

PROPERTIES AND PROCESSING OF *POPULUS DELTOIDES* BARTR. FOR PRODUCING QUALITY SAWN AND SEASONED TIMBER

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Introduction

Populus deltoides is a medium density hardwood species with an average specific gravity of 0.441 on oven dry wt/green volume basis. By virtue of its fast growth, it offers great potential for meeting the requirements of wood based industries in the country in the near future. Large scale planting of this species has been carried out in the plains of Punjab, Haryana and North-Western Uttar Pradesh under agroforestry and farm forestry schemes. Logs of this species are now becoming available for possible timber use. One of the major problems in the utilisation of this plantation grown timber is that a large proportion of this material is prone to severe distortion in seasoning primarily due to presence of longitudinal growth stresses in trees and logs. When logs are sawn by conventional cant method to get the desired size of planks, growth stresses cause crooks to occur at the headrig. Further, additional crooks develop in drying because of non-uniform longitudinal shrinkage and the inherent low resistance of planks to drying stress. Amount of warp occurring in *Populus deltoides* planks obtained through conventional sawing and dried at usual temperature have been compared with

those obtained by SDR process with high temperature drying and are reported in this paper.

Storage of logs

One of the major problems faced during storage of logs of Poplar in the timber yard is discolouration and decay in wood to fungus attack. Staining fungi cause mostly discolouration of the sapwood. The progress of staining fungi is very rapid and the entire Poplar sapwood may become stained in course of one to a few weeks. Though strength properties of stained wood mostly remain unaffected, such wood is not liked because of its unsightly appearance. To avoid this problem, prophylactic treatment of the logs should be undertaken as soon as log reaches the storage yard or at the felling site itself provided transportation of logs from felling site to storage yard is not done immediately.

The bark must first be removed completely for protective treatment before spraying thoroughly on all the surface with a 2.5 per cent water solution of sodium pentachlorophenate boric acid and borax mixed in the ratio of 0.5 : 1.1. the logs are then stacked on the ground under hygienic

conditions. It must be remembered that this treatment is effective only if it is undertaken immediately after felling and cross cutting into logs. Once infection occurs, it is difficult to control it through prophylactic treatment.

Seasoning behaviour

Earlier studies on air and kiln drying behaviour of *Populus deltoides* revealed that though it is not difficult to dry, the material is very prone to severe distortion. The reason for the tendency to warp is predominantly due to presence of residual longitudinal growth stresses (Sharma *et al.*, 1990). The major defects observed in air seasoning are bow, crook, honeycombing. In conventional kiln seasoning also, as per the conventional schedule, the species has shown severe bow, spring and twist. The value of degrade observed in one of the kiln drying experiments were recorded and are

presented in Table 1 along with permissible values to demonstrate the ineffectiveness of conventional seasoning method for this species.

In the conventional kiln drying, degrade in the form of bow, spring and cup was the most serious defect. Hardly any plank was free from warping degrade of one kind or the other. In addition several planks developed moderate to severe collapse. Planks free from collapse or having slight collapse belonged to outer positions in the log. However, a reconditioning treatment for 6 hours showed appreciable recovery in the collapse.

Wood processing by saw-dry-rip

To overcome this problem, the Forest Research Institute, Dehra Dun has now developed a new system of sawn wood manufacturing process known as Saw Dry

Table 1

Observed vs permissible degrade of different kinds over length of 125 cm during kiln drying*

Type of degrade	Extent of degrade & (No. of planks)				Permissible (mm)
	In sawing		After kiln drying		
Bow	7-8 mm	(2)	16 mm	(2)	8.00
	3-5 mm	(5)	8-11 mm	(6)	
	Nil	(5)	3 mm & below	(4)	
Spring	Not recorded		15-18 mm	(3)	10.00
			10-11 mm	(4)	
			3 mm & below	(5)	
Twist	Nil	(12)	20 mm	(1)	63.00
			10-12 mm	(5)	
			4-6 mm	(2)	
			4 mm & below	(4)	
Cup	Nil	(12)	4-5 mm	(3)	2.54
			2-5 mm	(2)	
			Nil	(7)	

*Estimated on proportional basis from permissible norms for 300 cm length.

Rip (SDR) (Pandey *et al.*, 1993). In this method first the logs are sawn in thick section slabs keeping the thickness of slabs equal to the width of desired ultimate planks. These slabs are then edged and are dried under high temperature drying as per schedule given below. The slabs thus dried are ripped into planks of desired width.

High temperature drying schedule :

Initial moisture content	: More than 50%
Dry bulb temperature	: 102°C
Wet bulb temperature	: 90°C
Duration	: 96 hours
Followed by reconditioning	
Dry bulb temperature	: 90°C
Wet bulb temperature	: 86°C
Duration	: 6 hours
Final moisture content	: 12-15%

When the material is dried at high temperature, it is theorised that the lignin, which naturally bonds fibres together is plasticized and the stressed fibres slip to a neutral or unstressed position. The lignin then rehardens and wood is stress free.

The comparative performance of drying by different methods is given in Table 2.

On the basis of above discussion it can therefore be concluded that SDR and high temperature combination is much better suited for the processing of *Populus deltoides* as the percentage of rejects were minimum due to warping.

The reasons which make SDR and high temperature combination successful for the degrade free seasoning of plantation grown *Populus deltoides* are due to the following facts.

1. Stress balanced by slab sawing
2. Wide planks restrain warp.
3. Drying stresses offset growth stresses.
4. Lignin plasticized at high temperature.

End uses

Improved method of sawing and seasoning of plantation grown *Populus deltoides* opened new areas for its use as solid wood, in addition to its conventional use in match, plywood, flush door, block board. This has enabled it to be commercially adopted for pencil making. The species possess all the requisite properties for pencil making after processing by an improved method. It has passed through all the pencil manufacturing operations and takes good printing, capping and excellent whittling properties. Studies conducted at FRI have also revealed that

Table 2

Comparative performance of drying by different methods

Air seasoning	Kiln seasoning	High temperature drying
25 mm thick planks 40-45 days	25 mm thick planks 6-7 days	100 mm thick slabs 4 days
Prone to severe distortion	28-57% rejection due to warp and honeycombing	5-8% rejection due to warp

the species possesses strength coefficients comparable to common packing woods and hence can be used for making packing cases. Due to its light colour, it is often preferred for furniture making. However, if required, suitable darkening can also be effected

through ammonia fumigation techniques developed at FRI. Recently door and window shutters have also been made from Poplar through various laminating, joining and glueing techniques to obtain improved strength and dimension stability.

SUMMARY

Plantation grown wood *Populus deltoides*, though presently available, possess problems in producing standard quality sawn and seasoned timber. Studies on air and conventional kiln drying behaviour revealed that though it is not difficult to dry, the material is prone to severe distortions like bow, crook and honeycombing. The reason for the tendency to warp is predominantly due to juvenile nature of wood and presence of residual growth stress. The major problem of this distortion degrade has been solved by adopting Saw Dry Rip method of sawing and high temperature seasoning. Recent improvements in processing have enabled this species to be commercially used for several value added products such as pencil making, doors and window shutters, light furnitures and for making quality packing cases etc. The details of the sawing and seasoning technology for Poplar are summarized in this paper.

अच्छी गुणवत्ता वाला चिरा और संशोधित प्रकाष्ठ उत्पादित करने के लिए *पोपुलस डेल्टायडिस* की

विशिष्टियाँ और विधायन

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सारांश

पोपुलस डेल्टायडिस रोपवनों से लकड़ी तो मिल रही है किन्तु प्रतिमानित गुणवत्ता वाला चिरा और संशोधित प्रकाष्ठ उत्पादित करने में समस्याएं हो रही हैं। वायु और पारम्परिक आपाक संशोधन करने के अध्ययनों से पता चलता है कि हालांकि इसे सुखाना कठिन नहीं है, इसकी लकड़ी में मुड़ने, मरोड़ खाने और शहद का छत्ता सा बन जाने जैसी विकृतियाँ आ जाने की प्रवृत्ति है। मरोड़ खाने की प्रवृत्ति का सर्वाधिक प्रधान कारण लकड़ी की बाल्य प्रकृति और उस पर बाद में पड़ने वाले वृद्धि दबाव होते हैं। इस विकृतिजन्य व्याघास वाली मुख्य समस्या का समाधान चिरान करने में आरे से शुष्क चिरान (सॉ ड्राई रिप) विधि और अधिक तापमान पर संशोधन करने से पा लिया गया है। इस प्रकाष्ठ जाति के विधायन में किए गए अधुनातन सुधारों ने इसकी लकड़ी को अनेक अधिमूल्यवान उत्पादों जैसे पेंसिलें बनाना, दरवाजों और खिड़कियों के पल्ले, हल्के उपस्कर तथा अधिक गुणवत्ता वाली माल भराई पेटियाँ आदि के लिए व्यापारिक स्तर पर उपयोग किया जाना संभव बना दिया है। पोपलर के चिरान और संशोधन प्रौद्योगिकी के व्योरो का सार इस अभिपत्र में दिया गया है।

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