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AN EVALUATION OF TWO HAHN HARVESTERS WORKING IN CLEARFELL CABLE OPERATIONS

Tony Evanson

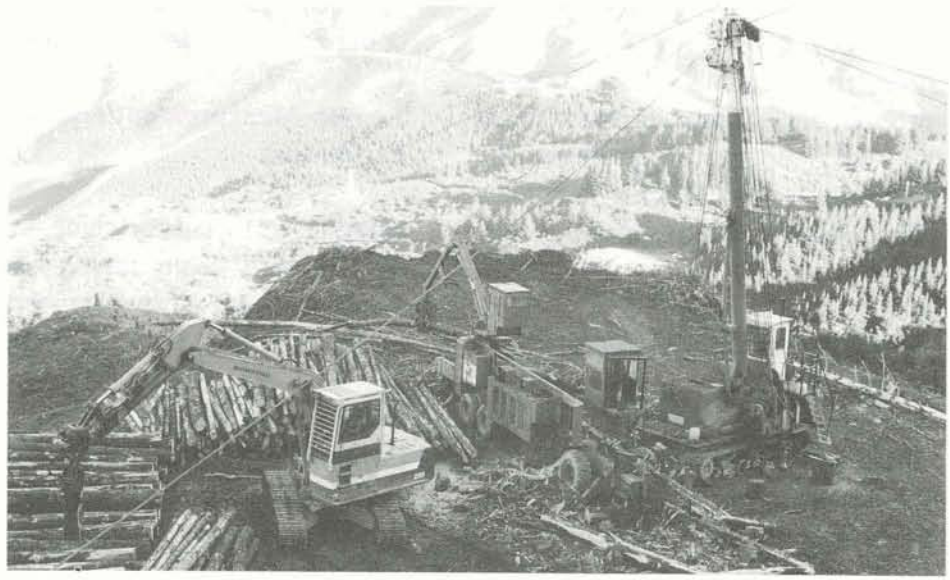


Figure 1 Kelly Logging's Hahn 300 HTL at Riwaka Forest, Nelson

ABSTRACT

Two Hahn Harvesters were evaluated processing radiata pine in clearfell cable operations in Nelson. Estimated productivity for the respective machines was: 33m^3 per productive machine hour (PMH) in an average extracted tree size of 1.27m^3 and 50m^3 PMH in an average extracted tree size of 1.33m^3. Oversized trees, and large-branched or malformed trees were processed manually.

Logs cut that were outside the ±5 cm length specification were 4% and 6% respectively. Out-of-specification logs due to inaccurate small-end diameter estimation comprised 4% and 8% of the totals respectively.

The introduction of the Hahns has reduced the exposure of skid workers to the risk of delimbing accidents. The skid workers have also been removed from the proximity of sorting and stacking machines and the inherent dangers associated with this.

INTRODUCTION

Mechanisation, complete or in part, of the chute clearance and/or processing function has been achieved in some cable-based operations. Machines currently in use clearing the chute, delimbing and/or

processing include excavators, Bell Loggers, machines such as the Waratah 234 HTH processor head (Evanson, Riddle and Fraser, 1994), Denis DM3000 stroke boom delimber (Robinson and Evanson, 1992) and Bell static delimber (Jones and Evanson, 1992).

A recent addition is the Hahn Harvester (Hahn). Previously trialled extensively in ground-based operations (Hill, 1990), a Hahn was recently introduced into cable operations in Carter Holt Harvey Forests (CHH), Southern Region. A further two Hahns have since been introduced, one of which is working in a ground-based operation.

CHH Southern Region's own quality control programme, which assesses three loads/crew/week, reports an average 2% less rejected logs for the Hahn crews than for crews with motor-manual log processing.

As part of LIRO's continuing interest in the promotion of safety and productivity in logging operations, a project was initiated which aimed to describe the Hahns operating with the cable operations of contractors, Rex Kelly and Ross Wood.

ACKNOWLEGEMENTS

LIRO acknowledges the assistance of Rex Kelly and Ross Wood and their respective crews, and Carter Holt Harvey Forests (Southern Region).

THE HAHN HARVESTER

The Hahn Harvester is a mobile, self-propelled, wheeled processor. It has two operator "stations", one equipped with a knuckleboom loader for loading the processing deck, and another for controlling delimbing and log making.

The two Hahns studied differed in that Kelly's Hahn 300 HTL (1990) featured a different location for the operator's cab, and modified length measurement equipment. This Hahn was brought into the country when near new in 1990, and has been working in the Nelson area for more than 12 months.

Wood's Hahn (1979) was an older model which had been reconditioned prior to being introduced to this operation.

Both Hahns were operated from single work stations, although the Kelly Hahn was fitted with a cable connection to the hauler. This enabled the hauler operator to pick up (using installed boom and grapple controls) stems from the chute in readiness for processing. This function could be overridden by the Hahn operator.

Length Measurement and Diameter Estimation

Hahn (1990) : This machine, in addition to the standard chain driven encoder, was also fitted with a travelling-saw system by Titan Plant Services Limited, giving the potential for a high degree of length measurement accuracy. This system was developed in response to concerns that high processing rates and accurate measurement were not always possible with the standard system. Diameters were estimated because Hahns do not have diameter sensing capability.

Hahn (1979) : This machine had the standard length measuring system, and diameters were estimated.

OPERATION DESCRIPTION

Table 1 - Stand details

	Kelly	Wood
Average Haul Distance (m)	215	204
Average Piece size (m^3)	1.27	1.33
Vol/ha (m^3)	855	596
Stems/ha	673	448

OPERATING METHODS

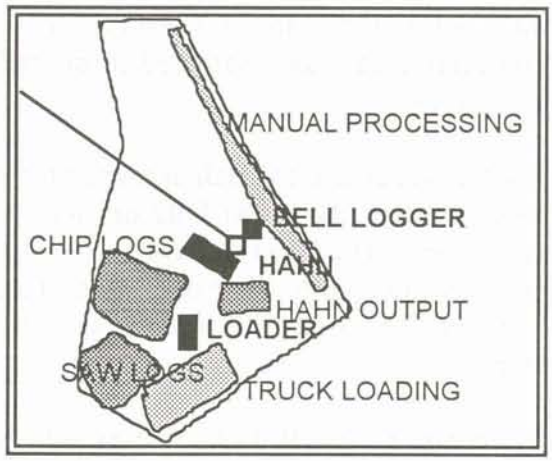
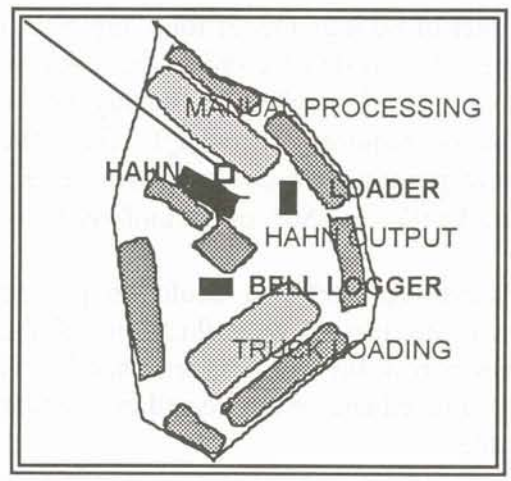


Figure 2 - Landing layout (0.21 ha) : Kelly



Landing Layout (0.24 ha) : Wood

Kelly Logging System

Stems were extracted by a Madill 071, with the skyline attached to stumps at the backline (resulting in more time required for line shifts). They were unhooked by either the skid worker and/or the Bell operator. Large or malformed trees were dragged aside to a manual processing area by the Bell. Other stems were cleared from the chute and processed by a Hahn (1990).

On occasion, the Hahn operator would unhook, manually process, operate the Bell, and assist with rope or carriage changes. The processed logs, short mill and chip, were sorted and stacked by a Komatsu PC220. This loader was also used to load trucks.

This crew is used by the Company to log setings with significant environmental constraint.

Wood Logging System

Stems were extracted by a Madill 071, with the ropes attached to a mobile tailhold (resulting in less time for line shifts). The stems were then unhooked by a skid worker/Cat 936 E rubber-tyred loader (RTL) operator. Large or malformed trees, or small chip stems were moved aside to a manual processing area by the loader and processed. Stems to be processed by the Hahn were cleared from the chute and presented to the Hahn by the loader.

On occasion, the Hahn operator (also the contractor) would cease processing to supervise the crew, unhook, or assist with rope changes. A Bell Superlogger handled the sorting and stacking of all logs except 11.5m. These were stacked by the RTL which also loaded trucks.

METHOD

Activity sampling at one minute intervals for two days per system was used to describe each operation. This enabled the percentage of time spent on different activities to be estimated.

Hahn productivity for each operation, was estimated using a combination of average extracted piece size, as estimated by the Company, and productive times for time elements (load, process and clear slash) for 50 trees which was derived from videotape.

Log quality was assessed by measuring 50 logs from each of four log types, for length and small-end diameter.

A total of 60 logs (15 of four log types) were subjectively assessed in the stack or on the skid for delimbing quality (stubs flush or requiring trimming). Only the visible portion of each log was assessed, typically 90° to 180° of circumference.

A short "feather" that could be pushed down was treated as a flush cut, if the major part of the stub was less than 2.5cm long. Frayed ends were treated in a similar manner.

RESULTS AND DISCUSSION

Time Distribution

The pie charts show for one day relative proportions of time spent on different activities for the respective machines for each operation.

Idle time/Balancing

"Idle time" when machines were unable to work, was subdivided into categories. "Interference" due to machines when wood was available, and "No work" if wood was unavailable. This data was obtained for two consecutive days and was used to quantify system balance.

For the hauler and the Bell and operator in Kelly's system there was little or no "No work" time. The Hahn and the Loader had approximately 40% "no work" each. Total "Interference" from all sources was less than 2%.

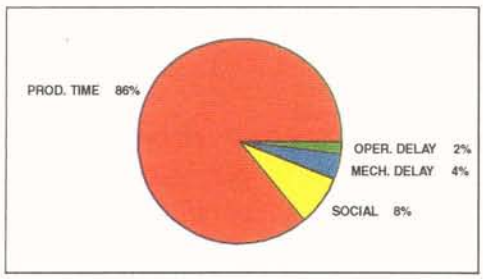
By contrast, for Wood's system all the machines had less than 3% "no work" time. "Interference" from all sources was less than 4%.

Both operations demonstrated flexibility to the extent that the loader, Hahn or Bell operators would perform other tasks such as manual processing, or assisting with rope changes, this is shown in the following figures as "Other work".

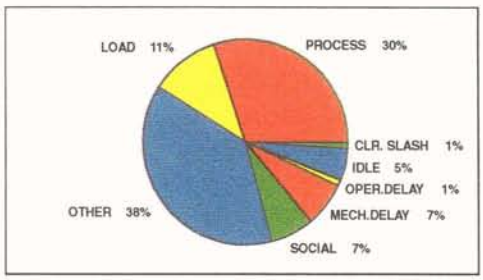
Kelly

The following charts illustrate time usage for machines in Kelly's operation:

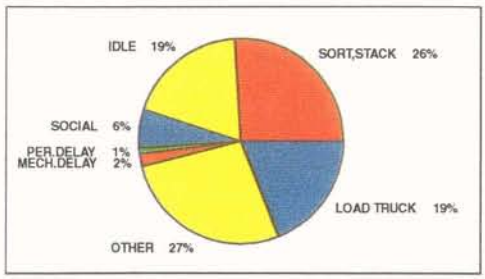
Figure 4 -Time distributions



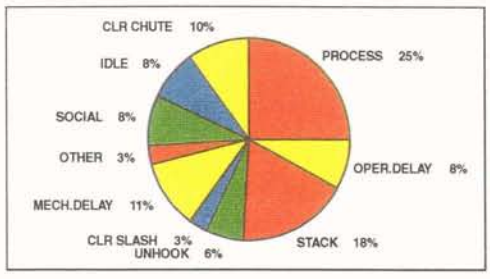
(a) - Hauler



(b) - Hahn and operator



(a) - Loader and operator



(b) - Bell and operator

In this operation, the hauler was setting the system productivity rate, but experienced no idle time because of its slow production rate and timely removal of trees from the chute by the Bell and the Hahn (Hauler cycle time ranged from seven to nine minutes, with 1.8 to 2 pieces per cycle).

The Hahn, the Bell and the Loader all had low levels of utilisation with their operators using "no work" time to carry out other tasks such as trimming, cross-cutting and assisting with ropeshifts. The loader loaded six trucks, with load times ranging from 17 to 20 minutes per load.

Hahn Productivity Estimate

The Hahn averaged 26 trees/PMH, with an average 3.7 logs being produced from each tree. Loading comprised 20%, and processing 72% of the productive work cycle. Slash was cleared every five trees, comprising 8% of the productive cycle time. Trees were "pre-loaded" (grappled and held in position) by the hauler operator 64% of the time. This took place while the Hahn was processing. The "Load" times for hauler-assisted loading were, on average, 60% faster than for Hahn only loading.

Maintenance was carried out during a 45 minute period at the end of the day. This involved greasing, turning the chainsaw bar, sharpening the chain and sometimes refuelling. All available members of the crew would assist. The Hahn would also be driven away from its position by the hauler so that the area could be cleared of slash.

Long-term Data

As part of a continuing record keeping process (Evanson, 1992), the Hahn operator recorded production, downtime and fuel use on a daily basis. The hauler operator also kept daily time and production records. Based on 43 days' Hahn records, with three different operators, an average 92 trees/day were processed (ranging from 23 to 215). At a rate of 26 trees/PMH, the Hahn would appear to be working productively for about 3.5 hours per work day.

Log Quality

Table 2 - Length (±5cm) and SED. Number of logs out-of-specification (± 5cm)

Length (m)	6.15	4.95	4.35	3.75
N	50	50	50	50
Length	1	0	3	4
SED	0	0	5	3

Of all the logs measured for length and SED, in each case, eight, or 4% were out-of-specification.

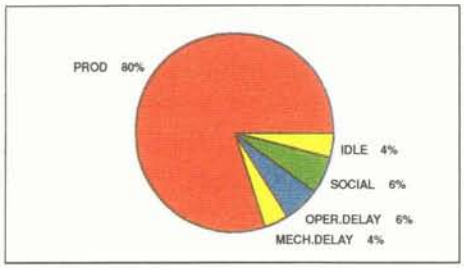
Delimbing : % Limbs flush trimmed (<2.5 cm stub)

Of the 60 logs assessed, 86% of 602 sampled limbs were flush trimmed.

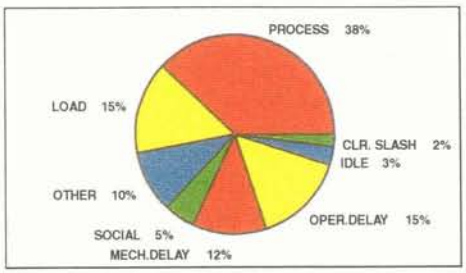
Wood

The following charts illustrate time usage for machines in Wood's operation :

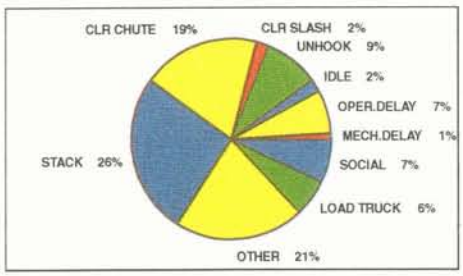
Figure 5 -Time distributions



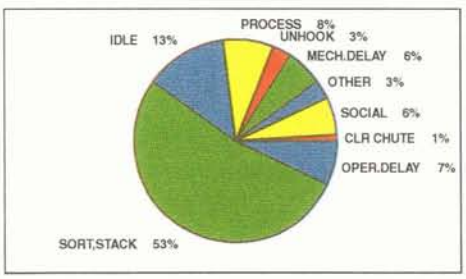
(a) - Hauler



(b) - Hahn and operator



(a) - Loader and operator



(b) - Bell and operator

In this operation, the hauler was also setting the system productivity rate, and experienced little idle time. Cycle time varied from 3 to 4.6 minutes, with 2.7 to 3.1 pieces per cycle. The Hahn, the Bell and the Loader all had high levels of utilisation and little idle time. The Hahn operator was also the main contractor and supervision and assistance to other parts of the operation accounted for 25% (Other plus Operational delay) of the total time. The "other work" component of Loader time occurred where the operator assisted with manual processing, ropeshifts and rope maintenance. The loader loaded three trucks, with load times averaging 15 minutes per load.

Hahn Productivity Estimate

The Hahn averaged 38 trees/PMH, with an average 2.9 logs being produced from each tree. Loading comprised 18%, and processing 81% of the work cycle. Slash was cleared on average, every 25 trees, comprising 1% of the productive cycle time. The operator speeded up the work cycle by frequently "grappling or pre-loading" a tree while cutting the sloven from the tree already in the Hahn. Trees were "pre-loaded" 60% of the time, usually during the cutting of the sloven. The "Load" times for pre-loaded loading were 42% faster than for "open-grapple" loading.

At the end of the day, when the rest of the crew had departed, the operator would process the last of the trees in the chute, then carry out maintenance on the Hahn.

Log Quality

Table 4 - Length (±5cm) and SED, number of logs out- of-specification (± 5cm)

Length (m)	11.15	6.15	4.95	3.75
N	50	50	50	50
Length	5	6	0	1
SED	3	6	2	5

Of all the logs measured, 12, or 6% were out-of-specification for length, and 16, or 8% were out-of-specification for SED.

Delimbing : % Limbs flush trimmed (<2.5cm stub)

Of the 60 logs assessed, 83% of 818 sampled limbs were flush trimmed.

CONCLUSIONS

Both Hahn harvesters demonstrated that they could be used to clear the chute, delimb and process trees in cable operations. The haulers were able to operate without interference from the processing activity of the Hahn. Productivity rates of the processors vary from 26 trees/PMH (3.7 logs/tree) to 38 trees /PMH (2.9 logs/tree) which compares favourably with rates of 29 to 36 trees/PMH reported by Hill, 1990.

The processing of large, heavy limbed or malformed trees was undertaken motor-manually thus optimising the effectiveness of the mechanised processing.

A key component in each of the two systems studied was the Bell Logger, required to sort and stack, and to clear the chute of trees for manual processing. Effective landing organisation was important, as using the Hahns divided the landing in two, with one side allocated to manual processing, and the other to sorting, stacking and loading.

Log quality produced by the Hahns was of a high standard, reflecting the care and skills of the operators, with 94% of logs being in specification for length, and 92% of logs being in-specification for small-end diameter. (This is an improvement over the length accuracy reported by Cossens (1991) where only 83% of logs were found to be in specification (±5cm)).

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For further information, contact:

LOGGING INDUSTRY RESEARCH ORGANISATION
P.O. Box 147,
ROTORUA, NEW ZEALAND.

Fax: 0 7 346-2886 *Telephone: 0 7 348-7168*