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DOUBLE-DRUM WINCH SKIDDER TRIAL

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Figure 1 - A drag arriving on the landing during the single-drum trial

INTRODUCTION

Double-drum winches on skidders have been widely used overseas for harvesting smallwood, but have had little use in New Zealand. The Forest Research Institute (Terlesk 1975) demonstrated a system that was designed to handle very small piece size (.044 m^3). This was unsuitable for use in conventional production thinning operations at that time with a piece size range of .15 m^3 to .3 m^3. LIRA reported on a study (Wells 1981) in an outrow system at Tarawera Forest which suggested a 20% increase in skidder productivity could be achieved, with a double-drum winch.

Skidders fitted with double-drum winches were introduced into thinning operations at Lake Taupo Forest in 1982. In these operations, the logs are extracted in tree-length after felling and delimbing, and then cut on the landing to 6 m lengths for transportation. The skidder is used for fleeting the tree-length logs. Load out is a separate operation carried out by an independent machine.

The skidders used in these thinning operations include both; purpose-built double-drum machines, and conversions of single-drum machines. These are described by Ansley (in prep.).

ACKNOWLEDGEMENTS

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Terlesk, C. (1975) "A Mercedes-Benz Tractor Production Thinning Radiata Pine", Economics of Silviculture Report No. 86, Forest Research Institute, Rotorua

Wells, G.C. (1981) "Double-Drum Winches in Thinnings", LIRA Report, Vol. 6 No. 1.

Ansley, R. (1985) "Double-Drum Skidders at Lake Taupo Forest, LIRA Technical Release, (in prep.)

METHOD

The trial was undertaken to compare the productivity of a double-drum skidder operating in its normal mode, with it operating as a single-drum unit. Trial design ensured that stand factors (tree size, thinning intensity and topography), operational factors (felling presentation and operator technique), and mechanical factors (line pull, winch size and rigging) were identical. The skidder extraction cycle was studied for a total of five days. It was studied as a double-drum operation and then as a single-drum operation for 1.5 days each. Trial completion was delayed for another four weeks, after one of the fallers left. This allowed time for another experienced faller to settle in. The remaining two days of the trial were divided equally between double-drum and single-drum operations.

The number of logs extracted were recorded and a sample of 120 were measured to determine average piece size using the 3-D formula (Ellis 1981). Another 30 were sectionally mesured and confirmed the validity of this formula.

STAND DESCRIPTION

The trial was carried out in a stand of 11 year old radiata pine which had been high pruned in three lifts, and waste thinned (after low pruning) to 1000 sph. The stand was reasonably uniform throughout, as indicated by the information from .06 ha assessment plots established after the stand was marked for thinning. Information from six plots located in the trial area are summarised in the table below :

Table 1 - Stand data for the trial area, Compartment 85, Lake Taupo Forest

	Crop trees	Thinnings	Unmerchantable trees	Total
Stocking (sph)	200	690	40	930
Mean dbh (cm)	25	22	15	23
Mean height (m)	-	-	-	20
Total stem volume (m^3/ha)	73	198	3	274
Merchantable volume (m^3/ha)	-	173	-	-
Estimated piece size (m^3)	-	.25	-	-

Stand topography was flat to gently rolling, with hollows and humps up to 2 m which occasionally delayed the skidder while travelling and positioning. The machine crossed a variety of surfaces during each cycle, including access roads and unplanted grid lines.

MACHINE DESCRIPTION

The machine was a John Deere 340D (52 kW) skidder, fitted with an Igland 8000/2H double-drum winch. The winch carried two 25 m lengths of 16 mm winch rope, each fitted with a toggle hitch. Seven chain strops, each 1.8 m of 8 mm chain, were carried on each mainrope. Generally, no more than twelve pieces were attached in total.

Eight strops were fitted to a mainrope when the skidder was used as a single-drum unit. This was considered to be a safe limit by the operator.

Ellis, J. (1981) "Two-Dimensional Log Volume Tables and the Development of a Three-Dimensional Formula", Forest Mensuration Report No. 55 (Unpublished), Forest Research Institute, Rotorua.

RESULTS

Results of the studies are summarised in Tables 2 and 3 below :

Table 2 - Summary of trial data

	Double-drum	Single-drum
Number of cycles studied	46	55
Average piece size (m^3)	.29	.29
Number of pieces hooked on	11.1	7.6
Number of pieces unhooked	11.0	7.5
Average extracted load size (m^3)	3.2	2.2

Table 3 - Summary of mean element times per cycle

	Element times (minutes/cycle)	
	Double-drum	Single-drum
Travel empty (mins/100 m)	1.4	1.3
Blading	.3 (n=14)	.2 (n=12)
Position and re-position	1.0	1.2
Hook on	4.7	3.3
Break out	2.2	1.3
Travel loaded (mins/100 m)	1.9	1.7
Unhook	1.7	1.4
Skidwork - butting ends	1.6	1.1
Skidwork - fleeting	1.7 (n=11)	1.6 (n=20)
Production delays	1.3 (n=27)	1.2 (n=31)
Extraction cycle time	17.9	14.2

Infrequently occurring elements are identified (e. g. n = 11) and their times have been expressed on a per cycle basis. Production delays include; pushing hang-ups, drop and winch, blading access tracks and work related discussions. Mechanical delays (servicing and refuelling) and operational delays (clearing slash off roads, tracks and fire breaks), have been excluded from this comparison.

Cycle times for a double-drum winch are some 26% longer, but drag size is 45% greater. From the information in Tables 2 and 3, hourly production rates can be calculated to give 10.7 m^3 per productive machine hour (PMH) for a double-drum winch operation, and 9.3 m^3 /PMH for a single-drum winch operation, a difference of 15%.

Examination of the individual element times in Table 3 show substantial differences between single-drum and double-drum operations for the following elements; hook on, breakout, unhook, butting ends. Element times for travel empty, travel loaded and position and re-position are similar for both operations. From this, it can be deduced that increased productivity with a double-drum winch is largely due to the increased payload with minimal additional travel and positioning time. It also indicates that the machine was working within its load capacity, although close to its optimum payload as indicated by the need to drop and winch loads during uphill extraction.

Felling presentation was of a reasonably good standard, with slash cleared from the butts and the tree-length logs aligned for butt extraction. This was favoured because of the larger payload that could be carried. It sometimes involved felling against the lean, but all fallers were equipped with a polypropylene hammer and wedge to aid direction of felling. Skidder assistance was available when required.

Figure 2 - A high standard of felling presentation for butt extraction

CONCLUSION

The trial results showed an increase of 15% in the hourly productivity of a double-drum skidder when compared with it operating as a single-drum machine. The main advantage of the double-drum winch in this situation lay in its ability to carry a load that was close to optimum payload for the machine. Elements such as; travel empty, travel loaded and position were similar in both operations, independent of load size. Other elements such as hooking on, breaking out, and unhooking were dependent on the number of pieces being handled. The low residual stocking of 200 sph allowed ready access for positioning and for travel loaded, but this may not apply in a situation with a higher residual stocking.

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