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# CHAIN STROPS IN SKIDDER THINNING

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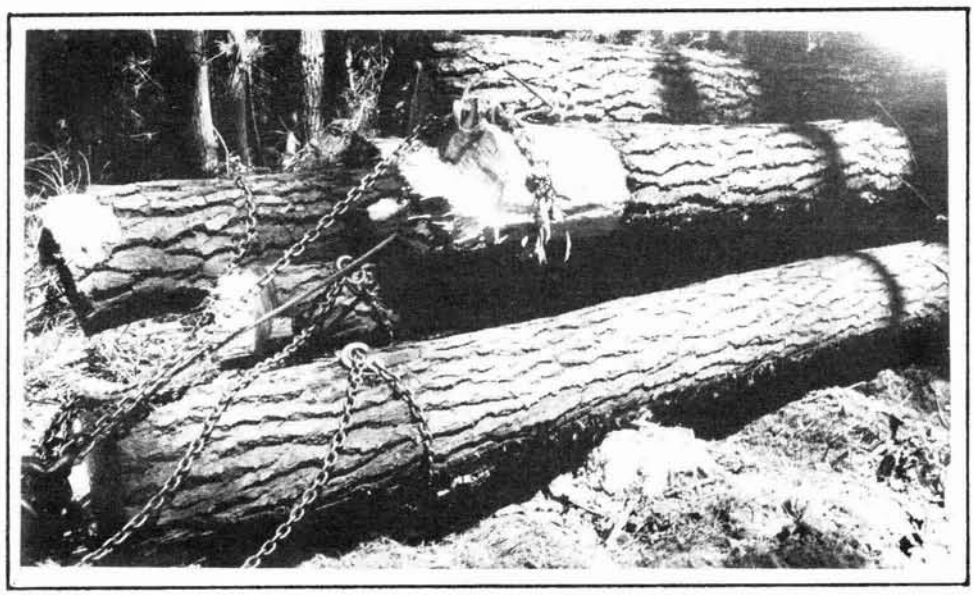

## INTRODUCTION

Several different methods of attaching logs for extraction have been tried in a variety of situations in New Zealand, but by far the most popular choice for strops is wire rope. In localised areas chains have been successfully used in both skidder and hauler operations, from small thinnings to native clearfelling. With the object of assessing the viability of chain strops in skidder thinning, LIRA set up a series of trials in production situations. This report summarises the results of these trials.

*ACKNOWLEDGEMENTS*

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## BACKGROUND

Chain strops were tried as early as 1968*, but problems with unhooking and breakages restricted their acceptance. More recently loggers in Nelson and Hawkes Bay have found that the increased durability and ease of handling of chain substantially outweighed any cost disadvantage. The use of higher grade steel has increased chain strength and reduced breakages, while the development of improved hooks has helped minimise unhooking problems. Because chain is very flexible it has always been regarded as difficult to pass under large butt logs. The degree of this restriction however, has not been documented or considered a hindrance by regular chain users. LIRA's trials therefore sought to identify suitable strop and hook configurations, and isolate any operational aspects which could improve efficiency.

* Dodd, R. and G. Rogers, "Chains for Chokers" NZFS Logging Notes 1968

## THE TRIALS

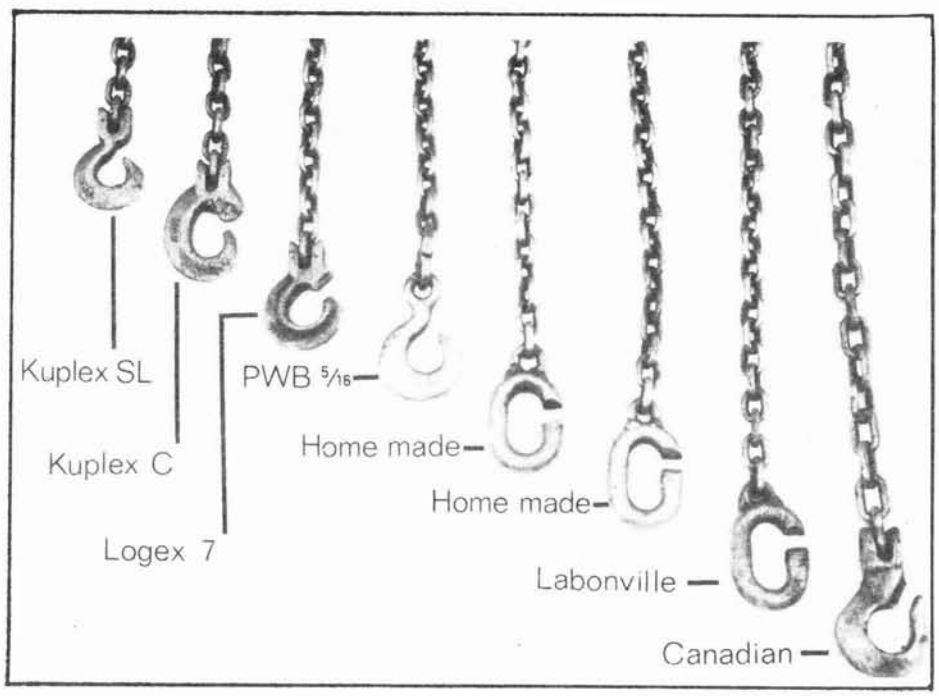
One trial was run in each of the three major forest company areas in the Bay of Plenty. All machines were contract skidder units rigged with wire rope and working in production thinning operations. The approach taken in each case was to sample extraction cycle times with the existing rigging and then replace the wire rope strops with chain. After one weeks operator familiarisation, cycle times were re-sampled. All costs quoted in this report are as at June 1982.

The first trial was undertaken in 19 year old radiata pine on undulating terrain in Kaingaroa Forest. The skidder was a 666C Clark Ranger which had two 16 mm and three 13 mm wire rope strops, with minimum breaking forces (mbf) of 11,600 and 10,000 kg respectively. The two larger strops were used because of breakages occurring to the 13 mm strops. During the study the machine operator broke out his own logs. The wire rope strops were replaced with six 8 mm Kito chains and hooks, with a mbf of 10,000 kg. After cycle times had been studied the chains remained with the skidder until no longer usable as a system.

Trial number two was conducted in 18 year old radiata in Kinleith Forest on flat to gently rolling terrain. A 664C Clark Ranger fitted with six 13 mm wire rope strops was used in a somewhat unusual system where the skidder waited while each drag was trimmed. After initial time studies, five of the wire rope strops were replaced with four 7 mm Kuplex chains (mbf 6317 kg) and one 8 mm Kito chain. Because only five chain strops had been acquired,one wire rope strop remained in this trial. From the first trial results, hook configuration was identified as a significant factor affecting efficiency, so a selection of hooks were attached, as follows:

| Strop No. | Type | Size | Length | Hook | Gap |
|---|---|---|---|---|---|
| 1 | Wire Rope | 13 mm | 3.0 m | Choker | N/A |
| 2 | Chain | 8 mm | 2.2 m | "Canadian" | 10 mm |
| 3 | Chain | 7 mm | 2.0 m | "Logex 7" | 9 mm |
| 4 | Chain | 7 mm | 1.9 m | "Labonville" | 10 mm |
| 5 | Chain | 7 mm | 2.0 m | "Kuplex SL"* | 9 mm |
| 6 | Chain | 7 mm | 2.0 m | "Kuplex C"* | 8 mm |

* Modified hook




Selection of hooks used in Trials 2 and 3

After study data had been collected, the chains remained on the skidder for one week and were then re-used in trial three.

The third trial was run on a 208D Timberjack skidder working in 10 year old radiata in Tarawera Forest. Nine 13 mm wire rope strops were on the machine and each faller assisted the skidder operator to break out his own logs. The time study sequence was again repeated and the wire rope strops substituted with the five chain strops from the second trial along with a further four 7mm Kuplex chains. Three of these strops had locally made hooks made from 19 mm chain links (similar to the Labonville configuration) and one had a "PWB 5/16" hook. All strops were 1.8 metres long and were still in use after six months operation.

RESULTS - TRIAL ONE

The 8 mm Kito chains were under capacity for the 0.55 $m^3$ piece size. However, after three initial breakages they were accepted and compared favourably with the equivalent wire rope strops. An improvement of 0.37 minutes per piece in stropping on times indicated that the chains were easier to attach but the long narrow tips of the Kito hooks tended to bend after successive use, and increased unhooking resulted.

Some further chain breakages occurred during the trial but these were quickly and easily repaired with simple hammerlock joiners. A limited supply of these however, meant that after four months the chains were no longer usable as a system. All breakages appeared to occur at the link where the chain passes through the hook after going around the log. A 60% increase in skidder positioning time resulted from extra blading necessary to position the logs, but average bush cycle times were reduced from 5.33 minutes per cycle to 5.06 minutes. The set of chains cost $394.20 compared to $248.78 for wire rope. The bush cycle elements are summarised below:

| *Element* | *Wire Rope* | *Chain* |
|---|---|---|
| *Position* | *.80* | *1.33* |
| *Walk in* | *.20* | *.22* |
| *Hook on* | *3.34 (3.3 pieces)* | *2.56 (4.0 pieces)* |
| *Walk out* | *.33* | *.24* |
| *Break-out* | *.43* | *.43* |
| *Reposition* | *.23* | *.28* |
| *TOTAL* | *5.33 minutes* | *5.06 minutes* |

RESULTS - TRIAL TWO

For the piece size of 0.38 $m^3$ the 7 mm Kuplex chains were also under capacity, but only two breakages occurred during the week's trial. Both of these happened in severe shock loading situations. Again, repairs were quickly done with hammerlock joiners. Unfortunately, the chains were one metre shorter than the original wire rope strops. This was a hindrance to the logging system and through it the chains lost popularity. Results from trial two are shown below:

| *Element* | *Wire Rope* | *Chain* |
|---|---|---|
| *Blade and position* | *1.65* | *1.30* |
| *Pull slack* | *.46* | *.53* |
| **Attach strops* | *4.02 (6 pieces)* | *2.85 (6 pieces)* |
| *Break-out* | *.86* | *.78* |
| **Unstrop* | *.45* | *.62* |
| *TOTAL* | *7.44 minutes* | *6.08 minutes* |

From the chart it can be seen that strop handling* was exactly one minute faster per cycle with chains.

A more detailed study of strop attachment and unstropping gave the following results:

| *Element* | *Wire Rope* | *Chain* |
|---|---|---|
| *Attach* | *.23* | *.14* |
| *Unstrop* | *.06* | *.08* |
| *TOTAL* | *.29 minutes* | *.22 minutes* |

These results indicate a 24% reduction in strop handling time. The trial was not long enough to identify any particular hook as being superior to the others. Instances of chains coming off were 2% compared with 1% for wire rope. The cost of chains, which was directly influenced by hook type, ranged from $50.60 for the 7 mm strop with the Labonville hook, to $99.74 for the 8 mm strop with the Canadian hook. Wire rope equivalents were $48.88 per strop.

RESULTS - TRIAL THREE

In a piece size of 0.13 $m^3$ the 7 mm chains were of correct capacity for the job. Almost immediate decreases in cycle times reflected the efficiency and ease of handling the chains. After several weeks operation the home-made hooks were considered to be the best configuration, mainly because of reduced unhooking problems and less tangling occurring during strop sorting. No significant differences in times were noticed between hooks. Cost differences varied again according to hook type, but the chains with home-made hooks compared most favourably at $58.67* each, to $48.16 for the wire rope strops. A summary of trial elements is shown below:

| *Element* | *Wire Rope* | *Chain* |
|---|---|---|
| *Position* | *.36* | *.33* |
| *Attach strop* | *2.31 (7 pieces)* | *2.03 (7 pieces)* |
| *Re-position and break-out* | *.78* | *.85* |
| *Unhook* | *.63* | *.63* |
| *TOTAL* | *4.08 minutes* | *3.84 minutes* |

During the study accidental unstropping of the wire rope strops was 4% and with chains 6%. After six months use six breakages had occurred and this exhausted the local supply of hammerlock joiners.

## CONCLUSIONS

All three trials indicated that in skidder thinning the use of chain for strops is a viable alternative to wire rope. In each study a substantial reduction in strop handling time was recorded when chains were introduced, and all operators found them easy to handle, particularly with the absence of sprags.

In the two long term trials the chains were found to be very durable, lasting over twice as long as the wire rope equivalent. This extra life offsets the higher initial capital outlay. Unfortunately the supply of hammerlock joiners was not always consistant and this tended to undermine the convience and efficiency of quick and easy field repairs. Until this is rectified by the suppliers, the use of chain is not likely to increase.

The frequency of unhooking during winching was directly influenced by hook configuration. Most hook types work satisfactorily providing the gap is kept to a minimum, and once attached, the chain can slide freely through the hook to allow the chokering effect. The oblong nature of the home-made hook, as well as satisfying the aforementioned requirements, was also found to reduce tangling during strop sorting.

The greatest advantages of chain for strops is not fully realised by many loggers. LIRA, through these trials, has clearly established that chains are a viable alternative to wire rope in skidder thinnings.

* excluding the Labonville configuration which could not be locally purchased.

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