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HOW TO REDUCE FELLING RELATED BUTT DAMAGE

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INTRODUCTION

About 30% of the value loss that occurs during felling (i.e. about 3% overall) can be linked to the loss of potential log volume in the stump. Value savings can be easily gained by keeping stump heights as low as possible and using felling techniques which reduce the incidence of butt-pull, side slabbing, and other forms of butt damage (Fig. 1) (Ref. 1).

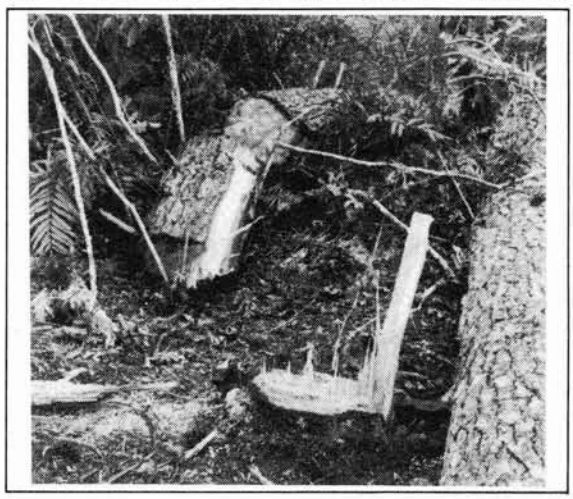

Fig. 1 - Side-slabbing and butt-pull can cause considerable loss of valuable timber.

Studies carried out by the Forest Research Institute (F.R.I.) over the past three years have recorded a great range in the incidence (11% to 63%) and length (10 to 250 cm) of butt damage occurring in Bay of Plenty logging operations (Ref. 2 and 3). It was obvious that the skill of the fallers and the sawcuts made had a large effect on butt damage.

In early 1982, some of the staff at N.Z. Forest Products Limited (N.Z.F.P.) were concerned about the amount of stumpwood being lost during felling operations. A small trial was therefore organised to see if this loss of stumpwood could be reduced. A modified side-cut method of falling was tried and early indications were that the modified method would save N.Z.F.P.in the order of 50 000 m^3 of wood per year. Side-cut falling or side-notching has been recommended in American literature as a means of reducing splitting and other forms of butt damage (Ref. 4).

In mid-1983 the Industrial Engineering Department of N.Z.F.P. and F.R.I. re-examined the modified felling method on an operational scale to assess volume and value savings and the effect on overall logging costs. This report briefly summarises the findings of the latter study and compares the results with conventional felling in stands of similar size.

Ref. 1 "Value Savings from Alternative Felling Patterns on Steep Country", Murphy, G., LIRA Report Vol. 7 No. 8, 1982.

Ref. 2 "Directional Felling Second Crop P. Radiata on Steep Country", Murphy G. & Gaskin, J. , LIRA Report Vol. 7 No. 1, 1982.

Ref. 3 "Felling Breakage and Stump Heights of a Pinus Radiata Stand in Tairua State Forest", Murphy, G., New Zealand Forest Service, FRI Bulletin 1984 (in press).

Ref. 4 "Timber Cutting Practices", Conway, S. Millar Freeman Publications, San Francisco, 2nd edition, 1973.

Side Cut Falling Method

The side-cut falling method is similar to the conventional method except that after making a scarf and prior to making a back-cut, two diagonal side-cuts on either side of the stump are made from the front.* The back-cut is also made slightly higher than normal. Figure 2 gives a plan of the order of cuts and Figure 3 gives an oblique view of a stump which has been cut in this manner. Diagonal side-cuts are better than horizontal side-cuts (which do the same job) since they are easier cuts to make (operator in an upright position) and the holding wood is less likely to be overcut.

Unless the faller can see that the butt of a tree is not of peeler or sawlog grades, all trees should be felled by the side-cut felled method.

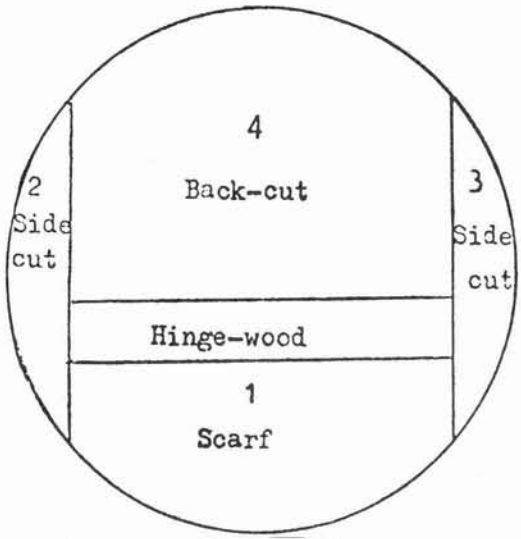

Fig. 2 - Plan showing order of cuts

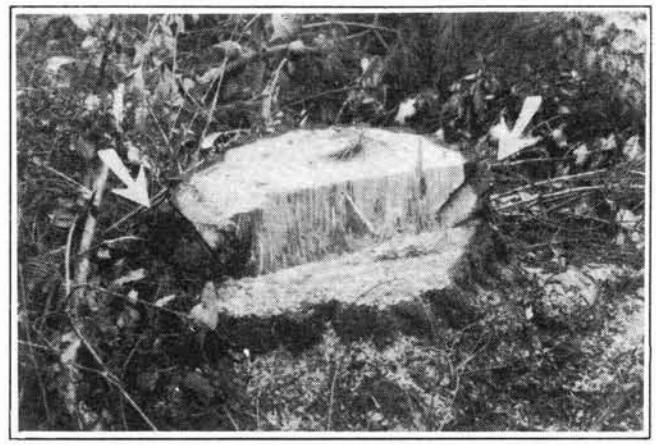

Fig. 3 - Oblique view of stump cut by side-cut method. Diagonal side-cuts are indicated by arrows

Value Maximisation and Felling Studies

Two studies were undertaken by the F.R.I. Harvest Planning Group in 1983 to investigate the ability of skid workers to maximise the value of each stem during log-making on the skid site. One study area was felled by the conventional method and one by the side-cut method. Felling was carried out by different people in the two study areas. Each stem was measured in detail (after felling but before extraction) for quality and dimension characteristics, including butt damage and stump heights. Both study areas had similar tree size (approximately 3 m^3) although the stocking was slightly lower in the side-cut felled stand (Table 1).

In the conventionally felled area, slopes averaged 18° and were 40 to 60 m long. The trees were extracted in tree-length form by a Caterpillar D7 tractor and arch. The side-cut felled area had flat slopes (2°) of 75 m average length. It was also extracted in tree-length form by a Caterpillar D6 tractor and arch.

Table 1 - Stand Characteristics

	Conventionally felled	Side-cut felled
Species	Pinus radiata	Pinus radiata
Stand age (years)	48	30
Treatment	Various portions thinned from ages 29 to 36	Production thinned at age 11 and 19. Four pruning lifts up to 10 m by age 11
Mean tree height (m)	41.0	42.0
Mean tree DBHOB (cm)	53.9	53.1
Live stocking (stems/ha)	271	211

* Although not tested in this study, operational staff at N.Z.F.P. believe that there is less slabbing if side-cuts are put in from the front rather than the back since the faller can see the scarf better.

Although log specifications differed slightly between the two studies, maximising the amount of high value wood (i.e. peelers) was one of the main targets. Any butt damage was likely to seriously affect the amount of peeler grade material cut.

The sample sizes were 350 trees and 298 trees for the conventionally felled and side-cut felled areas respectively.

RESULTS

Incidence and Length Of Butt Damage

In the conventionally felled area, one-third of the stems had butt damage greater than the arbitrary minimum length of 20 cm above the back-cut. Butt damage, particularly slabbing and splitting, was substantially reduced in the side-cut felled area. This is attributed to the felling method (Table 2).

When butt damage did occur in side-cut felled trees, the average length of the damage (except for splitting) was also significantly less than for trees felled conventionally (Table 3).

Table 2

	Damage incidence (% of total trees felled)	
	Conventional	Side-cut
Slabbing	15	6
Butt pull	6	8
Splitting	13	1
Total	34	15

Table 3

	Average length of damage (cm)	
	Conventional	Side-cut
Slabbing	94 (54)	46 (34)
Butt-pull	41 (15)	28 (10)
Splitting	63 (33)	63 (47)

Note : The figures in parentheses are standard deviations (i.e. 95% of results would be expected to fall within ±2 standard deviations of the average).

Stump Height

The fallers in the side-cut felled area were asked to make their back-cut higher (up to 15 cm) than they normally would to see if this would reduce the incidence and length of butt-pull. The average stump heights in the two study areas reflect this, although there is not 15 cm difference between the two - "conventional" area average 22 cm, "side-cut" area 28 cm. It was expected that, with the higher back-cut, holding wood would be

pulled from the stump rather than from the butt log. Butt-pull below 20 cm in length was not recorded in either study. It appears, however, that raising the back-cut slightly will reduce the length of butt-pull but not the incidence. A more detailed study on butt-pull alone would have to be carried out to see if savings gained by reducing butt-pull are not offset by value losses through having higher stumps.

It appears that following-up the back-cut, i.e. continuing cutting as the tree falls, would also produce the desired result of reducing butt-pull. However, this can be a dangerous practice, and is not recommended.

Felling Costs

The fallers in the side-cut felled area were observed and timed while a total of 154 trees were felled and trimmed. A comparison of the data collected from the side-cut felled area with other stands of similar characteristics indicated that the use of side-cuts increased the average fall and trim time by 2.8%. This is for a two-man falling team consisting of one faller plus an observer. Based on the production rates achieved and current labour costs, this represents only a $0.10 per tree rise in logging costs.

Volume and Value Savings

Based on the reduction in the incidence and length of butt damage, an average saving of 0.045 m^3 per tree, or about 10 m^3 per hectare by using the side-cut falling method was calculated. This 10 m^3/ha is generally of the more valuable peeler or sawlog grades.

Using the AVIS computer program developed at F.R.I. (Ref. 5), we were able to compute the difference in value for undamaged and butt damaged stems. For the log price ratios we were using (pulp : sawlog : peeler = 1 : 5½ : 8½) the value loss caused by butt damage, for damaged trees only, was found to be about 2.5%. The savings, through the reduction in the incidence of butt damage by using the side-cut falling method, were calculated to be about a half a percent of the stand's overall value. Although half a percent does not sound much, for most stands this would more than compensate for the increased felling costs.

CONCLUSIONS

For trees of about 3 m^3 average stem size, we found that the side-cut falling method would help to reduce both the incidence and the length of butt damage which results in normal felling operations. The volume and value savings resulting from using the modified method would more than compensate for the increased felling costs. Although other people using the modified side-cut falling method will almost certainly find volume and value savings which vary from those identified in this paper (because of such factors as different tree size, market constraints, and log values), the authors still believe the side-cut method is a viable option for reducing butt damage in radiata pine.

Ref. 5 "A Method to Assess Log Value Loss Caused by Cross-cutting Practice on the Skidsite", Geerts, J. & Twaddle, A.A., N.Z. Journal of Forestry 1984 (in press).

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