ISSN-0111-6711

LOGGING INDUSTRY RESEARCH ASSOCIATION
NEW ZEALAND

REPORT

Vol. 7 No. 6 1982

CUTOVER SALVAGE TRIALS

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Skidder Bringing Unprocessed Salvage Wood to Landing for Cutters to Trim & Stack

INTRODUCTION

Increased demands for wood during the 1980's will force more complete utilisation of the forest, and cutover residues will be an important source of wood. LIRA recently carried out trials to assess the productivity and costs of salvaging residues from radiata pine old crop cutover, using a variety of simple methods and machinery. Results from these trials, in combination with other company trials, will indicate the most promising options for salvaging cutover residues.

Conventional radiata old crop logging operations recover most of the main stem of the crop trees, leaving large quantities of tops. These are normally shattered into two or three pieces, have a lot of limbs, and vary in diameter and length; all of which makes them very difficult to process and harvest. In Kaingaroa Forest it has been estimated that an average of 31 m^3 (range 0-180) per hectare remains on the site.* (This does not include sound, dead wood.) Harvesting systems must therefore be aimed at the lowest possible cost and be relatively insensitive to changes in piece size and volume per hectare.

Several organisations have tested systems to recover logging residues. In 1972 the Fletcher Timber Co.Ltd. tried a shortwood operation where the Forest Research Institute assessed productivity at 9.5 m^3 per day/per cutter, and 73 m^3 per day/per skidder **. Costs were estimated at \$3.17/m^3, which compared favourably with some of the existing thinnings operations. N.Z.Forest Products Limited is currently using a two-phase logging system - the main butt logs are extracted first and a skidder or forwarder recovers the remaining residues down to 10 cm x 2.4 m. Kaingaroa Logging Company Ltd. is also conducting trials using a bunching system with horses or a Bell Logger for forwarder extraction to recover pieces down to 10 cm x 1.2 m.

* Ref: N.Z.Forest Service Utilisation Assessments.
** Ref: C.J.Terlesk, FRI Unpublished Report No.57, "Cutover Salvage - Pinus Radiata"

OBJECTIVES

LIRA's trials aimed to recover residues off skidder terrain following clearfelling operations. Residues for the purpose of the study meant any piece of wood that could be feasibly handled and had usable wood fibre content. With this in mind the objectives were threefold:

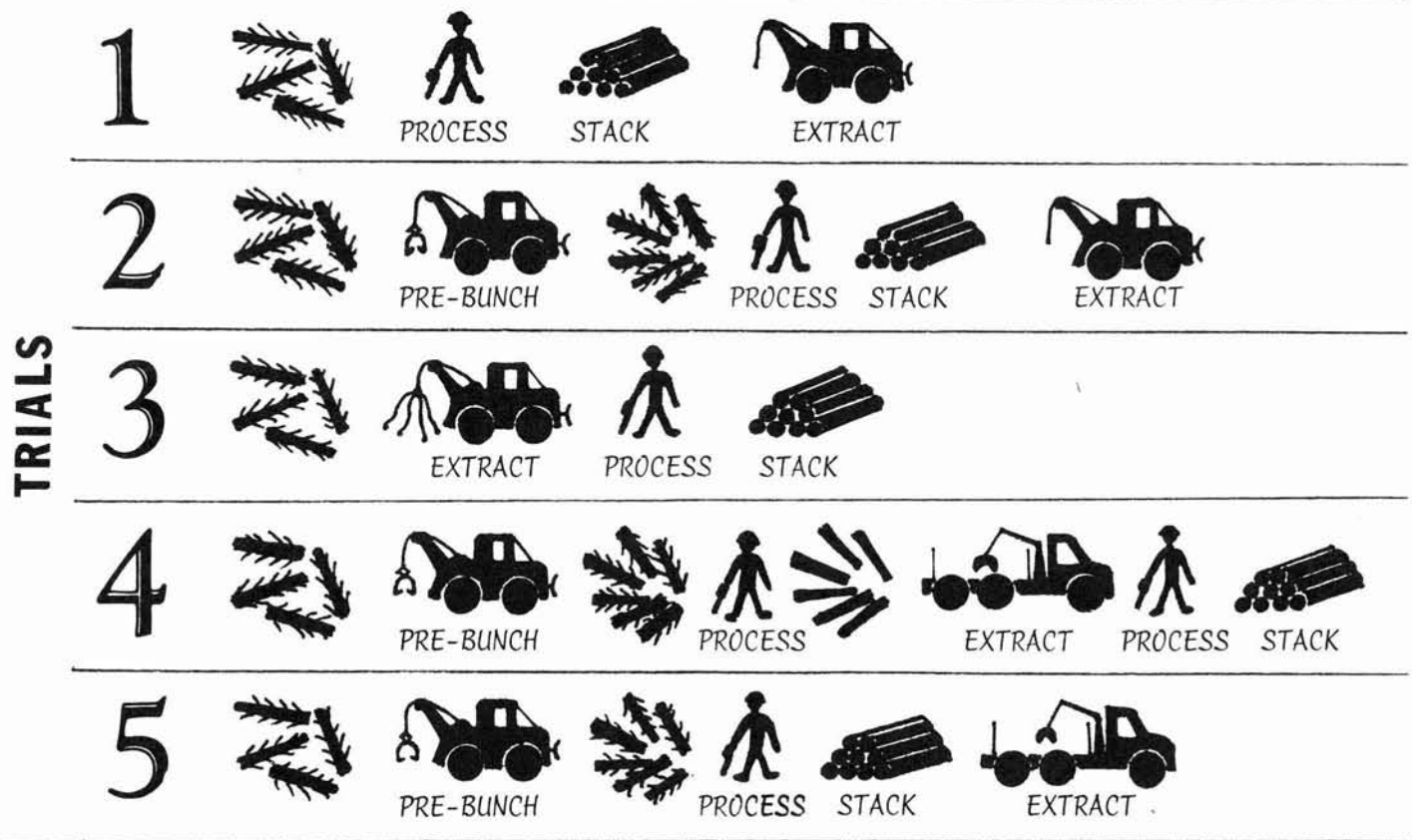
1) To recover all usable wood fibre, green or sound dead, greater than 7 cm x 1 m.
2) To test various harvesting systems involving manual inputs combined with pre-bunching techniques and a variety of extraction methods.
3) To monitor each phase of the system to determine levels of productivity for each phase, and to estimate the harvesting cost per m^3, delivered to the landing.

ACKNOWLEDGEMENTS

The NZ Forest Service, Kaingaroa, and N.Z. Forest Products Limited supplied the machinery used in these trials. Their assistance is gratefully achnowledged.

TRIAL DESCRIPTIONS

Compartment 174 Kaingaroa Forest,chosen for the trials,was easy terrain with an average volume of 36 m^3 residue per hectare (Forest Service assessment). Each trial area was one hectare, approximately 125 metres from the landing. Prior to each trial a volume assessment was carried out - all usable stems longer than 1 metre and larger than 7 cm were tallied. The plots averaged 57 m^3 per hectare (range 48 - 66 m^3).



Trial 1 - Process on cutover, skidder extract

Three cutters working on the cutover trimmed and cut to 1.2 to 1.8 metre lengths, and piled the residues into stacks of 11-34 pieces (average 20). The work was very difficult for the cutters and the chainsaws. The plot was bunched into 73 stacks. Stack size was small (.72 m^3) due to the difficulty of carrying pieces for long distances (average 3.2 metres). A 70 hp skidder was then used to extract the stacks to the landing.

Trial 2 - Pre-bunch, process on cutover, skidder extract

To increase skidder productivity the residues were pre-bunched into 19 bundles of approx. 25 stems each, using the same skidder with a set of logging tongs fitted to the main rope. Problems occurred due to the limitations of the winching system and crudeness of the tongs. Two cutters then trimmed, cut to length, and piled the residues into stacks of 14-28 pieces (average 21). By pre-bunching the stems, the processing and stacking was much easier and required less physical effort; stacking distance was reduced to 1.6 metres; and stack size increased to 1.1 m^3. There was a total of 48 stacks, and as in Trial 1, the skidder was used to extract the stacks.

Trial 3 - Skidder extract, process on landing

This was a conventional skidder extraction system. The skidder was fitted with seven strops and extracted processed stems to the landing. An attempt was made to double-up pieces on each strop, but the operator had limited time to shift pieces. Extraction was easier than anticipated, with an average of 9 stems per drag. Two cutters trimmed, cut to length, and stacked the pieces into two rows *(see cover photo)*. To aid with blading the slash was manually placed into piles. The cutters were able to keep up with the skidder and work on the landing was easier than on the cutover.

Trial 4 - Skidder pre-bunch, partial trim, forwarder extract, process on landing

The skidder was used to pre-bunch the residues into 14 bundles of approx. 47 stems each. Two cutters then trimmed as many stems as possible, removing around 90% of the limbs. This work was dangerous because cutters had to climb on top of the bunch. The trimmed random length stems were then extracted with a forwarder. At the landing the two cutters did a final trim, cut to length, and stacked the pieces into two rows. They were able to keep up with the forwarder extraction and there was spare time which allowed for saw maintenance and resting.

Trial 5 - Skidder pre-bunch, process on cutover, forwarder extract

The skidder was used to pre-bunch the residues into 15 bunches of approx. 35 stems each, and the two cutters then trimmed, cut to length, and piled the pieces into small stacks (average 10 pieces). Cutting and stacking was easier than in Trials 1 & 2 because of the smaller stack size. A forwarder then extracted the pieces to the landing and had no difficulty, even though the bunks were not designed for short pieces.

Time studies were conducted on each phase of the systems. Upon completion of each trial 300 pieces were measured for volume and weighed to obtain an average volume/weight per piece. The total number of pieces were tallied to determine the volume produced by each system. The pieces were then loaded with a self-loading bin-type truck for delivery to Plyco Particle Board Mill at Taupo. Each trial area was then reassessed to determine the residue remaining.

RESULTS

	TRIAL				
VOLUME	1	2	3	4	5
Pre-trial assessment (m^3/ha)	47.9	59.1	65.8	63.7	50.3
Post trial assessment (m^3/ha)	8.6	14.8	14.3	6.1	7.5
Actual harvest (m^3)	52.7	53.2	61.3	52.3	47.5
Average processed piece size (m^3)	.035	.051	.048	.047	.043
Average processed piece weight (kg)	33	42	39	31	29
Conversion factor (m^3/tonne)	1.11	1.23	1.24	1.53	1.50
PRODUCTIVITY					
Processing (m^3/man-hour)	1.2	2.1	1.9	2.4	2.8
Bunching (m3/man-hour)	0	3.5	0	3.7	3.7
Extraction (m^3/man-hour)	5.3	9.7	3.8	8.1	10.5
Total system (m^3/man-hour)	1.00	1.16	1.29	1.23	1.38
Total cost ($/$m^3$)	21.15	20.15	19.56	22.87	20.36

From these results the following points arise:

CUTTER PRODUCTIVITY was influenced by the system used and the working environment. Pre-bunching untangled the stems and dislodged them from the ground, which made processing easier for the cutters. Concentrating the stems reduced searching for pieces and carrying distance for stacking. Productivity increases in Trial 5 could be attributed to reduced stack size. In Trials 3 & 4 cutter productivity was dependent on the extraction machine, especially in Trial 4 where trimming had already been done on the cutover. In both these trials there was idle time.

MACHINE PRODUCTIVITY in pre-bunching increased slightly from Trial 2 through Trials 4 & 5, and this could be attributed to increased system effectiveness. By pre-bunching the residues, stacks were concentrated into groups of 2-4, and stack size was greatly increased - .7 to 1.1 m^3. These combined effects dramatically increased skidder extraction productivity from Trial 1 to Trial 2. Skidder productivity in Trial 3 was limited and dependent on residue stem size, and number of strops used. It appeared that the forwarder was more productive when picking up short pieces than random length stems.

COST EFFECTIVENESS of pre-bunching when comparing Trial 1 to Trial 2 was proven through increased cutter and skidder productivity. Trial 3 produced wood at the lowest cost and was the simplest of all five systems. The costs also indicated that forwarder extraction of shortwood is more economical than random lengths, and forwarders also have the ability to load directly onto pre-load trailers or multi-lift bunks, hence a further cost saving.

DISCUSSION

Productivity of all systems was hampered by the project's goal to recover all usable wood fibre. Much time was spent collecting and processing small stems which were below the practical and economic limits. Average skid distance was 210 metres which reduced the extraction machine's productivity, especially with skidder systems. In a production situation less time would be spent collecting all usable wood and skid distances would probably be around 150 metres.

Costing of all systems was based on new equipment, using the LIRA Costing Handbook*. With the productivity increases discussed above and the use of second-hand equipment, costs could be greatly reduced.

Under the trial constraints the simpler system, Trial 3, of using a skidder to extract to the landing, produced wood at the lowest cost. It required low capital investment, the least amount of manpower, and the cutters' environment was the safest of all trials.

A management problem with harvesting residues is setting pay rates for the salvage crews. Conversion factors from m^3 to tonne varied from 1.1 to 1.5, due to the drying of the stems. If crews were paid on a piece rate then some sort of gross volume measure, such as truck loads rather than tonnage, should be used to determine production.

The harvesting of logging residues is a costly process, but by removing the residues, re-establishment costs can be reduced by eliminating the need for wind-rowing and allowing the option of mechanical planters. The cost of producing salvage wood does compare favourably to some costs of thinning on steep country. The wood produced is of usable quality for the manufacture of particle board and paper products.

Full detailed information on these trials will be published in a LIRA Project Report.

*Ref. N.Z.Logging Industry Research Assoc., "Costing Handbook for Logging Contractors"

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