by the pulpwood, veneer and sawlog markets.

Although quality is a consequence of intrinsic wood properties and silvicultural practices, our goal as breeders concentrates in the first aspect.

The properties of wood can be quantified by several technological parameters according to its utilization (dimensional stability, strength, modulus of elasticity, etc), but the wood basic density is widely used as the best primary indicator of its mechanical properties.

The traditional wood density evaluation method has the disadvantage of consuming large amounts of time and effort with samples taken from standing or felled trees. In contrast, Pilodyn 6J-Forest (PROSEQ SA) is a fast, non-destructive and reliable tool for evaluation of wood density in standing trees. It measures the penetration depth of a pin shot into the stem with a constant energy of 6 Joule.

This study was carried out over a trial of *Populus spp*, planted in 1997 in a field protected against floods by a dike of the Delta of Paraná river, Argentina (lat: 34° 09’ 25.87” S, long: 58° 43’ 45.32” W). The goals were:

- To find the relationship between pin penetration depth and wood density in *Populus spp*.
- To measure the wood density of studied clones and to establish the relationship between this variable and the rest of variables used as selection criteria.

The correlation obtained between pin penetration depth and wood density was very significant and had negative slope. Evaluated clones showed significant differences for all the studied variables. Wood density was independent from the other selection criteria analyzed. The implications of these results for the development of breeding program are discussed.

**Key Words**: *Populus*, Pilodyn, wood density.
The Corporación Nacional Forestal (CONAF) has developed a new extension system to work with the smallholder forests owners, using participatory processes in which, starting from the needs of smallholder groups, it is possible to elaborate Forest Development Programmes, taking advantage of the production suitability of the areas of forest development where they live.

The CONAF’s Forest Extension Process has the following stages: (1) Information summary and diagnosis of the communities to consider; (2) Identification and priority definition of the communities to include; (3) Sensibility analyses; (4) Needs identification; (5) Identification of options and forest promotion tools to use; (6) Options choice with the community; (7) Community Forest Development Programme elaboration; (8) Programme application; and (9) Follow up and evaluation.

Within the framework of the permanent actions of the National Poplar Commission, the CONAF’s Forest Promotion Department appointed a forest extension specialist in 2002 to work in the communities of Coínco (El Rulo) and Coltauco (Idahue). Through a participatory project with smallholder poplar plantation owners, relationships between problems and causes were identified. Low internal prices of poplar wood were caused by oversupply of wood stocks; availability of more profitable substitute products; low profitability for smallholder growers were caused by low technical capacity; low-quality plantations and availability of too many intermediaries; incidence of diseases caused by low quality plantations and lack of application of county decrees; soil degradation was caused by bad use of resources, forest fires and riparian erosion due to the flow of the Cachapoal river.

The main needs reported by the smallholder group included firstly, improvement of forest products marketing and subsequently, technical support on wood processing and technology improvement. No special mention was made on silviculture and technical management problems.

Difficulties are being experienced in Stage 5 of the extension process, because there are no clear options for poplar wood utilization. The forest extension process was interrupted and the work was refocused, this time to options identification through the following activities: (1) The CONAF’s Forest Promotion Department together with the Forest Institute initiated the project “Industrial Model for the Integral Utilization of the Small Owner Poplar Plantations in the central Zone of Chile”; (2) A strategic alliance was created with the Wood Technology and Research Centre (CERTIM) of the University of Talca, to identify alternative wood uses for the available resources in the Coltauco and Coínco Counties. The process is focused on the identification of the value added chain for forest products based on the elaboration of poplar wood and the strengthening of the weakest links, in order to improve the producers’ capacity and capability to compete.

**Key Words:** smallholder, extension, markets, utilization, management.

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The cultivation of poplars has been considered a real option for forest production development in Chile, within Regions IV and X where a significant land area exists for the establishment of poplar. Also, the potential of reasonable profitability is seen if poplar is managed in an appropriate way in relation to market niches for final products of high added value. However, the small and medium owners that cultivate poplar have problems to find markets for their products, resulting in an oversupply of standing wood, with a loss of value of the resource. The main cause of this problem is the lack of a local industrial structure to absorb the available poplar.

In order to find the solution to the current problem around poplar plantations, the project “Industrial Model for the Integral Use of Poplar plantations of small and medium producers of the central area of Chile” was instigated in 2003.

This project involves four stages: firstly, market research and characterization of the supply of poplar in the Cachapoal valley (Region VI), with the objective of calculating the potential demand for final products in the United States and of quantifying the poplar plantations and describing their main attributes; secondly, determination of physical and mechanical properties of poplar wood; thirdly, evaluation of the technical and economic pre-feasibility of an industrial plant for the sawn wood production, remanufactured and finished products; fourthly, logical design of a system of information for supply, production and delivery of products, and development of an industrial “cluster” for the area under study.

The paper summarizes the results of the first three stages. In particular, the Chilean poplar products with competitive advantages in the US market, the availability of poplar from different plantation types and its projected growth; physical-mechanical properties of the wood of different plantations in the central area of Chile; and the early development of the proposed industrial modules.

Key Words: poplar, cluster, small and medium producers.

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DEFINITION OF A METHODOLOGY TO ASSESS THE YIELD AND QUALITY OF POPLAR PEELING WOOD APPLICATION ON SIX *POPULUS X INTERAMERICANA (POPULUS DELTOIDES X POPULUS TRICHOCARPA)* CLONES

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The peeling of six logs of *P. x interamericana* poplar clones is compared. The physical characteristics were measured on samples taken on the veneer sapwood.

Low average values and variability of infradensity and tangential shrinkage make it possible to predict the clone potentialities for valorisation by rotary peeling. The yield can be predicted using a formula based on two principal variables: the girth at the top of the log and the girth of false-heart. These parameters are proposed to calculate peeling recovery, since they allow to quantify the visual estimates often used by the processing industries.

**Key Words**: veneer logs, peeling, physical properties, *Populus trichocarpa* x *Populus deltoides*.

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VARIATION IN MICROFIBRIL ANGLE AND ITS INFLUENCE ON WOOD PROPERTIES OF POPLARS

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Microfibril angle (MFA) is a property of the cell wall of wood fibres which is made up of millions of strands of cellulose called microfibrils. The aim of this study was to examine the potential for genetic selection for low microfibril angle by estimating the variation in MFA and wood properties, and the relationships between MFA and wood properties among poplar trees.

The microfibril angle of seven new poplar clones was determined using the X-ray diffraction techniques. Microfibril angle, wood basic density, fibre length, fibre width and cellulose content were measured for every growth ring at breast height for all sample trees. Significant variation was observed among growth rings. Mean microfibril angle at breast height varied from 7.8° to 28° between growth rings with cambial age and showed a consistent pith-to-bark trend of decreasing angles. Analysis of variance indicated that there were significant differences in wood basic density, fibre length, fibre width and cellulose content between the growth rings, which had an increasing tendency along the direction from pith to bark. Regression analysis indicated that microfibril angle was significantly correlated with wood basic density, fibre length, fibre width and cellulose content. A polynomial function can best describe the relationships between microfibril angle and measured wood properties, and the correlation coefficients were greater than -0.56 (n=151).

The results from this study suggest that microfibril angle would be a good characteristic for improvement in future poplar breeding programs.

Key Words: poplar clone; microfibril angle, X-ray diffraction, wood property; selective breeding.

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TECHNO-ECONOMIC EVALUATION OF THE USE OF MECHANIZATION IN POPLAR PLANTATION HARVESTING

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The aim of the present paper is to assess the possibility of introducing, on a large scale, advanced mechanization of poplar plantation logging.

Four work sites, with different degrees of mechanization, were compared: the first (work site A) involved traditional mechanization (chainsaw and agricultural tractor); the second (work site B) had intermediate mechanization (chainsaw, excavator and chipper); the third (work site C) and the fourth (work site D) used advanced mechanization (with harvester, specialized loader, forwarder, and chipper on forwarder).

From a technical point of view, greater mechanization leads to greater productivity. The range of daily gross productivity - m³ per worker – was between 15 (work site A), and 91 (work site D), with intermediate values of 36 and 83 for work sites B and C, respectively.

The cost of production of sawmill material was lowest – 5.02 Euro/m³ - at work site B; at work site C and D, with advanced mechanization, it was 8.73 and 8.66 Euro/m³ respectively; the highest cost, 12.35 Euro/m³, was recorded at work site A, where traditional mechanization was employed. The high value at work site B is attributed to the high unit volume of the equipment - 1.75 m³ - which is twice the unit capacity of the equipment at work sites C and D. This resulted in a low unit cost of chip production at work site B in comparison to work site C (4.51 vs 8.74 Euro/m³).

The results suggest the possibility of introducing advanced mechanization in poplar plantation logging. It is important to consider the extreme variability of the market for a diverse range of poplar products. This could be a limit to machine use, but the problem could be partly resolved with specific subsidies for machine purchase.

Key Words: logging, advanced mechanization, poplar, harvester, forwarder, work site, yield, chips production cost.

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MEASUREMENT OF WOOD OPTICAL PROPERTIES IN WILLOW

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When pulp is obtained through high-yield processes, only some of the components responsible for the colour are eliminated. Therefore, pulp optical properties are close to those of the wood raw material, so that the darker the wood, the lower the brightness attained in the pulp. Most of the published papers relating to colour assessment have examined colour using pulp or paper, but very little information was found for optical properties measured on wood. The aim of this work was to compare two different wood colour measurement methods, analysing the relationship between colour values obtained on solid wood and those obtained on milled wood.

Seven 13-year old trees of the hybrid Salix babylonica x Salix alba cv. “A 131-25”, growing in Paraná River Delta, were sampled. Discs were taken at three fixed heights (1.3m, 4.3m and 6.5m). Two boards were cut from each disc, one was used to evaluate solid wood optical properties and the other was reduced to woodmeal in a Thomas Wiley Mill through a 40 mesh screen and colour values were determined on the woodmeal obtained. Measurements were taken with a reflectometer ELREPHO, using d/0° geometry and CIE (International Commission on Illumination) illuminant C. The variables analysed were: brightness and those related to the colour space systems CIELab and CIEYxy.

Optical properties measured on both solid and milled wood were compared using different statistical methods: paired means tests, Pearson correlations, analysis of variance. The mean values were similar in solid and milled wood. The correlations between the two methods were good for all the variables, except for a* values. Colour data from milled wood showed more sensitivity, opposed to the more difficult method to obtain the woodmeal. The results lead us to affirm that there were no relevant differences between colour values measured by both methods for the willow hybrid investigated. Given the greater ease to evaluate optical properties in solid wood, this method would seem to be the most suitable one for further development as an industrial scale application.

Key Words: optical properties, brightness, wood colour, Salix, Delta of Paraná River.

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