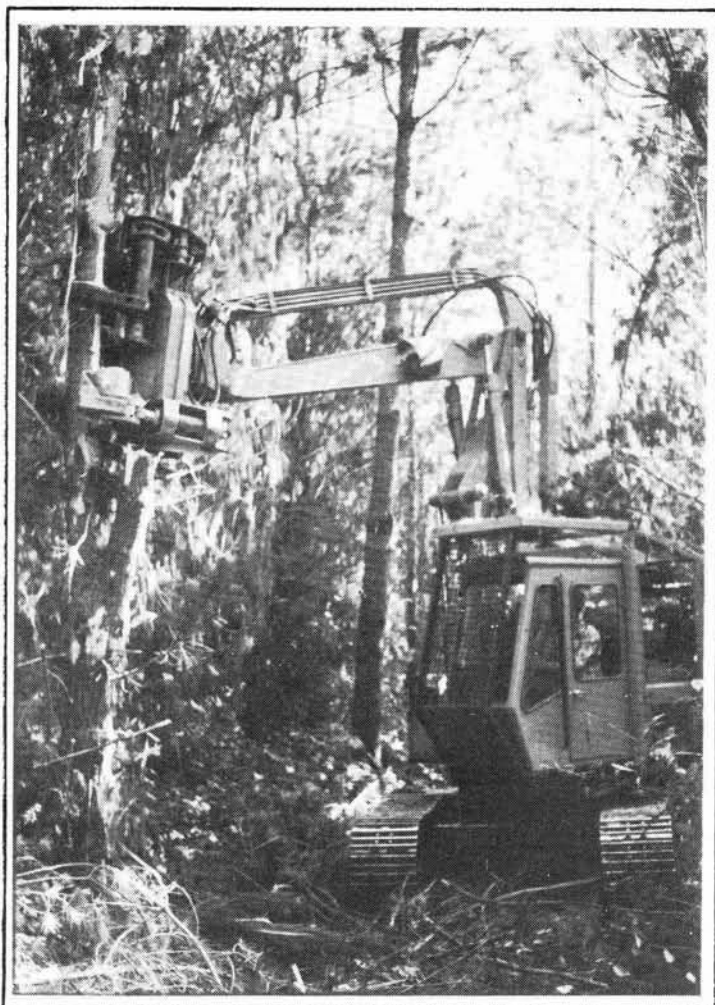




## HITACHI FELLER-BUNCHER TRIAL

A Report by J. R. Ansley, Thinning Department, N.Z. Forest Products Limited



### INTRODUCTION

In recent years several New Zealand companies have considered the possibility of using mechanised logging operations instead of traditional felling and delimbing methods. To establish the viability of mechanisation, New Zealand Forest Products Limited put a delimer feller buncher (DFB) to work in its Kinleith forest during April 1981. A Hitachi UH04 Excavator modified with a Waratah felling and delimbing head, was hired from Mr N. Pritchard, with an operator to work the machine. The machine is unique among present harvesting machines, in that it delimbs the standing tree to a maximum height of 7 metres, prior to shearing it from the stump.

The trial's objectives were to determine:

- productivity under Company thinning conditions;
- the DFB's effectiveness in unmarked and heavy undergrowth stands;
- the machine's ability to present wood for short pulp operations, and for long length extraction using 4WD agricultural tractors.

The trial was carried out in 12 year old p.radiata stocked to 1100-1200 s/ha. Contours were easy in the trial area which was bisected by small gullies, some steep sided. Heavy blackberry undergrowth was present throughout the area.

Experience with the DFB operation before the trial, suggested productivity was greatly affected where it was not working in an outrow system. Operators tended to become disorientated because terrain undulations had made it hard to define rows. The normal NZFP regime was modified in the trial to allow for a fifth row outrow system, retaining high pruned trees with the outrow. Bays were thinned to leave all high pruned trees plus some unpruned stems.

The logging operation is normally carried out using either a short pulp or an agricultural tractor crew. Normal age 11 thinning is selective, reducing overall

stocking to 370 s/ha without outrows. Because the trials were of relatively short duration and the operator was unfamiliar with the system, results must be taken as indicative and not conclusive.

## THE TRIALS

Short pulp: In normal short pulp extraction operations, the trees are felled, delimbed, cut to 1.8 metre lengths, and stacked in bundles of about 1.5 m<sup>3</sup> for later extraction by skidders or forwarders. In the trial, the DFB completed the delimb and fell operations, laying the logs complete with untrimmed tops in bundles of four to six. Cutters then trimmed, cross-cut and stacked the logs.

Long length: The agricultural tractor operations use conventional logging methods. Trees are felled, delimbed, headed by the crew and extracted in full log length with the tractor.

In this case the DFB performed the delimb and fell operations, laying logs in groups of 5-7 trees orientated for easy extraction to the dump. The gang followed, doing the heading, completing trimming and extraction.

## RESULTS

### Feller Buncher Production

The difference between actual and theoretical performance was due to the operator learning a new operation, possible time keeping errors, and rough ground conditions.

- (i) In the short pulp trial the machine produced 225 tonnes in 41 hours, 5.5 tonnes per hour. A study of the elements involved indicated :

| <u>Element</u>     | <u>Time</u>               |
|--------------------|---------------------------|
| Reach              | 0.24 mins                 |
| Delimb and shear   | 0.29 "                    |
| Lay stem           | 0.39 "                    |
| Move, clear ground | 0.10 "                    |
| <u>Total</u>       | <u>1.02 mins per tree</u> |

Measurement of 52 felled trees gave a mean D.B.H. of 20.3 cm with a mean merchantable volume of 0.23 m<sup>3</sup>. Based on this piece size expected production would be 12.6 tonnes per hour or 70 tonnes per day (70% utilisation).

The DFB reach did not allow complete delimbing of trees, because they generally were too tall. 52 trees were analysed after delimbing and felling :

|                 | <u>Mean</u> | <u>Range</u>  |
|-----------------|-------------|---------------|
| Length delimbed | 6.68 m      | 2.3 to 8.95 m |
| Not delimbed    | 3.56 m      | 0.23 to 8.6 m |

Tree volumes for the 52 trees analysed :-

|                 | <u>Mean</u>          | <u>Range</u>                  |
|-----------------|----------------------|-------------------------------|
| Length delimbed | 0.181 m <sup>3</sup> | 0.034 to 0.421 m <sup>3</sup> |
| Not delimbed    | 0.048 m <sup>3</sup> | 0.002 to 0.175 m <sup>3</sup> |

The DFB delimbed 79% of the volume. Studies indicated the cutters spent 30% of their trimming time on this part of the tree, and the remaining 70% on the undelimbed portion.

- (ii) DFB production in the agricultural tractor trial equalled 63 tonnes in 8 hours or 7.9 tonnes per hour. Time keeping for the machine was suspect -it had multiple breakdowns but ground conditions were more favourable with easy contours and gentle gullies:

#### Short Pulp Cutter Production

The cutters followed the DFB trimming, cross-cutting and stacking. Normal production of the cutters had been established and the following table indicates their increased production (in tonnes per man day) :

| Usual Production | Production Following<br>Feller Buncher | Percentage Increase |
|------------------|--|---------------------|
| 10               | 22                                     | 120                 |
| 9                | 16                                     | 78                  |
| 8                | 15                                     | 87                  |
| 7                | 11                                     | 57                  |
| 5.5              | 10.5                                   | 91                  |

Average production increase 87%

LIRA studied two top cutters preparing 81 logs. The basic time per tonne was 15 minutes which broke down to the following elements:

| <u>Element</u>     | <u>Percentage of basic time</u> |
|--------------------|---------------------------------|
| Trim and cut butts | 21                              |
| Trim and cut tops  | 23                              |
| Stack              | 49                              |
| Other              | 7                               |

If the rate of work while under observation was maintained during the day, productivity would be approximately 23 tonnes per day. This was very close to what was achieved by the top cutter in the overall production from this area.

#### Agricultural Tractor Gang Production

The crew followed the DFB - a bushman finished trimming, headed the trees and stropped them to the tractor. The logs were taken full length to the dump.

This crew produced 44 tonnes in 7 hours or 6.3 tonnes per hour. With more experience in drag preparation, productivity would be improved. This should be regarded as minimum production.

The following times were observed :

| <u>Element</u>     | <u>Average time (mins/day)</u> |
|--------------------|--------------------------------|
| Turn and position  | 0.48                           |
| Pull rope          | 0.07                           |
| Hook on            | 1.67                           |
| Wait from trimming | 0.23                           |
| Breakout           | 0.22                           |
| Run loaded         | 1.51                           |
| Unhook             | 0.80                           |
| Fleet              | 1.72                           |
| Run empty          | 1.40                           |
| <hr/>              |                                |
| TOTAL              | 8.1 minutes                    |
| <hr/>              |                                |

Average logs per drag was 6.6, average piece size was 0.18 m<sup>3</sup>, which equalled a daily production of 65 tonnes. Conventional operations in similar situations would produce 20 to 25 tonnes per day.

## DISCUSSION AND CONCLUSIONS

1. The DFB can effectively work in Company thinning conditions on tractorable conditions (up to 15°). Production decreases with increased grades. An outrow system is advisable to "locate" the operator.
2. The machine is not hindered by heavy undergrowth. It made working conditions for manual workers following much easier. The number of residuals left varied slightly from the prescription - this would improve with practice.
3. Improved presentation of logs enabled short pulp cutters to increase production by 87% in a difficult undergrowth area. The cutters felt less fatigued after a day's work. They used a third of their normal chainsaw petrol and appreciated the clean working conditions.
4. The logs were also well presented by the DFB for long pulp extraction with the agricultural tractor. The crews production doubled, benefitting from the reduction of slash and undergrowth.
5. The DFB operation caused little damage to the residual crop.
6. A cost analysis has not been included in this report. The economic viability of combining a mechanical operation with conventional thinning systems would depend on the hire rate of the machine in a continuous operation, and the effect of its use on the manual work following. The trial demonstrated that wood presented by a mechanical system could greatly increase the productivity of normal thinning operations and would be specially effective in areas of heavy undergrowth and poor ground conditions.

---

*This Technical Release is the work of the author and is not the result of LIRA project work. LIRA publishes it in the interest of wider dissemination of knowledge in the industry. LIRA takes no responsibility for accuracy of figures nor does it necessarily support or disagree with the opinions and conclusions shown.*

|                                  |   |              |
|----------------------------------|---|--------------|
| For Further Information Contact: | N.Z. LOGGING INDUSTRY RESEARCH ASSOC. INC.<br>P.O.Box 147,<br>ROTORUA, NEW ZEALAND. | Phone 87-168 |
|----------------------------------|---|--------------|