THE FOREST KING - INTRODUCTION OF IN-WOODS CHIPPING TO NEW ZEALAND

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INTRODUCTION

The purpose of this short paper is to summarise the highlights in the development of the Forest King 2318 mobile flail delimber-debarker-chipper. A brief outline of machine specifications is given. Productivity data are given for mobile landing work as well as for processing at a semi-permanent landing. The status to date of debarking quality achieved and the results of chip classification analysis are given.

The Forest King was designed and built in Rotorua by Wood Processors Ltd. It is presently producing in-woods chips from young radiata pine at Omataroa Forest for P. F. Olsen and Co Ltd to feed the Caxton Paper Ltd CTMP mill at Kawerau.

BACKGROUND

The project actually began in June 1989. Geoff Perfect and Colin Denholm had been to the United States to look at purchasing a debarker-chipper. Geoff decided to build one here in New Zealand rather than import one from overseas. Some components were ordered, including a chipper, two engines, a clutch and some hydraulic equipment. The first cutting torch was struck at Wood Processors Ltd shop in Rotorua in August 1989.

News of this development reached FERIC in Montreal from communication with LIRA by May 1990, and had picked up momentum by the time the LIRA board members visited Canada in June last year. My first introduction to the machine was in July 1990 when there was still some primer paint showing on parts of it.

The first logs were put through in Rotorua in early October. Chip samples taken at this time showed that bark content and chip size in radiata were good. Chip size in eucalypts was excellent, and bark percentage by weight was minimal, although light-weight eucalypt bark "hair balls" made their way into the chipliner.

The operational shake-down started in a 14 year old radiata thinning job in Matahina F forest block. Tree length was ground-skidded to, and stockpiled on bush landings. The chipper roved from landing to landing, working directly from the stockpiles.

For the benefit of a few of you who may not have seen the machine up close, the material flow is as follows:

An independent hydraulic knuckleboom loader feeds the trees in bunches or singly onto a live belt-type in-feed conveyor.

Trees up to a maximum of 58 cm diameter enter butt-first into the flail chamber and encounter two horizontal flail drums. 96 lengths of chains remove the limbs and break off the tops as required, and strip the bark from the bole of the trees. Trees then enter the gullet (maximum 45 cm) of the chipper. Pulpwood chips are blown into a parked chipliner. Flail debris is transferred onto a belt type elevator-conveyor which carries it away.

What is different about the Forest King and its cousins in North America?

A 600 HP diesel engine is dedicated solely to powering the chipper. A separate 240 HP diesel provides the hydraulics for the flail drums, conveyors and other circuits.

A 15 tonne excavator based on-loader feeds the Forest King. Being independent, the loader is free to re-position for best access to the wood piles.

The 5 metre long infeed trough is equipped with a powered conveyor belt.

A further 5 metre extension is provided with a powered support roller to facilitate feeding the longer trees which often go to 20 metres.

Digital read-outs are provided to monitor the lineal velocity of the rollers feeding the flail and the chipper. The chipper operator commands all the necessary functions by means of a hand-held remote control radio.

The belt debris elevator frame is hinged to fold up onto the top of the machine for transport, as is the infeed conveyor extension and the chipper spout.

DELIMBING QUALITY

When the machine first started, the raw material input was cleanly delimbed, topped tree length. This evolved rapidly into poorly delimbed tree length, and then to topped full tree.

The fact that more wood is presented to the flail in tree length than in full tree form is a function of skidding and materials-handling. At some point it becomes more economical to cut off the tops and some of the limbs rather than to skid a smaller number of full trees.

The same was true for arisings from cable-hauled clear-felled larger timber. By the time the trees were harvested, handled and carted to the chipper, there were no tops and few limbs remaining.

It became necessary to set up a special trial to establish if the flail on the Forest King could remove radiata branches and tops, and eliminate the debris effectively. In brief, the flail had no problem removing 5 cm diameter branches, and, any tops encountered were broken off at about 5 cm. There was no drop in chipping production rate, the bark content percent was lower than average, and the chip dimension classification stayed within mill purchase specifications. However, rumour has it the truckies involved in this test were not too happy about carting wood in full tree form.

It is obvious that debris disposal at the landing would become a problem if all trees arrived at the chipper intact with all their limbs and tops.

DEBARKING QUALITY

Chip samples were taken from over 80 of the loads produced between November and March. Bark content was 0.735 % average plus or minus 0.125 % at the 99 % Confidence Level.

CHIPPING QUALITY

LIRA staff had access to the Pulp and Paper Research Organisation (PAPRO) Williams classifier for analysis of chip dimensions. The results of 6 batches made up from samples from 18 loads of 14 year old radiata chips produced by the Forest King are as follows:

The "accepts" size range is 74 %, "pins" is 1%, and "fines" is almost negligible. The 32 mm oversize screen and the 10 mm overthick louvre retain 25 %. This is not due to length of cut or splinters but rather to "carding", which appears to be a characteristic of young green radiata, since samples from other chips produced by the Forest King show that oversize is less of a problem in Eucalypts, Douglas fir or old growth ratiata.

In analysis of chips from 18 year old radiata arisings, it was possible to isolate samples taken from 6 loads immediately before, and 6 loads immediately after chipper knife changes. There was no apparent change in the percent weight by chip size category except in the oversize area. Using dull knives **improves** (decreases) the oversize percentage. We are still pondering this phenomenon at the time of writing this paper.

PRODUCTIVITY AND UTILISATION

Two time studies were done at the "mobile" operation, one in December and 9 another in February. Another time study was done at a semi-permanent landing in March. The results are tabled below:

	Loads/ day	Green Metric tonnes per Load	per PMH	per SMH	Min/ Load*	Percent Util.**	Avail.
Study 1. Nov. 1990	7.3	29.5	31.7	26.8	36.1	54.6	90.0
Study 2. Feb. 1991	9.0	29.4	36.7	30.0	29.4	49.9	91.3
Study 3. Mar. 1991	12.0	24.4*	47.2	34.6	26.6	60.3	86.4

Table 1. Chipper Productivity, Utilisation and Availability.

** Utilisation is actual chipping time as a percent of total time.

* Load size decreases because the cartage route includes public roads.

Production increased from four loads per shift to eight during the first two months' operation.

Modifications were done to the machine during the Christmas shut down. This included the installation of a hydraulic oil cooler, the re-design to part of the debris elimination system, and powering the outer infeed support roller.

After modifications, and further improvements in operating technique, three trucks regularly made three trips per shift each (Study 2).

The unit was recently moved to a large landing to where wood is carted by truck. With reduction in moving time and improvements in operating skills, and the simplification of truck scheduling, production is now regularly twelve loads per shift (Study 3).

CONCLUSION

A locally manufactured flail delimber-debarker-chipper has been operated successfully for six months.

Production has consistently been 265 green metric tonnes of radiata chips per day in a mobile application and over 290 tonnes per day at a semi permanent landing. Bark content has averaged under three quarters percent in long logs, tree length and full tree.

Tests proving that it can remove radiata branches and tops have also shown no drop in productivity or chip quality. Chip dimensions are acceptable to mills, and more recently, for overseas sale in unscreened form.

It is obvious from the 60 % utilisation figure that the upper limit of the machine's productive potential has not yet been reached.