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SELECTIVE LOGGING TRIAL OF FMC IN INDIGENOUS FOREST

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INTRODUCTION

In February 1980 the Forest Service hired a FMC 220 Cable Arch tracked skidder from the Kaingaroa Logging Company. It was used for two weeks of trials in indigenous selective logging at Whirinaki State Forest.

The objectives were to compare the productive and environmental performance of the FMC with the commonly used tractors, in the same terrain and soil conditions.

The aim of selection logging in the indigenous forest at Whirinaki was to extract certain marked trees whilst minimising damage to the remaining stand. Developments over the past four years have established effective procedures for selection of trees, felling and log preparation, and location of skid tracks, roads, and landings. Further improvement possibilities were considered to be limited by the equipment available, and the environmental refinements had reduced production rate by approximately 30%. It was thus felt that the FMC skidder offered possibilities for increased production with further reduced ground and stand disturbance.

TRIAL CONDITIONS

The trial compared the FMC with a commonly used track laying tractor in the 135-150 kW (180-200 hp) class - in this case a Caterpillar D7E with blade and winch. The area contained between 125 m^3/hectare and 225 m^3/hectare of which 40-60% was extracted.

The topography covered a wide range of slopes with both uphill and downhill hauling and both wet and dry ground conditions. The soil types varied from deep pumice in the gully bottoms to steep rock and clay side faces, with broken clay and pumice on the ridge tops.

The slope range varied from plus 17.5^{o} to minus 17.5^{o}. Greater slopes were encountered but were travelled over too infrequently to ascertain any accurate results.

Both machines operated in virgin and previously worked bush, as an increasing amount of future production will come from previously logged areas.

TRIAL PROCEDURE Various sections of the Forest Service were called on to monitor and report on different elements of the trial.

1) The Kaingaroa Work Study Unit measured the performance of the machines.

2) The Rotorua Conservancy Mechanical Division reported on the mechanical performance and maintenance aspects.

3) The forest staff at Whirinaki colated and organised the various sections and data during the trial period.

EVALUATION AND RESULTS

The first part of the area was logged by the tractor before the trial started. This was done to put in the main haul track systems before measurements began. All minor tracking was left until the trial started.

The logging cycle was broken down into its basic elements and in the case of the medium distance (400 m) and medium load (5 tonne) the distribution of FMC cycle time was as follows:

Operation Elements	Minutes	Percent
Return empty to bush	2.94	21%
Positioning	.80	6%
Break out	3.31	24%
Haul loaded	5.77	41%
Drop and stack at landing	1.14	8%
TOTAL	13.96	100%

RETURN EMPTY The FMC was faster than the tractor in all slope classes, with performance ranging from 8.3% faster in the -12.5^{o} to -17.5^{o} class, to 25% in the +7.5^{o} to +12.5^{o} slopes. The longer the return empty distance, the greater the advantages the FMC had over the tractor.

Ground disturbance empty follows similar lines, the faster both machines travelled, the greater the advantages the FMC had. Similar damage occured where both machines turned sharp corners at high speed. The extra length of the FMC track frame caused slewing damage where as the grouser shape on the tractor caused the damage.

It became apparent during the trial that the preformed track was often a disadvantage to the FMC. The tractor had greater manoeuvrability, therefore the formed tracked with reduced grade improved its efficiency but increased the number of corners. The FMC would have been able to travel faster on steeper grades with fewer corners.

HAUL LOADED Again the FMC was noticeably faster than the tractor. With haul sizes varying from 3-9 tonnes, the FMC was between 27.4% and 50.4% faster than the tractor. This was most apparent with the largest haul sizes on the steepest slopes. On slopes greater than 13.0^{o} the tractor had to winch most of its loads, whereas the FMC carried loads of 9 tonnes plus on slopes exceeding 17.5^{o}.

The ability of the FMC to carry part of its load, significantly improved its traction. (The tractor was ground snigging throughout the trial.) However, because of the type of steering employed problems were experienced when turning under load. Therefore it is important to consider this when laying out tracks to reduce curves as much as possible.

Damage to the residual forest alongside the haul tracks was greater with the FMC, particularly on corners and side slopes. This is because stems were being held rigid on the machine, and when it turns it tends to sweep the tail of the log around the corner, rather than articulate it on the machine. Logs less than 6 m long caused more damage with the FMC than they did with the tractor, because of this tail sweep.

It was easier to load the FMC to the optimum because of the position of the arch and fairlead. Logs once attached to the butt rigging stayed on, whereas in some cases strops came free from the mainline hook of the tractor, when winching in steep country.

POSITIONING The FMC took 20% longer to position for loading, mainly due to its inability to turn on its own axis. The FMC was also slightly longer than the tractor. The increase in positioning time did not significantly increase the overall haul time.

Positioning of the FMC did however create some environmental problems. Its poor turning ability resulted in more virgin forest being disturbed while manoeuvring. It had to back under its load (especially with the larger pieces) to get traction for the break-out operation. The damage made by the machine backing to the log was slightly higher than the tractor winching to the main haul track from the stump, but not as bad as when the tractor backed from the haul track to the log.

BREAK-OUT The time difference in break-out was 3.8% longer with the FMC. This is insignificant and could have been reversed to the FMC's favour with operator experience. Until the trial the machine and operator had only worked in exotic clearfelling, which is vastly different.

The break-out element of the operation was different for both machines and therefore difficult to compare accurately. The tractor would normally sit on the main haul track and winch the logs to the machine. The FMC, because of its poor winching ability, found it necessary to back up to the load for break-out.

Although the FMC type operation was slightly more damaging than the tractor operation, modifications of the technique in tracking would reduce this damage.

DROP AND STACK AT THE LANDING The FMC was slower by some 17.8% (Drop also included fleeting). This element covers only a very short time and could easily be diminished by the FMC with more experience.

The FMC had more difficulty fleeting also, but managed satisfactorily.

UNTRACKED AREA The FMC spent almost one week in an untracked area to evaluate its capabilities without tracks. Information gained from this area proved that it could handle the situation more effectively than in the tracked area. The small push blade fitted to the front of the machine, in the same manner as a wheeled skidder, was adequate for minor tracking in extremely steep areas.

Where the machine was forced to travel through wet country without tracks, it had very little difficulty with mud up to one metre deep. The tractor had only minor difficulties in the same conditions when the mud was slushy. It could not travel through mud that had dried out and become sticky.

The tractor spent up to 15% of its time actually tracking in untracked country, whereas the FMC spent less than 5% in similar country.

Where only one tree had to be removed down a haul line, the FMC showed very little sign that it had travelled along the line. Small saplings and undergrowth up to 10 cm in diameter sprang back upright after it had passed over them. The upper layer of root fibre and leaf duff was only disturbed to about 5 cm depth (i.e. that is where the machine travelled in a straight line.)

The tractor, on the other hand, crushed all material flat and disturbed the ground to a depth of 10 cm.

CONCLUSIONS

The FMC proved that it is capable of doing log hauling tasks presently being carried out by conventional track-laying machines in steep or otherwise difficult country.

It proved superior to the tractor purely as a skidding machine. This comparison was, however, only as a hauling unit. The tractor had much better dozing ability.

To put the FMC type machine in its true context, it should really be considered as another option for log extraction, along with haulers, tractors, skidders. The FMC fits somewhere between a hauler and a tractor as far as the traditional methods used in New Zealand are concerned.

The difficulties encountered with positioning and break-out could easily be overcome if the operation was geared towards the FMC as the prime mover. Used in conjunction with a conventionally bladed and tracked machine it could handle all but the most difficult country - that would require a cable logging operation.

The FMC, with its high travel speed, has greater mobility to travel from site to site without the need for a transporter, and it can operate in both exotic and indigenous operations without modifications.

The FMC incorporates a lot of proven mechanical components. Most maintenance costs would therefore be expected to be about the same as a conventional track laying machine. The main difference lies in the track gear, and although costs in this area are expected to be higher, no experience based figures are yet available. The FMC is about 15% cheaper at purchase price than an equivalent horsepower crawler tractor.

The FMC met the selective logging objective well, by hauling 70% more than the current machines in use and required only 30% of the tracking that a current machine requires, thereby doing less damage. It did this with an operator who was new to the environmentally conscious logging methods and who had not worked in indigenous forests before.

Because of its high environmental acceptance, the FMC could have a far reaching use. Areas where ground damage, topography and conservation pressure are important governing factors in logging operations, would favour the use of such a machine.

A high degree of the trial success must be attributed to the conscientious manner the Kaingaroa Logging Company operator showed in his approach to an unfamiliar and extremely difficult operation.

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