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THE EFFECT OF IMPROVED WORKING CONDITIONS FOR CHAINSAW OPERATORS IN WINDTHROW

Trevor Moore

ABSTRACT

This study was primarily designed to improve the working conditions of chainsaw operators working in windthrow.

In the conventional method three men felled and processed the windthrown stems where they lay. In the alternative method only one man worked at the stump, felling standing trees and spars or cutting windthrown stems free. The trees were then pulled out and bunched on the cutover and trimmed by the remaining two men, before being hauled to the skid. The relative productivity and risk of the two methods was evaluated.

The effect of the changed work method on extraction productivity was also evaluated. Both cable and grapple skidders were trialled.

The bunching method resulted in a significant reduction in the percentage of time trimmers were exposed to risk situations.

The productivity of the grapple skidder was reduced by 14% in the bunching system, but the cable skidder was actually more productive at haul distances up to 165m.

Further method development has the potential to improve the imbalance in machine productivity.

INTRODUCTION

In the harvesting of windthrown trees, severing the tree from the stump is often classified as the most dangerous part of the operation (Gleason, 1983). Techniques have been developed, and training has been carried out, to promote safer working practices while butting off windfelled trees and felling broken spars and heavy leaning trees (e.g. NZFP, 1988).

Delimbing windfelled trees is also dangerous. It is labour intensive and is the area where the chainsaw operator is exposed to hazards for

Figure 1 : Delimbing windthrown trees in Tauhara Forest

the greatest period of time. Not only is the operator expected to trim to an acceptable level, he must also contend with branches under tension, and more or different ground hindrance than normal. In areas where trees are crossed over and there are a large number of uproots the operator walks along the felled tree while delimbing. As well as subjecting his spine to excessive loadings (Gaskin et al, 1988) he is often poorly balanced, working sometimes a metre or more above the ground.

During the first three months (April-June 1988) of Cyclone Bola windthrow salvage, 44% of all lost time accidents recorded by LIRA's accident reporting scheme for the Bay of Plenty region occurred during trimming. For the corresponding period of 1987 only 30% of lost time accidents in the same region occurred while trimming.

It was reasoned that if the working conditions of the trimmers could be improved there would be less accidents.

This study was designed to measure the effect of two working conditions on chainsaw operator safety and extraction machine productivity. Skid worker manpower requirements were also assessed for each system.

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STUDY AREA AND METHOD

Both trials were conducted in Tasman Forestry Limited Tauhara Forest. The terrain was predominantly flat with some moderate downhill hauls. Ground conditions were good with free draining pumice soils.

Grapple skidder area : Planted in 1968, the block had been production thinned to 220 stems per hectare (sph). The measured extracted piece size during the trial was 0.71m^3.

Cable skidder area : Planted in 1969, this area had been production thinned to 200 sph. The extracted piece size during the trial was 0.75m^3.

Continuous time study data was collected on the skidders for each comparison. Skid activity was sampled and extracted logs measured.

Gang structures:

Grapple crew

Cat 518 grapple skidder
Bell 120 Logger
2 machine operators
3 fallers
2 skiddies

Cable crew

Cat 508 cable skidder
Bell 120 Logger
2 machine operators
3 fallers
1 skiddy

An assessment of the element of risk to the trimmers both at the stump and on the cutover was carried out using video recording techniques.

RISK ANALYSIS OF TRIMMING

The rationale behind this trial was to significantly reduce the percentage of time the trimmers were exposed to a hazardous situation. In the conventional method the chainsaw operators trimmed the trees where they lay and therefore were more at risk than when they trimmed on the cutover, where they could more easily see and assess obstacles. Once broken out the trees and the branches were under less tension and the trimmer could walk alongside the stems when trimming.

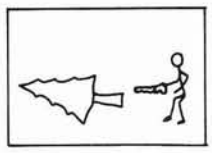
Due to the delay associated with determining the effect of the improved working conditions on delimbing accidents, risk analysis techniques were used to provide an immediate indication. Risk analy-

sis has been used extensively in studies of logging operations overseas, (Makijarui/ Ihonen 1987 and Roberts et al 1983).

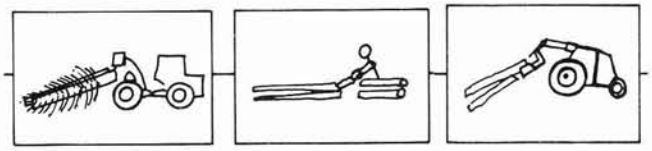
OPERATING PROCEDURE

Conventional

Three men cut and trimmed the wood where it lay, for extraction to the skids. At the skids it was retrimmed, cut to log length and stacked by the Bell logger. Slash buildup on the skids resulted in both extraction machines spending approximately 5% of each cycle blading the skids.



3 men work at stump

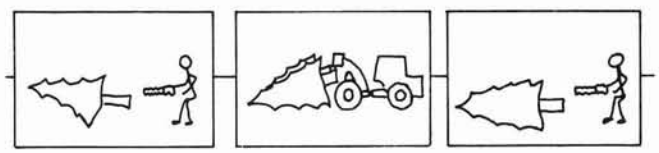


partially trimmed wood hauled to skid

Figure 2 : Conventional Method

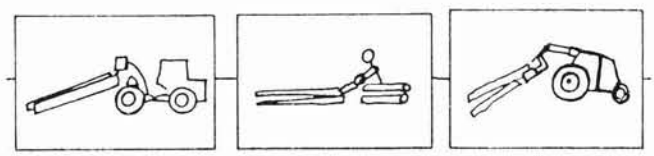
Bunching

The objective of this method was to reduce the number of men working at the stump and provide safer conditions for trimming.



1 man at stump whole trees to trim area

2 men trim on cut over drags exchanged



trimmed wood hauled to skid

Figure 3 : Bunching Method

One man from each crew worked at the stump and was only required to sever or fell the trees (not trim).

After breakout the logs were hauled a short distance across the cutover (normally about 30 metres) and dropped for trimming, by the remaining two men. The untrimmed drag was exchanged for a trimmed drag and hauled to the skids.

Data Collection Techniques and Analysis

Continuous videoing of trimming in both the conventional method and the bunching method was undertaken. The video was played back at 30 second intervals.

The activity of the operator was noted according to the following predetermined risk situations:

(1) Where the operator was walking along the log and more than one metre off the ground.

(2) Where the operator was walking along the top of the log trimming and the log was bouncing resulting in poor balance. This typically occurred when delimbing the last third of the tree.

(3) Trimming when the saw is less than 10 centimetres from the foot.

(4) Where the upper torso is bent greater than 90° ,thus placing unacceptable loadings on the lower spine.

(5) Where the upper torso was bent more than 45° but less than 90° . Such a posture still places high loadings on the spine.

The percentage of time each risk situation occurred was calculated and all risk situation percentages were summed. This gave the percentage of time the operator was exposed to a risk situation which had the potential to result in some form of accident or injury.

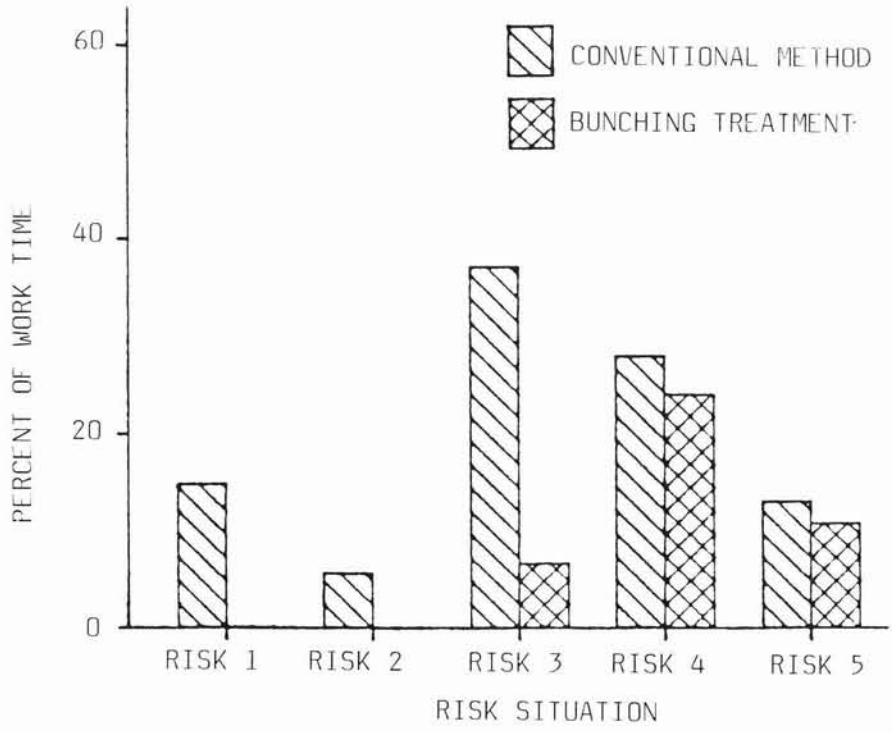


Figure 4 : Risk Analysis
(Percent of time for each situation)

RESULTS AND DISCUSSION

Risk Analysis

Figure 4 details the percentage of time the operator was observed to be at risk by each risk category.

The reduction in the percentage of time the operator is placed at risk in the bunching method is clearly apparent. While there can be some debate about the definition or seriousness of risks 4 and 5 there can be no such discussion with regard to risks 1, 2 and 3. The fact that the first two have been eliminated in the bunching method must reduce the potential for accidents while trimming. Within the bunching method, provided adequate technique instruction was available to operators, the exposure to risks 3, 4 and 5 would be expected to reduce even further.

Extraction

In the conventional system the grapple skidder demonstrated fast 4.55 minute cycles (Table 1). The only unproductive machine time was the 0.25 minutes per cycle blading slash off the skids.

In the bunching system the 11% reduction in drag volume and the 0.4 minute exchanging drags resulted in a decrease in productivity of 14% per productive machine hour.

The cable skidder in the conventional system took almost 9 minutes per cycle (Table 2).

The time taken to accumulate a drag in this system (i.e. blade logs, position, hook on and breakout) was 4.63 minutes or 53% of each cycle.

In the bunching system the cutter assisted with hook on. With an average of only 2 trees per cycle the drag accumulation time was 30% of the cycle. Although the drag volume was reduced by 39%, the faster cycle time of the skidder was sufficient to make the bunching method more productive than the conventional system up to a distance of 165 metres.

TABLE 1 : EFFECT OF SYSTEM CHANGE ON EXTRACTION - GRAPPLE SKIDDER

	Conventional System		Bunching System	
Element	No. of Cycles	Mean Time Per Cycle (min)	No. of Cycles	Mean Time Per Cycle (min)
Travel Empty*	84	1.40	71	1.40
Position	81	.01	47	.01
Blade Logs	3	.37	2	.29
Load	81	.90	70	.90
Exchange Drags			71	.39
Travel Loaded*	84	1.62	71	1.75
Blade Skid	26	.25		
Total Cycle Time		4.55		4.74
Piece Size (m^3)		.71		.71
Pieces per Cycle		2.25		2.0
Volume per Cycle (m^3)		1.6		1.42
Haul Distance (m)		150		150
Productivity (m^3/pmh)		21		18

* Travel times standardised to 150 m for comparison

TABLE 2 : EFFECT OF SYSTEM CHANGE ON EXTRACTION - CABLE SKIDDER

	Conventional System		Bunching System	
Element	No. of Cycles	Mean Time Per Cycle (min)	No. of Cycles	Mean Time Per Cycle (min)
Travel Empty*	64	1.21	70	1.21
Blade Logs	17	.75	20	.16
Position	40	.46	50	.19
Hook On	64	2.41	70	.82
Breakout	64	1.01	70	.45
Exchange Drags			70	.58
Travel Loaded*	64	1.90	70	1.75
Stop and Winch	13	.15	1	.06
Unhook	64	.47	70	.17
Blade Skid	15	.41	3	.03
Total Cycle Time		8.77		5.42
Piece Size (m^3)		.75		.75
Pieces per Cycle		3.27		2.0
Volume per Cycle (m^3)		2.45		1.5
Haul Distance (m)*		170		170
Productivity (m^3/pmh)		17		17

* Travel times standardised to 170 m for comparison

SKID ACTIVITY

Grapple Skidder

The activities of the two skiddies in the conventional method were combined. The skiddies were occupied in productive work for 76% of their time. The main activity was retrimming. All other activity times remained similar between the two methods with the exception of trim and idle time. In the bunching system only one skiddy was required and he was idle for 27% of his time. This was a direct result of the high quality of trimming on the cutover rather than in the bush.

Cable Skidder

During the conventional system the one skiddy was occupied for 86% of his time (33% taken up with retrimming). With the change to the bunching system his retrim time was reduced to 15% and as a result he was occupied only 68% of the day.

CONCLUSIONS

Putting the productivity of the skidders aside, it is obvious from the results of the risk analysis that improved conditions for the cutters were created. If the bunching method was employed it should reduce the number of accidents occurring while trimming in windthrow.

The productivity of the grapple skidder was reduced by 14% or nearly 20 m^3 per 6.5 machine hour day in the bunching system.

The cable skidder was more productive with the bunching system until the haul distance reached 165 metres.

This Report has clearly shown that trimming in windthrow can be made safer. While there was a sacrifice in the production levels of the grapple skidder, further refinement would most likely improve the imbalance highlighted in this study.

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For further information, contact:

N.Z. LOGGING INDUSTRY RESEARCH ASSOC. INC.
P.O. Box 147,
ROTORUA, NEW ZEALAND.
Fax: (073) 462-886 *Telephone (073) 87-168*