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PULLING MAINROPE WITH A PORTABLE WINCH

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INTRODUCTION

This Report describes the continuation of trials evaluating the KBF brand chainsaw powered winch (Moore, 1987). The study's aim was to investigate the potential use of the portable winch for pulling tractor mainrope uphill, to increase the reach of ground-based extraction units (Gaskin 1984). This study compares the use of the portable winch for pulling tractor mainrope uphill, with the conventional manual system.

ACKNOWLEDGEMENT

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THE TRIAL AREA

The trial was carried out in an 8 year old stand of mixed radiata pine and eucalypt in Kawerau Forest. The production thinning operation consisted of felling the two rows of radiata pine adjacent to each row of eucalypt to form extraction corridors. The non-crop trees in the two remaining rows of radiata pine were then felled in a herringbone pattern to these lines (see Figure 1). In total, twenty rows of 50 metres length were precut; ten for the manual system and ten for the mechanical system.

The extraction machine was a D31A Komatsu tractor, fitted with 80 metres of 13 mm mainrope and six 9 mm strops. The first part of the trial involved both the breakerout and the tractor driver manually pulling the mainrope and strops uphill. The slope range for these first ten lines was between 26° and 33°, with cross slope up to 24°.

Figure 1 - Extraction corridor

For the second part of the trial, the portable winch was used to pull the tractor mainrope uphill to evaluate its effect on the production of the operation.

METHOD OF OPERATION

The winch was anchored to a tail tree at the bottom of the line. An 80 metre length of 10 mm polypropylene rope was attached to the end of the portable winch to extend the haulback line. This was then run from the

1. Brent Madsen was a third year Forestry School student working on this project during his summer vacation.

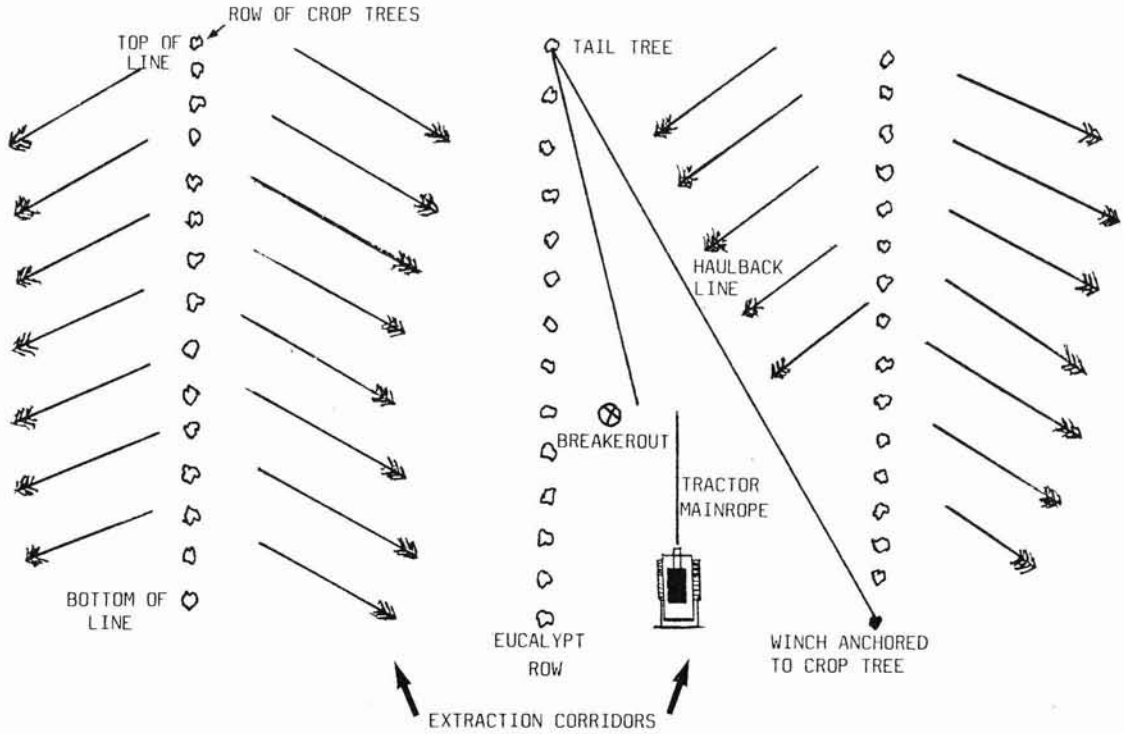

Figure 2 - Layout of Operation

bottom of the extraction corridor, up through a block and back, to be attached to the tractor mainrope (Figure 2). The block at the top of the line was attached to a tree at an approximate height of 2.5 metres. This was done to provide elevation to prevent the strops from snagging on slash. By using this method, the tractor driver operated the chainsaw winch while the breakerout was able to remain on the hill to clear as much slash as possible from each drag whilst waiting for the tractor to return from the skids.

The position of the winch ensured that it only had to be moved after two lines had been extracted. Once the line closest to the winch was extracted, the haulback line was fed down the adjacent extraction corridor by the breakerout (Figure 3).

RESULTS

The average piece size for the twenty lines extracted was 0.2 m^3. The cycle times for the manual operation and the winch operation are summarised in Tables 1 and 2.

The hook-up element for the manual operation involved both the breakerout and the tractor driver. The travel element includes; travel loaded from the extraction corridor to the skid site, unhooking the drag, clearing the load of slash, fleeting the logs and travel empty. The travel element was not included in the total cycle time as it was not considered significant for the purposes of this study.

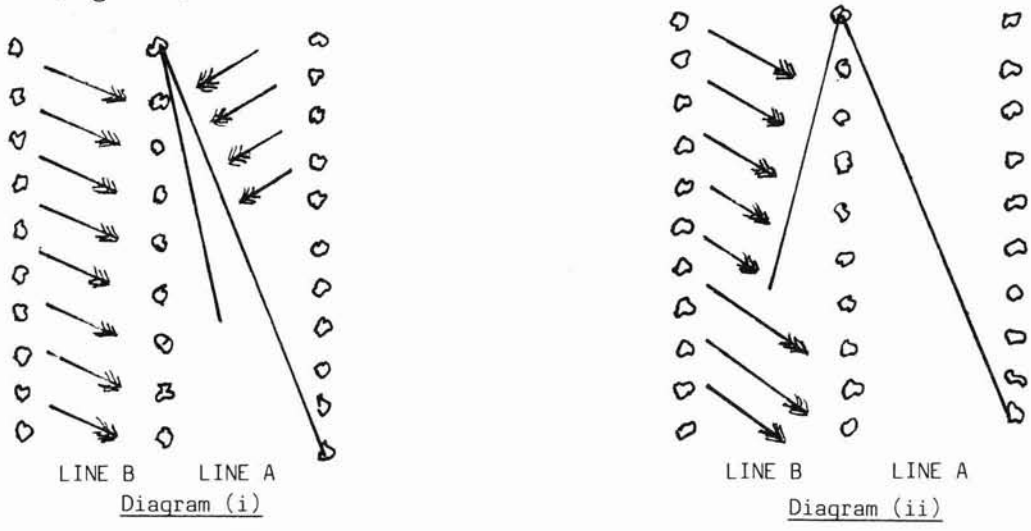

Figure 3 - Diagram (i) - Set up for extraction of Line A
(ii) - Set up for extraction of Line B

Table 1 - Manual Operation

Element	Average Time per Occasion (min)	Range (min)	No.of Occasions	Mean Per Cycle (min)
Pull mainrope out		0.43-7.68	34	2.71
Hook up		0.20-4.72	34	2.14
				4.85
Inhaul		0.29-2.12	34	0.97
Operational delays	1.46	0.41-5.18	10	0.43
Mechanical delays	1.12	0.28-3.29	4	0.13
Personal delays	0.52	0.30-0.78	8	0.12
Total cycle time		1.16-14.99	34	6.50
Travel	4.42	1.94-11.47	32	4.16
Number of pieces		1.0-9.0	34	6.3
Distance, m		8.0-56.0	34	31.0

Table 2 - KBF Winch Operation

Element	Average Time per Occasion (min)	Range (min)	No.of Occasions	Mean Per Cycle (min)
Attach haulback line		0.36-2.09	40	1.02
Start winch		0.06-0.35	40	0.14
Pull mainrope out		0.46-3.91	40	1.21
Detach haulback line		0.40-1.94	40	0.86
Hook up		1.38-5.65	40	3.41
Attach haulback line	0.25	0.11-0.49	31	0.19
Inhaul		0.29-1.76	40	0.97
Detach haulback line	0.81	0.13-1.76	31	0.63
				8.43
Operational delays	1.14	0.30-2.72	16	0.46
Mechanical delays	0.61	0.32-0.89	9	0.14
Personal delays	0.31	0.14-0.47	2	0.02
Total cycle time		5.75-13.59	40	9.05
Travel	7.34	3.43-15.51	37	6.79
Number of pieces		2.0-8.0	40	5.9
Distance, m		10.0-66.0	40	33.5

Only one breakerout was used for the winch operation, i.e. the tractor driver did not assist. The time taken to move the chainsaw winch and set up the block at the top of the line was not included in the total cycle time since line changes were completed before the tractor returned, i.e. included in the travel element.

Delays

Table 3 gives a breakdown of delays for both operations expressed as a percentage of total delay time.

DISCUSSION

The analysis of total cycle times indicates that the winch operation took approximately 40% longer to pull a drag than the manual method (9.05 versus 6.50 minutes). A number of factors must be considered to explain this result.

Through the use of the winch, the outhaul time was half that of the manual operation (1.35 minutes per cycle versus 2.71 minutes per cycle).

Table 3 - Analysis of Delays

Manual Operation		*Winch Operation*	
(a) Operational delays :		*(a) Operational delays :*	
Strops coming undone	*23.5%*	*Drag caught on crop trees or slash*	*4.1%*
Drag caught on crop trees or slash	*44.7%*	*Strops caught in slash during outhaul*	*3.7%*
Slash cleared from the drag at bottom of line	*2.3%*	*Chainsaw winch rope tangled in slash during inhaul*	*45.6%*
Repositioning tractor to keep drag clear of crop trees and/or slash	*5.7%*	*Slash cleared from drag at bottom of line*	*14.6%*
(b) Mechanical delays :		*(b) Mechanical delays :*	
Mainrope jammed in tractor winch	*6.3%*	*Mainrope jammed in tractor winch*	*24.1%*
(c) Personal delays :		*Brake not released on the chainsaw winch*	*6.1%*
Breakerout resting while pulling out mainrope	*17.5%*	*(c) Personal delays :*	
		Breakerout resting	*1.8%*
	100 %		*100 %*

Figure 4 - KBF Portable Winch

However, the extra time taken to attach and detach the haulback rope in the winch operation more than offset this advantage. This time, totalling 2.7 minutes per cycle, was considered excessive and could have been greatly reduced by using a hook or clip on the end of the haulback rope.

The manual operation used two breakerouts as opposed to one for the winch operation. On average, it took 2.14 minutes to hook up for the manual operation compared with 3.41 minutes for the winch. A greater volume per cycle was hauled for the manual operation (6.3 pieces versus 5.9). Consequently, there were fewer drags per line for the manual operation, thereby reducing the amount of physical work, i.e. pulling strops and mainrope uphill.

Analysing operational delays for the manual system, it can be seen that nearly 74% of the total delay time was caused through :

- strops coming undone
- drag caught on slash, stumps and crop trees
- re-positioning the tractor during inhaul

This was mainly due to the fact that the breakerouts hooked on as many logs as possible after having pulled the rope uphill. This resulted in bunches of logs being stropped at random lengths. The short stropped logs being lost and the longer stropped logs being caught.

One factor in the portable winch operation involved the use of a tail tree at the top of the line through which the haulback rope ran (see Figure 2). The positioning of this tail tree is criticial. Where none was available in the centre of the line, a tree on the side had to be used. This resulted in the haulback rope becoming tangled in slash during inhaul. This problem accounted for nearly 46% of the total delay time.

CONCLUSION

In general, the winch worked well and had no problem hauling the six strops and mainrope uphill. Although the manual operation proved more productive on short hauls of 30 m, it was felt the winch would come into its own where the outhaul distance was 50 metres or more.

One factor that influenced results was that during the trial the men pulling the rope in the manual operation never did so for more than two lines at a time. Therefore, they were not exposed to this hard physical task for long periods. It is expected that manual productivity would reduce dramatically if they were required to pull mainrope all day.

With a few refinements to the operation, i.e. quicker attach/detach times for the haulback rope, better selection of tail tree position, the haul time would be substantially reduced. The winch has shown potential where longer haulback distances are required and where tracking is not an option.

Further studies are planned to analyse the portable winch over longer haul distances (e.g. up to 80 metres) and its ability to pull heavier ropes and strops in a clearfell operation.

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