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COMMERCIAL THINNING USING A NIAB 5-15 PROCESSOR AND A FORTRANS PROTOTYPE MINI-FORWARDER

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INTRODUCTION

Part of FERIC's commercial thinning program evaluates lower-cost equipment and methods of interest to small-scale operations. In December 1997, FERIC worked with Donohue St-Félicien Inc. and the Corporation d'Aménagement de la Forêt Normandin to study the Niab 5-15 tractor-mounted processor and the Fortrans MT 408 mini-forwarder during first and second thinnings in jack pine stands. The total cost of this system (processor, tractor, and mini-forwarder) was less than $150 000, an investment that can be recovered over a relatively short period given stable, reliable wood markets.

MACHINE DESCRIPTIONS

The Niab 5-15 processor with a remote-controlled winch was mounted on a 50-kW, four-wheel-drive John Deere 1840 tractor, with approximately 350 kg of counterweights added to balance the processor. Ewing and Lirette (1997) provide more details on the Niab processor and its operation.

The Fortrans MT 408 (Figure 1), a prototype mini-forwarder, was built by its owner–operator. The 50-kW, four-wheel-drive forwarder is driven by a two-range variable-speed hydrostatic transmission. Maneuverability is impressive as a result of the machine's short wheelbase (2.9 m), narrow width (1.9 m), and 30-cm ground clearance. A Majeco M120 grapple loader (3.5-m reach) mounts between the articulation and the bunk's headboard. The load bunk is designed for 2.4-m-long wood and the machine weighs 2.8 tonnes.

STUDY CONDITIONS

Two adjacent stands (both 54 years old) were located on well-drained sandy soils. The stand subjected to a first thinning contained 90% jack pine plus 10% poplar, spruce, and birch, whereas the stand that underwent a second thinning contained 94% jack pine and 6% poplar, spruce and birch. The terrain in both blocks provided unrestricted mobility for both machines (CPPA classification 2.1.1 and 1.1.1, respectively).

The first thinning was intended to remove 30 to 35% of the stand's basal area in the form of dominant and codominant trees of inferior quality and competing trees (i.e., thinning "from below"). The second thinning was intended to open the stand by removing defective and competing trees, thereby improving growing conditions for the residual trees. Table 1 summarizes the pre- and post-treatment stand conditions.

Figure 1. The Fortrans MT 408 mini-forwarder.

PRODUCTIVITY

In the second thinning, extraction trails were equally spaced at 30-m intervals. The Niab traveled backwards on each trail, winching stems across the entire width of the strip and depositing processed bolts on the opposite side of the trail. A similar technique was used in the first thinning, but the primary extraction trail followed the irregular stand perimeter. In both thinnings, trees targeted for removal were selected by the feller. Stems were processed into 3.6-m bolts, and 96% of the bolts were within 10 cm of their target length. Productivity was 3.7 m^3/PMH in the first thinning and 4.8 m^3/PMH in the second thinning (Table 2). The average cycle times per tree were 2.1 and 2.6 min, respectively, in the first and second thinnings.

Based on an average forwarding distance of 150 m, the average cycle times for the forwarder in the first and second thinnings were 22.2 and 21.2 minutes, respectively, for average productivities of 5.9 and 7.8 m^3/PMH (Table 3).

Table 1. Pre- and post-treatment stand conditions for the first and second thinnings

	First thinning			Second thinning[a]		
	Before	After	Diff. (%)	Before	After	Diff. (%)
Density (stems/ha)	1661	952	–42.7	942	698	–25.9
Basal area (m^2/ha)	32.8	19.2	–41.5	19.8	14.5	–26.8
Merch. volume (m^3/ha)	178.1	104.9	–41.1	123.1	89.6	–27.2
Average dbh (cm)	15.9	16.0	+0.6	16.4	16.3	–0.6
Average vol. per stem (m^3)	0.107	0.110	+2.8	0.131	0.128	–2.3

[a] Data provided by Donohue St-Félicien Inc.

Table 2. Summary of processor productivity

	First thinning	Second thinning
Study duration (PMH)	7.6	3.8
Avg. volume (m^3/stem)	0.129	0.209
Productivity		
bolts/PMH	76	77
stems/PMH	29	23
m^3/PMH	3.7	4.8
Estimated direct operating cost ($/PMH)[a]	90.33	90.33
Cost ($/$m^3$)	24.41	18.82

[a] Based on a two-worker crew (feller and processor operator) and 1600 SMH/year, excluding transport and supervision costs, as well as profits and other overhead.

Table 3. Summary of forwarder productivity

	First thinning	Second thinning
Study duration (PMH)	3.6	6.3
Average volume		
m^3/bolt	0.049	0.054
m^3/trip	2.2	2.7
Productivity		
bolts/PMH	120	144
m^3/PMH	5.9	7.8
Estimated direct operating cost ($/PMH)[a]	51.56	51.56
Cost ($/$m^3$)	8.74	6.61

[a] Based on 1600 SMH/year, excluding transport and supervision costs, as well as profits and other overhead.

DISCUSSION

The manual feller spent 82% of his time “waiting” in the second thinning compared with 23% during the first thinning. This higher percentage was partly due to felling fewer trees per hectare, which required less work from the feller, and was also due to the longer processing cycle. It should be possible to reduce unproductive “waiting” time for fellers by reducing strip width; this would shorten the winching distance and thus the processing time. In most studies of remote-controlled processors, maximum winching distances of 10 to 15 m were observed. Asking fellers to assist in choking and performing partial delimbing of larger stems would also make them more productive. The time distributions of the various elements in the processing phase were similar in both thinnings, though the cycle duration was longer in the second thinning as a result of handling the larger trees.

No damage to the residual trees was detected in the second thinning, but minor damage (4%) was observed in the first thinning, in which the processor's grapple/delimber struck some trees along the edges of extraction trails and removed some bark.

The forwarder's load bunk, which had been designed for 2.4-m logs, showed signs of bending under the strain of transporting 3.6-m logs, which extended beyond the bunk. Lengthening the bunk and repositioning the axle should improve this situation, but at the cost of an increased turning radius. Forwarding productivity was lower in the first thinning because the operator loaded less wood to account for the more difficult conditions when traveling out of the stand.

For further information, please contact:

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Fabricator/owner of the Fortrans mini-forwarder:
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Tel.: (418) 274-3526

REFERENCE

Ewing, R.; Lirette, J. 1997. Partial cutting with a Niab 5-15 tractor-mounted processor. For. Eng. Res. Inst. Can. (FERIC), Pointe-Claire, Que. Field Note Partial Cutting-12. 2 p.

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