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THE EFFECT OF THINNING DAMAGE TO CROP TREES

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INTRODUCTION

Damage to crop trees during production thinning operations has always been a matter of concern to forest managers. This can be caused by :

- thinnings "brushing" crop trees during felling
- the blade, frame, tyres or tracks of the extraction machine
- the mainrope
- the thinnings during extraction

Damage will involve: removal of the bark, death of the thin cambial layer and often damage to the underlying woody tissue. The exposure of this tissue can lead to infection by insects or fungi, as well as loss of growth.

Radiata pine is a remarkably resilient species. It responds to this type of damage by rapidly exuding a protective layer of resin to seal the surface wound. Previous investigations have suggested that thinning damage is not a major problem in terms of its effect of wood quality. However, forest managers have tried to minimise its effect by prescribing acceptable levels of thinning damage. This is particularly important in pruned stands where the value of the butt log may exceed the value of the logs from the rest of the tree (Somerville, et al, 1985).

Large scale clearfelling of high-pruned, second-rotation stands of radiata pine in Kaingaroa Forest commenced in 1986. This Technical Release describes a survey on the effect of thinning damage on the wood quality of crop trees.

STAND DESCRIPTION AND STUDY METHOD

Compartment 1068 was planted in 1947 and thinned with small tractors and skidders to approximately 320 stems per hectare at age 20 years.

Transects were established to determine the number and size of damaged trees in the stand. During felling, 100 trees with signs of old bark damage were sampled. The damaged sections were removed, sawn up, measured and photographed to record the extent of the damage.

TABLE 1 : STAND DETAILS

Age	*29 years*
Age when production thinned	*20 years*
Stocking before thinning	*1000 stems per hectare (estimated)*
Stocking after thinning	*215 stems per hectare (range 183 - 250 stems per hectare)*
Incidence of damage	*37% of crop trees (range 27 - 45%)*
Mean dbh	*55 cm*
Merchantable volume	*600 m^3 per hectare (estimated)*
Merchantable volume per tree	*2.9 m^3 (estimated)*
Damage types	*Resin streaks, staining, bark pockets, soft rot, insect attack*

RESULTS

TABLE 2 : DAMAGE TYPES

	DAMAGE COMMENCING AT STUMP LEVEL	DAMAGE ONLY ABOVE STUMP LEVEL
Frequency of damage	48 stems/ha	32 stems/ha
Location of damage (above ground level)	53 cm (range 18 - 117 cm)	60 cm (range 11 - 795 cm)
Stump height	18 cm	16 cm
Direct volume loss	0.17 m^3 per tree 8.1 m^3 per hectare	0.14 m^3 per tree 4.5 m^3 per hectare

TABLE 3 : VOLUME AND VALUE LOSS

Total volume lost	12.6 m^3/ha
Volume left on cutover/dock on skids	10.6 m^3/ha
Volume utilised as pulp	2.0 m^3/ha
Value lost* (at peeler prices of \$80.00 per m^3)	\$1,110 per hectare
(at sawlog prices of \$42.00 per m^3)	\$505 per hectare
* Allows for a credit of 2 m^3 of pulp at \$12.29 per m^3	

DISCUSSION

Figure 1 - Damage caused by falling tree

The stocking within the stand was variable and some areas appear not to have been thinned. Sampling was restricted to the thinned areas. The thinning-related damage appeared to originate from two main causes :

- trees brushed by falling trees (Figure 1)
- machinery damage to the base of the trees (Figure 2).

The immediate result of this damage was staining and resin build up. The cambium then occluded by growing in from the sides, leaving a pocket of rock-hard resin and usually some encased bark. Where the damaged area was restricted in size, occlusion by the surrounding tissue would be rapid and there would be little sign on the mature trees (Figure 3).

Figure 2 - Damage caused by extraction machine

Figure 3 - Occlusion scar covering thinning damage

Larger areas of damage remained visible where damage occurred to the underlying tissue. The effect was often substantial (Figure 4).

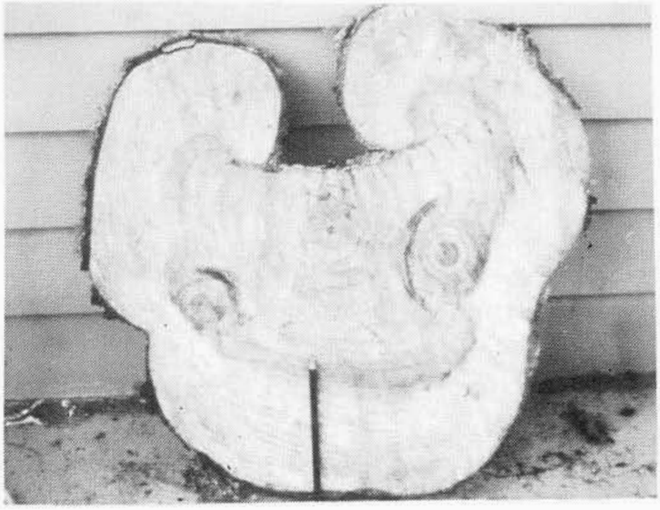

Figure 4 - Cross section of log showing effect of severe bark damage

Soft rot was present in 15% of the cases (Figure 5). However, it did not appear to be related to the degree or type of damage. This is probably due to the season in which thinning was carried out. Infection by soft rot fungi is most likely to occur during wet, warm weather (late summer), particularly after drought. Insect damage was limited and occurred only in badly damaged trees. In most cases, damage did not extend far beyond the exposed surface (10 cms on average), but in severe cases extended up to 67 cm up the stem.

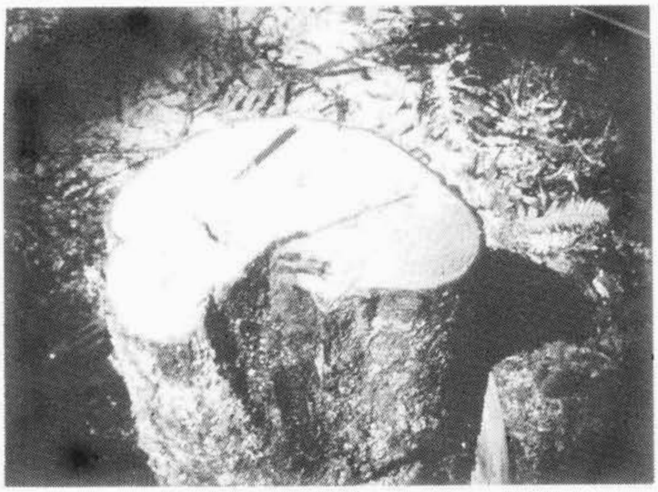

Figure 5 - Rot on site of severe thinning damage

There was also some evidence of damage occurring to the young trees (age 4 to 5 years). There was no record of animal damage in the stand records, although it was known that deer numbers were high at this time.

Value loss was calculated from the volume affected and their stumpage value at current peeler and L1[1] sawlog prices. A credit was allowed for the small volume of pulpwood recovered. Value loss was estimated to be in the region of $500 - $1,100 per hectare. This figure is conservative as the effect on the rest of the log (i.e. through downgrading) was not considered (Twaddle, in press). For instance, the remaining length of pruned butt log would sometimes be too short to make a veneer log and would become a sawlog with a subsequent reduction in value. If damage was reduced from 37% to 10% of crop trees, value loss would reduce from $500 - $1,1000/ha to $160 - $350/ha.

In present-day thinning operations with widespread use of Bell Loggers to bunch thinnings, stump-level damage could well reduce. But machine damage from swinging booms, tyre chains and machine counterweights could well increase the incidence and severity of damage on the lower stem. This would cause a substantial increase in the effect of damage on the butt log.

It is common for substantial premiums to be paid for pruned peelers and sawlogs. Undetected damage (as a result of occlusion) can cause significant degrade. Buyers who regularly receive logs with a proportion of damage will rapidly lose faith in the quality of the product and either reject the defective logs or pay a lower price for the product. They will eventually take their custom elsewhere if the problem persists.

Forest managers can minimise damage by :

- suitable marking to recognise extraction tracks and predominant lean
- insisting on the use of the appropriate size of machine
- restriction of production thinning to easy terrain and to stands with low residual stockings
- specification of acceptable levels of damage
- quality control systems that provide incentives for good performers and penalties for poor performers.

CONCLUSION

It is concluded that forest managers would be prudent to maintain tight controls on production thinning operations to minimise damage to final crop trees.

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Twaddle, A. (in press) : "Pruned Logs - How Well Can We Find Them", N.Z. Forestry.

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[1] L1 logs are reasonably straight large diameter sawlogs with a small-end diameter greater than 40 cm and a maximum branch size of 14 cm (Whiteside and Manley, 1985).

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