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GRADED RECOVERIES OF TIMBER MILLED FROM RADIATA PINE LOGS FROM DIFFERENT THINNING TREATMENTS

G.R. Siemon and D.J. Donnelly

May 1989
W.U.R.C. Technical Report
Limited Distribution

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SUMMARY

The management of radiata pine (*Pinus radiata* D.Don) plantations in Western Australia is based on a 30-year rotation length. This sawmilling study of 23-year-old radiata pine harvested from three different thinning treatments (heavy thinning to 200 sph at age 11 years, light thinning to 500 sph at 18 years, and unthinned), showed that heavy thinning considerably increased the proportion of sawlogs to particleboard logs. Sawlog volumes were 72, 19, and 12 per cent of the total volume removed from the three treatments (46, 149 and 191m^3/ha respectively).

The sawn graded recoveries of structural and appearance grade timber from the treatments were 39, 30 and 32 per cent respectively. Visual stress grading showed that the percentage of sawn timber making F5 stress grade or better was 56, 46 and 54 per cent respectively. The heavy thinning treatment produced a higher proportion of F8 material than the light thinning, but less than the unthinned. In appearance grades, board production was 23, 29, and 35 per cent respectively. Timber quality tended to be similar in the three treatments, although the proportions of structural and appearance grades varied.

INTRODUCTION

In 1970 the radiata pine *(Pinus radiata* D.Don) resource in Western Australia was limited and there was a need to promote fast growth in plantations. Consequently, the major objective for pine plantations in Western Australia was defined as the production of high quality sawlogs in the fastest possible time, the silvicultural regime initiated to achieve fast growth was termed 'Silviculture 70' (Forests Department of Western Australia 1972). The main features of Silviculture 70 were the selection for pruning crop trees (200 sph) at age 7 years, with a production thinning to remove all other trees at age 11 years, and estimated rotation age of 30 years. The schedule was modified slightly to 'Silviculture 74' (McKinnell 1981).

Thinning trials were set up to assess volume production under different thinning regimes. These included a trial on non-commercial thinning in *P. radiata* which received a treatment closely resembling Silviculture 70. Unfortunately this trial was damaged by cyclonic winds (Cyclone 'Alby') in April 1978, which restricted its usefulness for thinning research.

Several publications from New Zealand (e.g. Fenton 1973,1977; Fenton *et al.* 1971; Park 1980) have referred to the milling of boards, and Fenton (1970) discussed milling of structural timber from fast-grown *P. radiata*. The latter study provided information relevant to New Zealand conditions, which indicated graded recoveries achievable with short rotation length. It discussed the rationale of producing specific end products in short rotations, compared to keeping options open, which requires longer rotations but gives more market flexibility. However, the Forests Department needed specific data on recoveries of structural timber from stands grown under local conditions, managed using schedules like Silviculture 70.

The cyclone damaged non-commercial thinning trial, although now unsuitable for thinning research, was considered a useful source of material for a sawmilling study in which sawn graded recoveries from fast-grown and conventionally-grown pine could be compared. All wind damaged plots were excluded from the sawmilling study, except for some unthinned.

MATERIALS AND METHODS

The sawmilling study was carried out in 1983, at the Forests Department (now Department of Conservation and Land Management) pine mill at Harvey, 140km south of Perth.

The source of material was the non-commercial thinning trial, located in a 1960 planting (2.75m x 2.75m spacing), in Bussell's Compartment A3 in the Collie Hills Plantation. The treatments had eight replications, randomly allocated, with plot size 0.08 ha.

Heavy thinning	-non commercially thinned at age 6 to 750 sph, commercially thinned at age 11 to 200 sph, and at age 18 to 125 sph.
Light thinning	-commercially thinned at age 11 to 750 sph, and at age 18 to 500 sph.
Unthinned	-unthinned to 30 years (actual stocking 1200 sph)

Cyclone "Alby" in April 1978 damaged 12 of the 24 plots, including all unthinned and three of the lightly thinned plots. Trees in the heavily thinned plots were not damaged by bending or breaking (there was little uprooting in the plantations because of dry soil conditions), because the more open-grown trees had greater stability than trees with a higher height-diameter ratio in conventional plantations. These heavily thinned plots were taken from 200 sph to 125 sph in June 1978.

The damaged thinning trial was considered a useful source of material for a sawmilling study, extracting both sawlogs and particleboard logs. Inspection indicated that sufficient undamaged material remained in three unthinned plots, five lightly thinned plots, and all eight heavily thinned plots to enable the sawmilling study to be carried out. Damage to trees in the other plots was too severe to provide representative material for a sawmilling study.

Each tree in the selected plots was measured when the plots were marked for thinning. The stocking was reduced from 125 sph to 100 sph in the heavily thinned plots by removing two trees per plot, from 500 sph to 250 sph in the lightly thinned by removing 20 trees, and from 1200 sph to 350 sph in the unthinned plots by removing about 70 trees.

Logging was done in May 1983. After felling, the selected trees were docked into sawlogs and particleboard logs. A sawlog was defined as having a minimal small end diameter under bark of 20 cm, with no excessively large knot whorls, and a maximum sweep of 30 mm in any 2.1 m of length. Particleboard logs had small end diameter between 10 cm and 20 cm, or excessive defect.

Both ends of each sawlog from each thinning treatment were painted to identify that treatment at the sawmill. The logs were grouped by thinning treatment because the small sample size (2 trees/plot) from the heavily thinned plots would invalidate statistical analysis. In addition, it was impractical with operational constraints at that time to maintain identification of timber sawn from individual logs in the sawmill.

Conversion and Grading

The logs were milled at Harvey in August 1983, after storage under water sprays for eight weeks, producing both structural and appearance grades. The cutting pattern used was intended to produce at least 20 per cent of appearance grades. After seasoning and dressing, boards had dimensions of 70 x 19 mm or 90 x 19 mm, and structural timber 70 x 45 mm or 90 x 35 mm respectively.

The timber was seasoned using R.P.A.A. Industry Standard 100-1979 (Radiata Pine Association of Australia 1979), then dressed to the respective finished dimensions. Grading of the timber was done using R.P.A.A. Grading Rules (Radiata Pine Association of Australia (1981).

RESULTS AND DISCUSSION

The heavy thinning treatment produced a high proportion of 4.8 m logs compared to the other two treatments (Table 1). Mean small end diameter in the three treatments ranged from 332 mm in the heavy thinning treatment to 237 mm in the unthinned, and mean log volumes ranged from 0.408 m^3 to 0.166 m^3 in those treatments. Mill logs comprised 71.9, 19.2 and 11.9 per cent respectively of the total volume removed in the heavy, light and unthinned treatments (46, 149 and 191 m^3/ha respectively).

Table 1. Log volumes removed from each thinning treatment

Thinning Treatment	No. logs	Length (m)	Small end diameter (mm)		Volume (m^3)		Mill log volume (m^3/ha)	P/board volume (m^3/ha)
			Mean	SD	Mean	SD		
Heavy	7	2.4	290	42	.176	052		
	10	3.6	315	50	.317	0.99		
	34	4.8	331	52	.483	.146		
	51	-	332	51	.408	.171	33.02	12.89
Light	22	2.4	251	45	.130	.039		
	25	3.6	236	34	.180	.050		
	15	4.8	247	36	.272	.091		
	62	-	244	39	.184	.080	28.53	120.35
Unthinned	15	2.4	224	11	.106	.011		
	14	3.6	238	34	.190	.055		
	4	4.8	266	23	.303	.057		
	33	-	237	28	.166	.077	22.75	68.38

Graded recoveries for boards and structural timber are given in Table 2. The cutting pattern was designed to produce at least 20 per cent boards, based on existing market requirements for the Departmental sawmill at that time. The board recoveries for heavy thinning, light thinning and unthinned treatments were 23.3, 28.6 and 34.5 per cent respectively (Table 2).

Table 2. Graded recoveries (per cent) from logs from three different thinning treatments.

Product	Grade	Treatment Heavy Thinning	Light thinning	Unthinned
Boards	Standard	17.4	20.8	30.3
(70x19 90 x 35)	Dressed merch	5.9	7.8	4.2
Structural	Merch	20.9	25.9	11.4
(70x45 90 x 35)	F5	39.4	38.0	34.6
	F8	16.4	7.5	19.5

The thinned treatments produced about twice as much merchantable grade of structural timber as the unthinned treatment did. The major defect that reduced the recovery from the unthinned material was knot size. The F5 and F8 production were similar in the heavy thinning and unthinned, with the light thinning treatment producing less. The percentage of F8 material was substantially higher in the heavy thinning treatment that in the light thinning, but less than in the unthinned. In general, the data in Table 2 indicated a reasonable mix of grades from each treatment.

However, the recoveries when related to log volumes show substantial advantages for the heavy thinning treatment (Table 3). With mill log volume, that treatment produced 38.8 per cent sawn dressed timber, 8.7 per cent more than the light thinning and 6.6 per cent more than the unthinned treatment. Comparing sawn dressed volume with total volume showed an even greater difference, with recoveries for the three treatments of 27.9, 5.8 and 3.8 per cent respectively.

Table 3. Recovery percentage from logs from different thinning treatments, combining structural and appearance grades.

Treatment	Mean S.E.D. (mm)	Sawn dressed vs. mill log volume (%)	Sawn dressed vs. total volume (%)
Heavy thinning	332	38.8	27.9
Light thinning	244	30.1	5.8
Unthinned	237	32.2	3.8

This sawmilling study indicated that silvicultural treatments using heavy thinning contribute substantially to the Departmental objective of producing radiata pine sawlogs in a 30-year rotation, to produce mainly structural timber. The high proportion of sawlogs to particleboard logs produced was in accord with current market predictions, although the demand for residue logs can change, and hence influence the economic situation. Obviously economics must be taken into account in deciding management priorities. The data confirmed the higher recoveries achievable from larger diameter sawlogs, but with the more modern sawmilling equipment now installed in the Departmental sawmill, recoveries would be even higher in sawlogs of any size.

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