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DELIMBING RADIATA PINE WITH THE HUNT PROCESSOR

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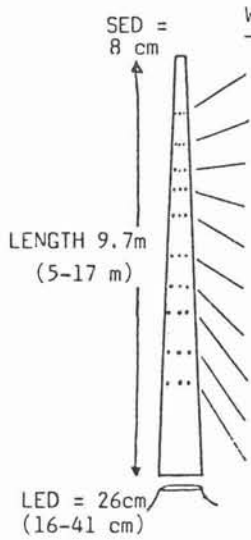
INTRODUCTION

The Hunt log processor (Ref. 1), a New Zealand-built machine, has proven successful for delimbing Ponderosa pine (Ref. 2). To further test the Hunt processor, a trial was conducted using the machine to delimb, crosscut, and stack young radiata pine. This Report describes the machine's ability to delimb, its potential productivity, and the cost to process radiata pine.

ACKNOWLEDGEMENTS

LIRA wishes to acknowledge S. & R. Hunt Contractors for supplying the machinery and manpower to conduct the trial. LIRA also acknowledges the assistance of the New Zealand Forest Service, Hanmer State Forest Park, and Canterbury Timber Products Limited.

THE TRIAL



WHORL	NO. OF BRANCHES PER WHORL MEDIAN	RANGE	BRANCH SIZE (cm) MEDIAN	RANGE
10	6	(3-8)	2	(1-5)
9	5	(3-8)	2	(1-7)
8	5	(2-8)	2	(1-5)
7	5	(3-12)	2	(1-6)
6	5	(2-11)	2	(1-6)
5	5	(2-10)	2	(1-8)
4	6	(2-10)	2	(1-5)
3	5	(2-10)	2	(1-7)
2	7	(3-12)	3	(1-5)
1	6	(3-8)	3	(1-6)

TOTAL PER TREE - 55 branches (34-144 branches)

TYPICAL BRANCH ANGLE = 60° (30° - 90°)

Figure 1 - Stem and branch characteristics of typical or median tree delimbed during the trial

The study was carried out in 13 year old radiata pine, planted under 80 year old European larch (60 spha) to a stocking to 1200 sph in Hanmer State Forest Park. In 1978, the stand was thinned to waste down to 666 sph and in 1979 parts of the stand were low pruned. The stand could be described as average in terms of branch size for radiata thinnings.

100 trees, ranging from 14-40 cm dbh, were selected and marked. The trees were then felled and skidded an average of 100 metres to the landing. Drag size was kept small (less than three trees) to reduce branch breakage. At the landing, 30 trees, representing the range of tree sizes, were selected, labelled, and every branch was measured. The remaining 70 trees were labelled and the l.e.d., s.e.d., merchantable length, and the number of whorls were measured. The typical or median tree is described in Figure 1.

Ref. 1 Hunt, B. "Log Processor and Stacker", LIRA Technical Release, Vol. 5 No. 5 1983

Ref. 2 Gleason, A.P. "Mechanised Delimbing in Conjunction with a Hauler", LIRA Report Vol. 9 No. 7 1984.

THE MACHINE

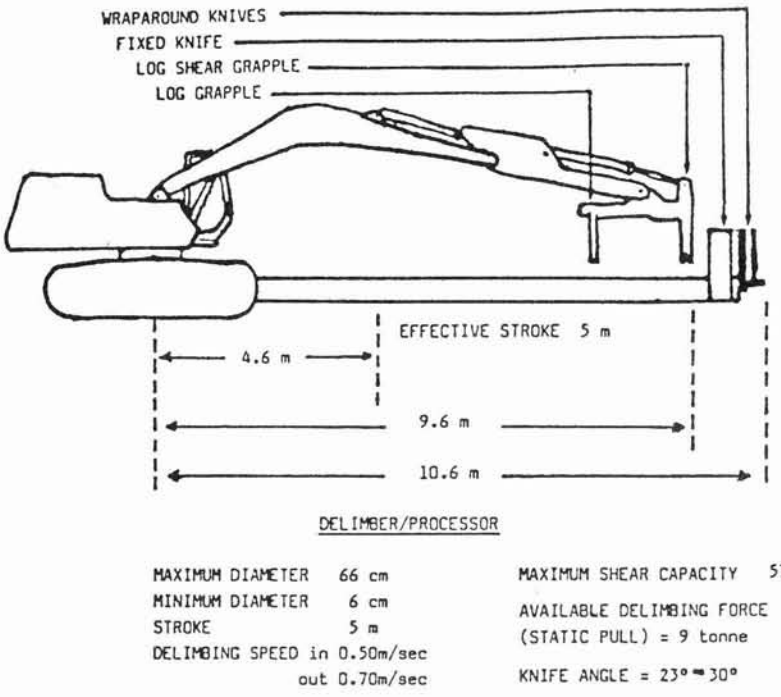


Figure 2 - Hunt log processor specifications

The Hunt log processor is an attachment to an International 640 HD excavator (90 kW). The excavator has an eight metre beam, which holds the delimbing knives. A log grapple and shear head is mounted to the end of the excavator's stick boom in place of the bucket (see Figure 2). Trees are picked up by the shearing head and branches are removed as the trees are pulled past the knives by the crowding stroke of the excavator. Multiple delimbing passes can be done by pushing and pulling the tree past the knives. The tree is then crosscut into 3-5 m log lengths, stockpiled and the process repeated. There is no facility for topping, so the final log is stockpiled with the top, for later removal by chainsaw.

PRODUCTIVITY

The 100 trees had been skidded and fleeted into four piles. The log processor delimbed, crosscut, and stockpiled the logs. A skidder was used to remove the accumulated slash once every fifteen trees. The average volume per tree was .27 m^3 (range .07 - .63 m^3/tree). There were 182 logs produced, for an average of 1.8 logs per tree. Time studies were conducted during the processing of the trees, and the average cycle time is shown below :

Table 1 - Delimbing cycle times

Element	Time per tree (min)	% of cycle
Acquire	.16	13 %
Load delimber	.14	11 %
Delimb*	.62	50 %
Crosscut **	.06	5 %
Stockpile *	.26	21 %
Total	1.24 min. Range (0.58-2.13 min)	

* Delimb and stockpile occurred an average of 1.8 times per tree. During delimbing there was an average of 2.7 strokes per log.

** Crosscut occurred an average of .9 times per tree.

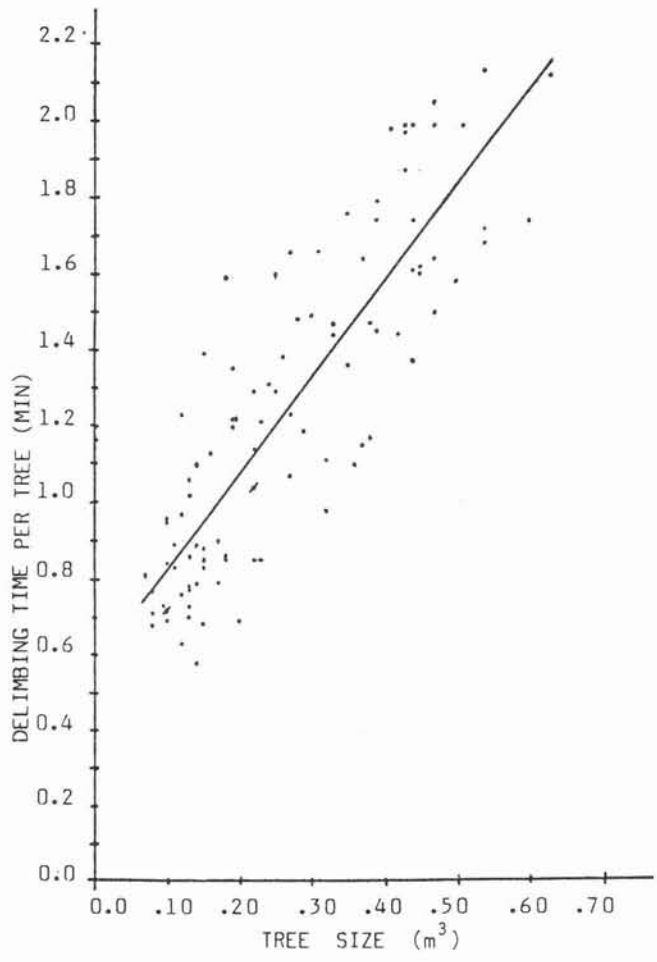


Figure 3 - The relationship between delimbing time per tree and tree size

The average delimbing time per tree of 1.24 min. had an expected range (95% confidence limits about the average) of 1.16 - 1.32 min. per tree. This means the expected average productivity would be between 46 to 52 trees or 12 to 14 m^3/hour. Further analysis of the data showed a relationship between time per tree and tree size (see Figure 3). Linear regression analysis indicated the following relationship :

Time per tree (minutes) = 0.57 + (2.51 x (tree size in m^3))

r^2 = .74 (74% of the relationship is explained by the equation)

DELIMBING QUALITY

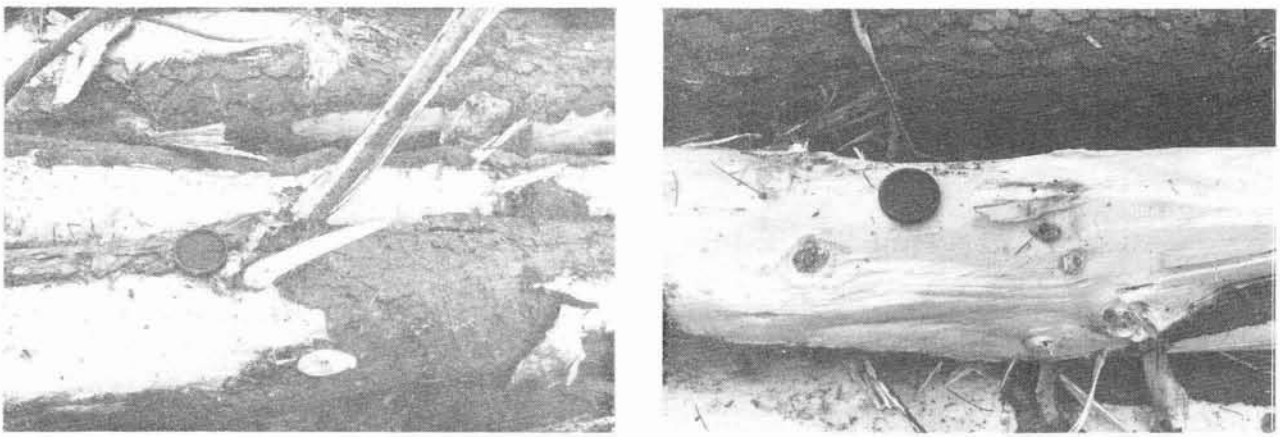


Figure 4 - Typical delimbing quality of logs produced by the machine

As stated earlier, every branch on 30 trees was measured. After each of these trees had been processed, the logs produced were measured and the number and length of branches remaining was recorded. The results are shown below :

2029		original branches
1717	(85%)	removed cleanly to less than 2 cm
101	(5%)	remained 2-5 cm in length
112	(5%)	remained 5-10 cm in length
99	(5%)	remained greater than 10 cm in length

The majority of the longer branch stubs resulted from the delimbing knives slicing through the branch, leaving a sliver or the branch being bent and broken as it was pulled past the knives (see Figure 4). This delimbing quality would be unacceptable for sawlogs or a groundwood pulpmill but acceptable for most pulpmills that use drum debarking. The delimbing quality achieved was acceptable to the end user (Canterbury Timber Products Limited).

COSTS

If mechanised delimbing is to be adopted in New Zealand, it must provide more than improved productivity, safety, and worker environment. It must achieve a lower cost than existing methods. Using the LIRA Costing Handbook (Ref. 3), the estimated cost of the Hunt processor with an operator would be $52 per hour. With an expected average productivity of 12-14 m^3/hour (.27m^3 tree size), the cost to delimb, using the Hunt processor, would be between $3.75 - $4.30/$m^3$. This compares with a cost of manual delimbing of approximately $4.20/$m^3$ (Ref. 4).

Using the hourly productivity predicted by the regression equation, the cost per m^3 to delimb, using the Hunt processor, for different tree sizes was calculated and is shown in Figure 5. For a comparison, the cost to chainsaw fell and delimb and the estimated delimbing costs are shown in the graph (assumed cost of $90/man and $15/chainsaw per day).

Ref. 3 Wells, G. "Costing Handbook for Logging Contractors", LIRA, 1981

Ref. 4 Gleason, A.P. "Mechanised Delimbing - Can it cut Costs?", LIRA Report, Vol. 9 No. 9 1984.

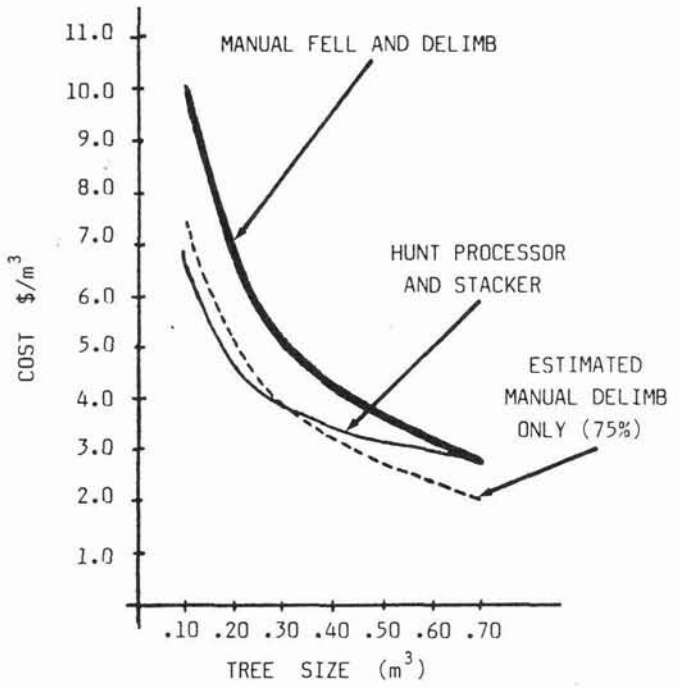


Figure 5 - The cost to delimb using a machine or a man with a chainsaw versus the tree size

As can be seen in the graph, the cost of mechanised delimbing is less than manual delimbing for tree sizes less than .30 m^3. This cost difference is small, making the decision to mechanise marginal, but the processor performs the added functions of crosscutting and stacking. In some operations this may make mechanised delimbing the best option.

DISCUSSION

The Hunt log processor in its present configuration has limited movement capabilities. The machine is mobile enough to travel on the skids or along a road edge but could not work in the forest. Whole trees must be delivered or positioned within reach of the machine grapple (8m). A skidder is required to blade slash from the delimbing head approximately once every fifteen trees. In addition, the operator must top the trees with a chainsaw periodically, or the fallers would have to top them in the bush.

The Hunt processor is best suited to a "hot" operation, where the skidder delivers whole trees to the machine and removes slash on a regular basis. Wood in 3-5 m lengths is produced and is stockpiled for load out by self-loading trucks or an independent loader.

CONCLUSIONS

During the trial, the Hunt log processor was capable of handling and delimbing radiata pine, ranging from .07 to .63 m^3 per tree. Delimbing quality was 85% complete and could be considered acceptable for most pulpmill requirements. Average productivity (at .27 m^3 tree size) was in the range of 12 - 14 m^3/hour, resulting in a cost of \$3.75 - \$4.30/m^3. This compares to a manual chainsaw delimbing cost of approximately \$4.20/m^3. Although this is not a significant reduction in delimbing cost, the additional functions performed (crosscutting and stacking) and improved safety conditions, may make mechanised delimbing with a Hunt processor a viable option for some operations.

The costs stated in this Report have been derived using the procedure shown in the LIRA Costing Handbook. They are only an indicative estimate and do not necessarily represent the actual costs for this operation.

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