LOGGING INDUSTRY RESEARCH ASSOCIATION

MECHANISED DELIMBING

CAN IT CUT COSTS?

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INTRODUCTION

Delimbing in New Zealand has long been recognised as a major cost component in smallwood harvesting, contributing up to 30% of the total log extraction costs (Ref.1). Motor-manual delimbing is labour intensive and also potentially dangerous. The logging industry Accident Reporting Scheme indicates that over 25% of all logging injuries in 1983 occurred during delimbing. These factors have resulted in renewed interest in the use of machines for delimbing.

Mechanised delimbing offers improved worker environment in terms of safety and comfort, as well as the potential for increasing man-day productivity. The major questions have been; whether the existing machines could handle radiata pine, and whether their productivity could offset their high ownership and operating costs, thereby reducing delimbing costs.

In Australia, various delimbing machines have been tested on radiata pine. Their experience has indicated that the "stroking" type delimbers can process 60-120 trees per hour and produce good delimbing quality in radiata pine, up to 1.2 m^3.

This Report looks at the productivity and cost of the Harricana delimber, one of the more promising machines tested in Australia, and compares it to motor-manual delimbing in New Zealand.

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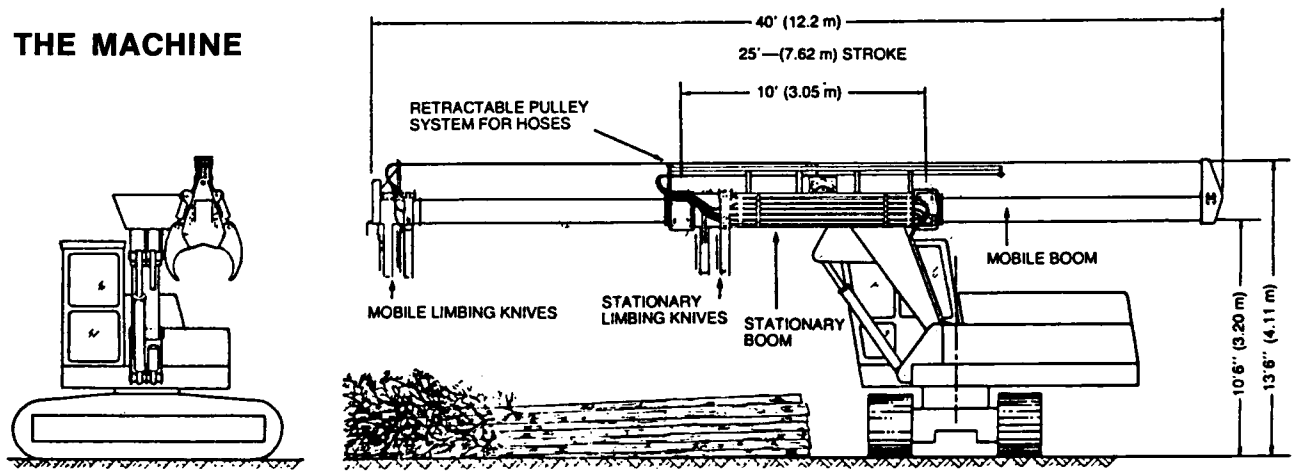
THE MACHINE



The Harricana delimber can be mounted on most excavators in the 70-100 kW class, e.g. Cat 215 or JD 690. It is a stroke delimber in which trees are delimbed by two delimbing heads, each comprised of two wraparound and one fixed knife. This configuration allows for two knife passes over the log to ensure high delimbing quality. Tree lengths are measured with an electronic eye and an hydraulic chainsaw cuts the trees to length. The delimbing knives can handle tree diameters from 7 cm to 60 cm. The boom has a maximum reach of 12 m and a 7.6 m delimbing stroke.

PRODUCTIVITY IN AUSTRALIA

A Harricana delimber mounted on a Cat 215 excavator base is being used by a logging contractor in Victoria. The unit is working in a radiata clearfell operation behind a feller-buncher. The machine travels over the cutover, delimbing and processing trees into sawlogs and long length pulpwood. Logs are piled as they leave the machine for later extraction by forwarder.

The productivity of the Harricana, with a good operator, has been in the range of 24-42 m^3/hour, in tree sizes ranging from .2 to 1.2 m^3. Detailed studies have shown the following relationship (linear regression) between productivity in cubic metres per hour and tree size - *m^3/hour = 18.4 x m^3/tree + 20.4 (where r^2 = .95).*

The production figures are based on :

(1) Lighter branched Australian radiata pine
(2) A system where the machine travels over the cutover
(3) The machine working behind a feller-buncher
(4) The machine producing sawlogs and long length pulpwood

Experience in Canada with the Harricana and other stroking delimbers has shown higher productivity. Part of the reason is that the Canadian tree species have lighter branches but more importantly, harvesting systems have been developed to suit the delimber. Whole trees are extracted and stockpiled at right angles to the road edge. The delimbers then work from these stockpiles producing tree length logs. The large stockpiles minimise machine movement during delimbing and reduce the amount of non-productive machine shifting time, thus utilising the full capacity of the delimber.

EXPECTED COSTS IN NEW ZEALAND

In New Zealand, the cost of a Harricana delimber ready for mounting would be approximately $162,000*. This figure would include all the hydraulic controls, cut-off saw, measuring device, log deflection plate, machine and operator protection, assembly and mounting charges and $9,000 in spare parts. For the purposes of this Report, three machine costing options are shown in Table 1. In the absence of actual costs from Australia, the LIRA Costing Handbook was used to establish hourly machine costs.

Option 1 - New John Deere 693B/Harricana delimber (NZ$315,000 complete) working a single 7 productive hour shift per day (8000 hour life, 20% salvage value).*

Option 2 - New John Deere 693B/Harricana delimber (NZ$315,000 complete) working two 6.5 productive hour shifts per day (12000 hour life, 10% salvage value)*

Option 3 - Secondhand excavator/Harricana delimber (NZ$225,000 complete) working a single 7 productive hour shift per day (8000 hour life, 10% salvage value)*

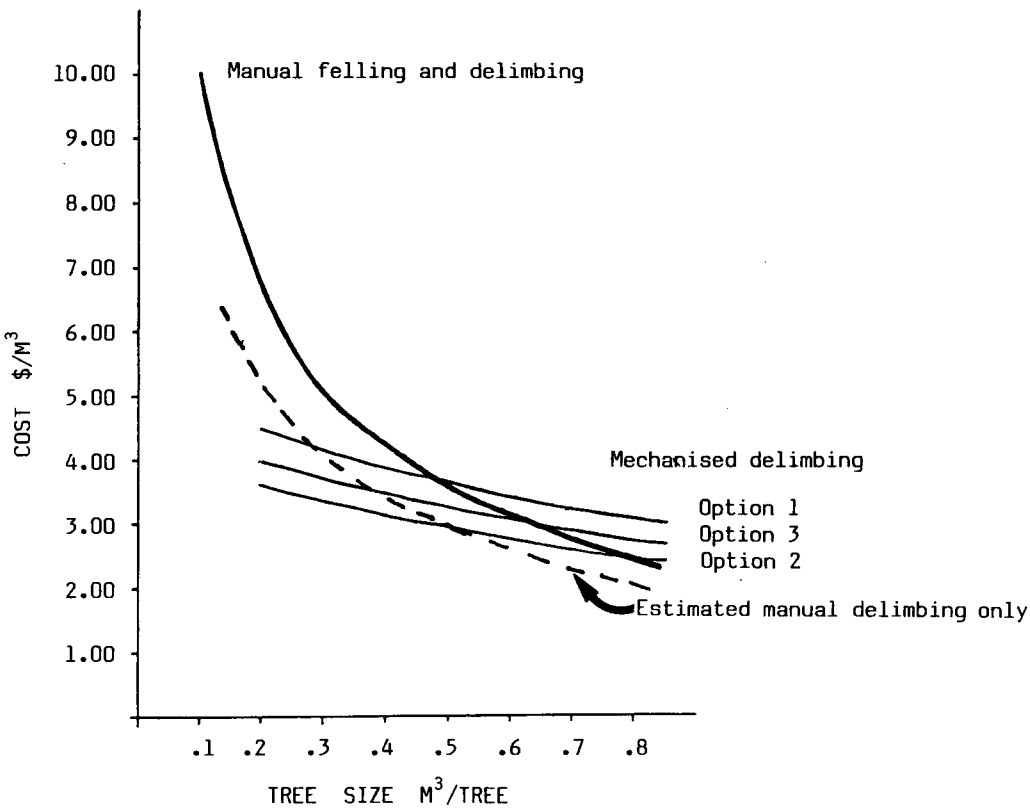
TABLE 1 - MACHINE AND LABOUR COSTS
($ per productive machine hour)

	Option 1 $	Option 2 $	Option 3 $
Owning cost	56.40	35.40	41.10
Operating cost :			
Fuel and oil	9.25	9.25	9.25
Repairs and maintenance	29.50	29.50	32.80
Operator	12.85	12.85	12.85
Total per hour $	108.00	87.00	96.00

* NZ$1 = 0.52 U.S.A., 0.68 Canadian dollars (9 August, 1984, after devaluation)

To determine if mechanised delimbing using a stroke delimber can reduce cost, it will be compared with the cost of manual chainsaw delimbing. It is difficult and often misleading to isolate the cost of delimbing in manual felling and delimbing operations. For the purposes of comparison, the delimbing cost ($/m^3) by Harricana will be compared with the estimated cost of delimbing as a percentage of total felling and delimbing (75%). This cost to manually fell and delimb is based on productivity over an eight hour day at a cost of $90/day per man and $15/day for the chainsaw (Ref. 1, 2). Using the Harricana productivity figures and the costs presented in this Report, three cost curves were calculated (Figure 2).

Fig. 2 - Cost per m^3 versus tree sizes for mechanised delimbing and manual felling and delimbing



DISCUSSION

Fig. 2 shows that delimbing with the Harricana could be cost competititve with manual felling and delimbing in tree sizes less than .3 m^3. These costs will be dependent on whether the predicted machine production rates can be achieved. With a potential productivity in .2 m^3 tree size of 170 m^3 per single shift or 320 m^3 per double shift, the total harvesting system will have to be matched to the delimber. In addition, end mill users must be willing to accept these volumes of wood. Quotas that limit production will raise costs.

Machine limitations will restrict systems to easy terrain, or to road edge delimbing on steeper terrain. Possible systems are discussed :

Clearfell minor species

The clearfell of small trees has the greatest potential for the use of mechanised delimbing. Road edge delimbing would minimise delimbing machine travel. A combination of feller-bunchers and grapple skidders could be used to deliver whole trees to the road edge to match the delimber's productive capacity. The more

conventional central landing approach would be altered to road edge strips or abandoned completedly with wood delivered directly to the road edge. Conventional rubber-tyred loaders would be less suitable for load-out than excavators or knuckle-boom loaders.

Radiata thinnings

In thinnings, road edge or in-the-bush delimbing could be carried out but the residual stand would pose limits on either system. Manual felling with skidder extraction of whole trees to a landing would be one option. However, four to six skidding gangs would be required to produce enough wood for one delimber and the residual stocking may inhibit whole tree extraction and reduce drag sizes. In addition, large landings or road edge landings would be required to stockpile trees and the delimber unit would be shifting on a daily basis.

CONCLUSIONS

Based on the productivity achieved in Australia, the use of a Harricana delimber could be cost competitive in New Zealand with motor-manual delimbing, in tree sizes less than .3 m^3. This assumes that similar production rates and delimbing standards could be achieved in New Zealand conditions. It would also eliminate the potentially dangerous job of chainsaw delimbing and may provide an alternative for areas with shortages of skilled bushmen.

To be successful, new systems will have to be developed to utilise the delimber's capacity to its fullest potential and this will require balancing productivity of the felling, extraction, loading and transport operations. To achieve this balance will require a higher degree of planning and management control than required for conventional systems. The machines will require good servicing backup in terms of maintenance, spare parts, tools and well-trained mechanics in order to maintain mechanical availability. The high cost ($300,000) specialised delimbers will require high productivity to offset their cost.

This Report is only a general investigation into what the potential for mechanised delimbing is in New Zealand. Anyone interested should contact LIRA for more specific information.

Ref. 1 Gordon, R. D. "Delimbing Studies", LIRA Project Report No. 4, 1978

Ref. 2 Cochrane, B. et al. "The Future of Smallwood Mechanisation in New Zealand", Seminar Proceedings on Research and Development in Tree Harvesting and Transportation", LIRA, 1983.

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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