Sawmilling Study of Pinus Pinaster Ait. (Landes Provenance) in Western Australia

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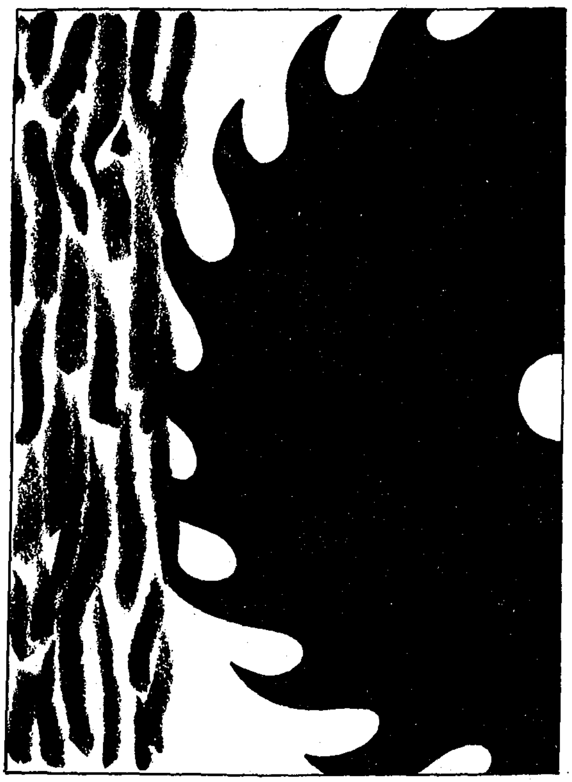

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SUMMARY

Small areas in the south-west of Western Australia were planted with the Landes provenance of *Pinus pinaster* Ait before 1942, after which the superior Leirian provenance was planted. The present study had the primary objective of assessing whether Landes material conformed to current pine sawlog specifications, and allowed economic sawmilling. A secondary objective was to assess the material's performance under a high temperature drying schedule developed for *P. radiata* D. Don.

The results indicated that insufficient silvicultural treatment in the *P. pinaster* plantations' early years had resulted in excessive defects, particularly knots. The relative importance of different defects is discussed. Dry dressed graded recoveries are given. High temperature seasoning was achieved satisfactorily using the standard *P. radiata* drying schedule.

INTRODUCTION

The major exotic pines grown in Western Australia are *Pinus radiata* D. Don and *P. pinaster* Ait. The areas planted to each species in 1984 were 30 000 ha and 27 000 ha respectively (Forests Department of Western Australia 1984).

The growth characteristics of *P. pinaster* were described by Hopkins (1960) and Perry and Hopkins (1967). There are four major provenances of the species: Leirian, Landes, Esterel and Corsican. The Landes provenance was the initial source of seed for Western Australian plantations, but provenance trials showed the Leirian is superior (Hopkins 1960). Leirian material has better volume production and acceptable stem taper, although it may be downgraded by high branch angle, poor stem form and forking in unselected stock. The Leirian provenance has been used for general planting since 1942, and a tree-breeding program commenced in 1957. Commercial quantities of improved seed have been produced since 1971.

Stands of Landes provenance are now over 40 years old, and are available for harvesting. Form is not good, and dead branches persist on the stem below the green crown. Limited pruning in the past accentuated the latter problem. It was considered necessary to assess whether this material could satisfy the Departmental marketing specifications for mill logs*.

The permitted defects in mill logs are as follows:

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*. A Department of Conservation and Land Management (formerly Forests Department, W.A.) schedule is issued with conditions of sale documents. Various categories of logs for sawmilling are sold - mill logs are those in excess of 20 cm small end diameter.

(1) dead knots up to three per whorl, with the biggest not exceeding 4 cm diameter on the greatest axis;

(2) individual dead knots not exceeding 6 cm diameter on the greatest axis;

(3) in logs 3 m and over not more than two whorls of cone holes in any 3-m length;

(4) in logs less than 3 m length not more than one whorl of cone holes;

(5) maximum sweep of 30 mm in any 2.1 m length.

Blue stain, abrupt changes in diameter, and massive knot whorls are not permitted.

The seasoning performance of Landes provenance material using high temperature drying also required assessing. In addition, as the final test of suitability of sawn material is compliance with Australian Standards grading rules, for structural or appearance grades, dry dressed graded recovery was assessed.

In brief, the present paper considers:

(1) suitability of current mill log specifications for the Landes provenance of *P. pinaster*;

(2) seasoning behaviour of the material;

(3) sawn graded recoveries of the material.

MATERIALS AND METHODS

The logs milled in the study came from Compartment 27 in Myalup Plantation, west of Harvey and about 150 km south of Perth. Myalup and the nearby McLarty Plantation are important for winter logging purposes when other areas are impractical to harvest.

The area of the study comprised 11.5 ha, planted in 1933 at 3.9 x 1.6 m spacing (12 ft x 5 ft). Fertilizing was a single application of superphosphate (110 g $tree^{-1}$) in 1944. All stems were low pruned to 2.1 m at age 17 years, but no high pruning was done. The first thinning was to 200 stems per hectare (s.p.h.) in 1957-8, and the second thinning to 100 s.p.h. was in 1965. The third thinning was to a basal area of 11.5 to 17.8 m^2 ha^{-1} in 1973-4, when 40 m^3 were removed as case logs*.

Material for this study came from clear felling in mid-1980. The compartment was separated into two areas by an east-west boundary line. The treatments were as follows:

Group 1 -logs conforming to the current mill log schedule (northern part)

Group 2 -logs conforming to the current mill log schedule (southern part)

Group 3 -logs from the southern part selected as having faults in excess of those permitted by the schedule. These included:

- more than three branches per whorl over 4 cm diameter
- branch angles less than 45°
- knot whorls less than 1 m apart
- dead knots greater than 6 cm diameter.

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*. A case log is a short saw log with a small end diameter of less than 20 cm.

Crown logs were therefore included. Each group was identified by end painting of logs. The volume logged was 782 m^3 of mill logs. In addition, 404 m^3 of particle board logs were removed, including logs from the northern part having excessive defects.

Milling

The logs were sawn at the Department of Conservation and Land Management's (formerly Forests Department's) research sawmill at Harvey. The initial breakdown of each log was by circular saw. Both boards and building scantling dimensions were cut. The objective was to back-saw wherever possible. The green sawn material was docked where necessary to remove sections with excessive wane. Sawing accuracy of 1 mm was considered acceptable. The dimensions required for the dressed graded product were 90 x 35 mm for scantling and "heart-in" studs, with 70 x 19 mm, 90 x 19 mm, or 140 x 19 mm for boards.

Seasoning

All pieces were stripped within 48 hours of sawing. High temperature drying of heart-in material was in accordance with requirements of RPAA Industry Standard No. 100 (Radiata Pine Association of Australia 1979). Using the oven-dried method, moisture contents of five specimens per bundle were measured prior to pre-steaming, then after seasoning and cooling.

Dressing and Grading

Each piece was square dressed, and scantling and studs given eased arrises. Visual grading was carried out to Australian Standards according to RPAA Grading Rules (Radiata Pine Association of Australia 1981). The reasons for downgrading or rejecting any piece were recorded. Grades separated were:

Structural - F5, F8 and F5 heart-in studs
Appearance - various dressed board grades.

The RPAA rules were used as both *P. pinaster* and *P. radiata* have the same strength group of SD6 and therefore the same defect limits defined for each stress grade apply to both species. Grading was by a single operator to avoid between-grader variations.

RESULTS

Treemarking indicated that only 70 per cent of logs in the compartment met the dimension requirements for mill logs but had defects larger than the permissable minimums.

The combined results for each parcel of logs are given in Table 1, and volumes lost in docking the sawn timber in Table 2.

TABLE 1

Effect of log quality on sawn graded recoveries (percentage of log volume)

Product	Lengths (m)	Mill log Schedule (Group 1)	Mill log Schedule (Group 2)	Defects exceeding mill log Schedule limits (Group 3)
		%	%	%
Scantling:				
F8	2.4-4.8	5.6	5.0	2.6
F5	1.2-2.1	2.4	2.6	4.0
F5	2.4-4.8	10.1	11.6	8.2
Heart-in (*a*)	2.4-3.0	4.6	3.6	3.3
Merchantable (*b*)	Varied	1.6	1.2	3.2
Boards:				
Standard		1.9	2.1	3.1
Merchantable (*b*)		0.4	0.7	1.2
Total		26.6	26.8	25.6

(*a*) Heart-in refers to timber with growth rings of less than 50 mm radius.

(*b*) Merchantable material is utilisable, but does not meet the standards of relevant grading rules (Radiata Pine Association of Australia 1981).

TABLE 2

Volumes lost in docking sawn timber
(percentage of log volume)

	Group 1	Group 2	Group 3
Structural:	2.7	1.9	3.2
Boards:	0.6	1.2	0.4
Total	3.3	3.1	3.6

The reasons for degrade as a percentage of total number of pieces graded in each log class are given in Table 3.

TABLE 3

Defects resulting in downgrading of sawn product
(percentage of total number of pieces)

Scantling	% defective		
Defect	Group 1	Group 2	Group 3
Large knots (green/dry)	11.8	17.0	42.6
Spike knots	3.2	4.2	0.4
Wane	3.1	3.6	2.0
Undersize	3.3	2.4	0.9
Twist	1.7	1.4	2.0
Splits	0.4	0.4	0.2
Pith	1.7	0.9	1.3
Heart checks	0.3	0.3	0.1
Resin bleed	0.2	0.2	0.2
Wind damage	0.1	0.1	0.1
TOTAL	25.8	30.5	49.8

TABLE 3 (cont.)

Boards

Defect	Group 1	Group 2	Group 3
Large knots (green/dry)	26.4	44.8	63.6
Wane	7.1	5.9	7.0
Undersize	1.6	2.2	3.3
Twist	0.3	0.2	0.1
Splits	0.3	0.1	-
Pith	-	0.2	0.3
Heart Checks	-	0.5	-
Resin bleed	0.1	0.5	0.7
Blue stain	0.8	1.8	-
Wind damage	-	0.1	-
TOTAL	36.6	56.3	75.0

DISCUSSION

Poor form and the profusion of both green and dry large limbs were the reason for the high percentage (30 per cent) of logs of mill log size but with defects greater than the permissable limit.

While economics of the operation are outside the scope of this paper, it should be noted that merchantable grade material has about half the value of sawn scantling and boards complying with the RPAA Grading Rules. The percentages of merchantable material were 2.0, 1.9 and 4.4 per cent respectively for the three groups (Table 1). Excluding these, the recoveries to graded material become 24.6, 24.9 and 21.2 per cent respectively. Group 3 material is therefore at an economic disadvantage.

Similar percentages were lost from each group in docking after seasoning and dressing the timber (Table 2). One major factor was that although boards were sawn in all lengths of log, no 4.8 m boards met the requirements for standard grade in the full length. The reason for this was that boards were sawn as recovery sizes only, coming from the bark face, and therefore carrying excessive dry knots and wane. The only exceptions were 3.6 m boards sawn to include the pith, which was necessary as pith cannot be included in visually graded structural grades except for heart-in studs 2.4 m, 2.7 m and 3.0 m lengths.

The high temperature seasoning of the Landes material, following the requirements of the RPAA Industry Standard 100-1979 (Radiata Pine Association of Australia 1979), produced satisfactory results. The percentage of pieces with twist were small for each group, as will be discussed later. The overall indication is that accuracy of sawing was satisfactory and that this provenance of *P. pinaster* could be satisfactorily seasoned using the schedule developed for *P. radiata*.

Defects or characteristics that affect the strength of scantling and the appearance of boards are more common in softwoods than in hardwoods. In general, knots are the major reason for degrade, as they reduce the strength of a piece of timber, mainly because of the sloping grain around them. The knots are assessed according to size and position in the piece. In the RPAA Grading Rules (Radiata Pine Association of Australia 1981) dry knots encased with bark for more than half their perimeter are rejected, and totally encased dry knots must not exceed one knot of 20 mm diameter in any 4 m board length. These knots occur when pines are either not pruned or else dry pruned (i.e. dead branches removed), which happened regularly in past decades before pruning became a feature of forest management.

In standard board grades large green knots are acceptable provided they do not exceed half the width of the sawn face, and do not contain seasoning checks larger than 2 mm.

Overall, knot size accounted for about 15 to 20 per cent of the rejects in structural timber cut from mill logs, but more than 40 per cent in that cut from logs with defects larger than the mill log schedule. The presence of green and dry knots accounted for up to 45 per cent of rejects in boards cut from butt and mid-length logs (Groups 1, 2) and 64 per cent in that cut from crown logs (Group 3). In this study, therefore, percentages of pieces reduced by knots indicated the importance of correct silvicultural treatments. It is difficult to explain the differences between Group 1 and Group 2, which were based on a geographic separation.

Wane up to one quarter the width and one quarter the thickness is permitted in structural grades. This allowed a marginal improvement in sawn graded recovery compared with a more restrictive requirement. Consquently wane accounted for about 3 per cent of rejects from logs complying with the schedule and 2 per cent in other logs, so it is not of any great practical significance (Table 3).

This defect is really an indication of sawing methods, where careful cutting minimizes the amount of wane, but reduces sawn recovery.

In board grades, wane is more restrictive, and is only permitted on the back of the graded piece up to 6 mm deep in thickness and up to 12 mm in the width. The percentage of rejected material increased from about 3 per cent in scantling to about 7 per cent in boards (Table 3).

In this study, undersized material accounted for an average 2.2 per cent rejection in boards. This percentage would be less with the better equipment in a more modern sawmill.

Circular saws tend to blunt after a few hours cutting, and hence to overheat. With overheating the saw may wander, and cut oversize or undersize pieces. In the seasoning stack oversized pieces carry both the weight of the timber above them and the restraining weights, while undersized pieces have room to twist.

These twisted pieces cannot be improved by dressing. This characteristic was common in 'heart-in' material which contains juvenile wood with short tracheids, a high micellar angle in the S2 layer of the cell wall, and high spiral grain (Hillis 1975). High temperature drying under restraint has practically eliminated this problem, provided sawing accuracy has been satisfactory.

Pith is not permitted in visual stress grades, with the exception of heart-in studs. Wandering pith is common in young *P. pinaster* of Landes provenance, so is difficult to avoid. If log lengths are not suitable for required dimensions of heart-in studs some volume can be lost. Rejects were 1.7, 0.9 and 1.3 per cent respectively. With correct sawing accuracy and following the requirements of high temperature seasoning (Radiata Pine Association of Australia 1979), this material can be utilised efficiently, and losses are negligible. In boards, pith is limited in width and length up to 450 mm by 10 mm wide, or 500 mm aggregate on the face. The losses of 0.2 per cent and 0.3 per cent were negligible.

ACKNOWLEDGEMENTS

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