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THE DENIS STROKE DELIMBER IN RADIATA WINDTHROW

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ABSTRACT

A study of a Denis stroke delimeter working in windthrown radiata pine indicated a productivity level of 92 trees per machine hour.

The time to process each tree was not significantly affected by tree size within the 0.11m³ to 0.3m³ piece size range observed. Average tree size was 0.22m³.

The delimeter worked in a "cold deck" system in conjunction with a manual cutting crew and a Cat 518 grapple skidder.

Delimiting was carried out both at the roadside and on the cutover.

INTRODUCTION

The Denis stroke delimeter was first introduced to New Zealand in late 1986. A second stroke delimeter, a Harricana, was documented working in radiata pine (Raymond, 1988).

The Denis was successfully trialled in a variety of species and piece sizes. Since the early trial work conducted by Tasman Forestry Limited, the machine has become contractor-owned and operated. Most of its 3,000 hours has been worked in 0.35m³ piece size Ponderosa pine. Based on contractor records, productivity rates in the Ponderosa pine have averaged about 100 trees per machine hour



Denis delimeter working in windthrow in Tauhara Forest

and in excess of 700 trees per day.

The objective of this study was to evaluate the machine in small radiata pine and consider its potential for handling a large number of pieces from early age clearfell or thinning operations.

ACKNOWLEDGEMENTS

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THE MACHINE

The delimeter is mounted on a Komatsu PC200 LC tracked excavator base. The 88kW (118hp) Komatsu base unit supplies the required power and oil flow required to drive the delimeter. At 4440 x

3090mm, the size of the track frame provides a stable base while the delimeter is operating. The overall length of the telescopic boom is 13.1 metres when retracted. It has a maximum extension of 21.64 metres, providing a 17 metre delimiting stroke. This allows greater manoeuvrability in confined spaces. Two chainsaws are fitted to the delimeter, one for butt trimming and the other, a topping saw mounted on the delimiting head. Both saws run .404 pitch chain. Chain lube oil is supplied to each saw from independent reservoirs. A computerised length measuring device is also fitted to the machine. Maximum log diameter is 71cm.

STUDY AREA AND METHOD

The study of the Denis was carried out in Tasman Forestry Limited Tauhara Forest, in an area windthrown by the March, 1988 Cyclone Bola. The area, planted in 1973, featured moderate terrain and pumice soils. Ground conditions were good for both rubber-tired and tracked machines.

Details of the stand were supplied by Tasman Forestry Limited and the scaling of individual delimited logs provided the average merchantable volume (Table 1).

Continuous time study data was collected on each delimiting cycle. As well as scaling of processed pieces, the form of each tree was noted.

Table 1 : Stand Details

<i>Stand age</i>	<i>15 years</i>
<i>Stocking sph</i>	<i>220</i>
<i>Mean merch volume m³</i>	<i>0.22</i>
<i>Mean LED (m)</i>	<i>28</i>
<i>Mean length metres</i>	<i>10</i>
<i>Mean sed cm</i>	<i>12</i>

LOGGING OPERATION

The windthrown trees were cut by chainsaw operators. No trimming was done at the stump. A Bell Logger bunched the whole trees for extraction into windrows by a Cat 518 grapple skidder. The delimeter is known to have difficulty in breaking out trees from tangled stacks. To alleviate this problem, the decked wood was not pushed up or driven over by the skidder. No landings were formed.

The delimeter walked across the cutover delimiting the rows of wood and stacking them for loadout. With an average delimited log length of 10 metres there was no cutting to length required.

The delimeter worked in conjunction with a chainsaw operator. He worked his way along the rows of trees and cut branches larger than about 8cms and delimited any badly malformed stems. Being an experienced delimeter operator, he was able to relieve on the machine as required.

After delimiting, low cost trucking roads were formed alongside the rows. Loadout was done by a truck-mounted Prentice 410 knuckleboom loader.

RESULTS AND DISCUSSION

The results of the work study are given in Table 2. Operational delays in the table indicate aspects such as changing operators and inspections of the delimiting head and the topping saw. During the trial it became apparent that the delimeter was unable to delimit the branches in the first 1.8 metres from the butt. The main reasons for this were; the small diameter, the deteriorated state of many of the stems (which had been on the ground for five months) and the large branch diameter. The diameter of the stem where the delimiting head had to hold the tree to be able to use the rear knives to delimit the butt was approximately 12 to 15 cms. This

Table 2 : Productivity of the Denis

Element	Number of Occasions	Mean per cycle (min)	% of total cycle
Pickup	314	0.172	26.5
Process	314	0.304	46.8
Sort and Stack	18	0.057	8.7
Clear slash	55	0.064	9.9
Move	31	0.036	5.6
Operational Delay	7	0.016	2.5
TOTAL CYCLE		0.649	100.0

PRODUCTIVITY : 314 trees in 204 min = 92 trees/pmh
 @ 0.22m³ piece size = 20 m³/pmh

small diameter and the forces of the delimiting knives often caused the tree to break when delimiting was attempted. Because of this breakage problem, eighteen malformed and heavily branched trees were put aside for manual trimming. The time for this activity is listed in the table as sort and stack. This makes the total pieces handled 332.

During the study the machine delimited an average 92 trees per machine hour (PMH). Working in conjunction with the chainsaw operator the total number of trees handled was 98 trees/PMH.

In this study there was no significant relationship between piece size and processing time per tree. Throughput varied between 90 and 100 trees per hour over a piece size range of 0.11 to 0.3m³.

The delimitter normally worked a 10 to 11 hour shift with two operators relieving each other and carrying out other work as required. Although not measured in this study the longer term utilisation of such machines has been measured at 75% (Raymond, 1988a) and over 80% (Raymond, 1988b). Using the lower figure, the Denis would be achieving about 8 PMH per day.

COST

The LIRA costing format (Wells, 1981) gives a daily machine rate of \$1277 and a delimiting cost of \$7.80 per m³ at 163 m³ per day.

Operating with three manual fallers, 1 Bell logger and a grapple skidder the system can be compared to an alternative conventional operation where the trees are delimited manually in the bush. The cost and productivity is consistent with actual operations.

In the comparison, cutting and extraction costs are based on a normal 9 hour day and the delimitter on 11 hours (8 PMH).

Delimitter System

1 Denis & 2 operators	\$1140
3 fallers @ \$130	390
3 chainsaws @ \$23	69
1 Bell Logger (bunch)	240
1 Grapple skidder	400
2 operators @ \$130	260
plus profit @ 10%	250
and overheads @ 2%	50

Total Daily Cost \$2800
 at 163 m³/day
 = \$17.20/m³

Table 3 : Productivity and Cost based on an 8 machine hour day

Piece Size m ³	Volume/day m ³	\$/m ³
0.15	110	11.60
0.18	132	9.70
0.20	147	8.70
0.22	163	7.80
0.25	185	6.90
0.28	207	6.15
0.30	222	5.75

Manual System

10 fallers @ \$130	\$1300
1 skiddy @ \$130	130
11 chainsaws @ \$23	253
2 Bells (bunch & stack) @ \$240	480
1 Grapple skidder @ \$400	400
3 operators @ \$130	390
plus profit @ 10%	295
and overheads @ 2%	59

Total Daily Cost
at 163 m³ /day
= \$20.30 /m³

Table 3 gives cost and productivity for a variety of piece sizes from .15m³ to 0.3m³ at 92 trees per hour. These results are based on an eight productive machine hour day.

CONCLUSIONS

In this study the Denis delimeter processed an average of 92 trees per productive hour.

For piece sizes between 0.11 and 0.3m³ the time taken to delimb a tree did not vary with piece size. Any increase in productivity and reduction in unit cost was therefore directly attributable to piece size (Table 3).

The availability of two operators was seen as a major benefit to the operation, both in terms of reducing operator fatigue and in having

someone available to manually delimb malformed and heavily branched stems.

The Denis delimeter demonstrated the ability for high production, even in difficult windblow timber.

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

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