Advantage
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Contents

Evaluation of the Waratah HTH-470HD multi-stem harvester head

Abstract

Processing more than one stem at a time during the harvesting of small trees can increase productivity. This report describes the results of two FERIC studies of the Waratah HTH-470HD multi-stem harvester head conducted in 2001. The ability to handle more than one stem at a time increased productivity by 25 and 39%, on average, compared with handling comparable stems one at a time. The delimbing quality and the length-measurement accuracy for sawlogs were comparable to those produced by conventional heads currently on the market.

Author
Jean-François Gingras
Eastern Division

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Introduction

Using single-grip harvesters often results in high wood costs when harvesting small stems, as is often the case in the boreal forest and in commercial thinning. Processing more than one stem per cycle would offer potential productivity increases under such conditions, and thus, reduced costs. Gingras (1999) described the first trials of a multi-stem single-grip head, the Timberjack 745. After these trials, the head was modified and improved, and is now being sold by Waratah Forestry Attachments as their HTH-470HD model.

This report describes the results of two FERIC studies of the HTH-470HD head conducted in 2001. The characteristics of this head, which is similar to but a bit larger than the Timberjack 745 described by Gingras (1999), can be found on the company's Web site (http://www.waratah.net/harvester-470.html). Briefly, the key elements that let this head efficiently process several stems at a time are the accumulator arms, which keep the cut stems vertical during felling, and the four hydraulically or mechanically linked feed rollers that prevent the stems from slipping during processing.

Results

The first study of the HTH-470HD head occurred in the operations of Abitibi-Consolidated Inc. (Charlevoix, Que., division) in June and July 2001, and a second study was conducted with Norbord Industries Inc. (Senneterre, Que., division) in September 2001. In the Charlevoix study, the head was mounted on a tracked Timberjack 608L carrier (Figure 1); at Senneterre, it was installed on a wheeled Timberjack 1270B carrier (Figure 2).

Figure 1. (*left*) The Waratah HTH-470HD head on a Timberjack 608L carrier in the Charlevoix study.

Figure 2. (*right*) The Waratah HTH-470HD head on a Timberjack 1270B carrier in the Senneterre study.

Table 1 describes the study sites and the results of our productivity studies. Although the average values are roughly comparable in both cases, the Charlevoix stands were more variable than the Senneterre stands in both density and stem volume.

The ability to handle more than one stem at a time increased productivity by 39 and 25% compared with harvesting similar stems one at a time. On average, multi-stem work cycles were longer than single-stem cycles (e.g., 0.54 min versus 0.49 min at Senneterre), but the ability to process more than one stem at a time in 30 to 40% of the cycles lowered the mean harvesting time per stem (e.g., 0.30 min/stem versus 0.49 min/stem at Senneterre). These productivity differences were greater than those obtained by Gingras (1999). Under the study conditions, the multi-stem option could represent an additional volume of nearly 300 m³/week for the contractor. Obviously, such productivity gains cannot always be guaranteed since they depend on several factors, including the operator's skill, the spatial distribution of the stems within the stand, and the mean stem volume.

Figure 3 illustrates the effect of DBH on the productivity with and without multi-stem processing over the range of study conditions. It's clear that as mean diameter increases, the advantage offered by multi-stem processing decreases. At a DBH of around 20 cm, the two curves meet, since it becomes difficult to process more than one stem at a time with larger trees.

The usual concern with multi-stem processing relates to the quality of the logs produced, and particularly the delimbing quality and length-measurement accuracy. In the field, we observed no difference in delimbing quality between logs produced by processing one stem at a time or with multi-stem processing. The five knives and four feed rollers of the HTH-470HD head seem to provide

Forest Engineering Research Institute of Canada (FERIC)

Eastern Division and Head Office
580 boul. St-Jean
Pointe-Claire, QC, H9R 3J9
(514) 694–1140
(514) 694–4351
admin@mtl.feric.ca

Western Division
2601 East Mall
Vancouver, BC, V6T 1Z4
(604) 228–1555
(604) 228–0999
admin@vcr.feric.ca

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Table 1. Results of the field studies at Charlevoix and Senneterre (n.a. = not applicable)

	Charlevoix		Senneterre	
Stand and terrain conditions				
Stand	Fir (86%) – Spruce (14%)		Spruce (65%) – Jack pine (35%)	
Density (stems/ha)	1570		1300	
Mean DBH (cm)	14.4		14.7	
Volume/stem (m^3)	0.102		0.098	
Volume/ha (m^3)	160		127	
Terrain – CPPA class	3.2.2(3)		3.1.1	
	Without multi-stem processing[a]	**With multi-stem processing**	**Without multi-stem processing[a]**	**With multi-stem processing**
Productivity				
Proportion of cycles with two stems (%)	n.a.	28	n.a.	25
Proportion of cycles with three or four stems (%)	n.a.	12	n.a.	6
Stems/PMH	113	157	123	154
Volume/PMH (m^3)	11.5	16.0	12.1	15.1
Difference (%)		+39		+25
Length-measurement accuracy				
Target length – sawlogs[b] (cm)		315		254 and 515
Proportion within ±5 cm of target length (%)		80		88

[a] The productivity without multi-stem processing was simulated by using the mean positioning and cutting times for single-stem cycles to replace the recorded positioning and cutting times in cycles that combined felling and multi-stem processing, and by reducing the number of stems per cycle to one. At Senneterre, a short-duration trial of strictly single-stem processing confirmed the validity of this simulation.

[b] Logs with a minimum diameter of 10 cm at the small end.

excellent contact with the stem surface during processing.

Table 1 shows that the proportions of sawlogs whose length was within 5 cm of the target length were 80 and 88%, respectively, for the Charlevoix and Senneterre operations. These values were comparable to the results obtained in other operations that used conventional heads (Plamondon 1999). Note that the head in the Senneterre study had been equipped with a larger measuring wheel specifically designed for multi-stem applications; this wheel is now standard

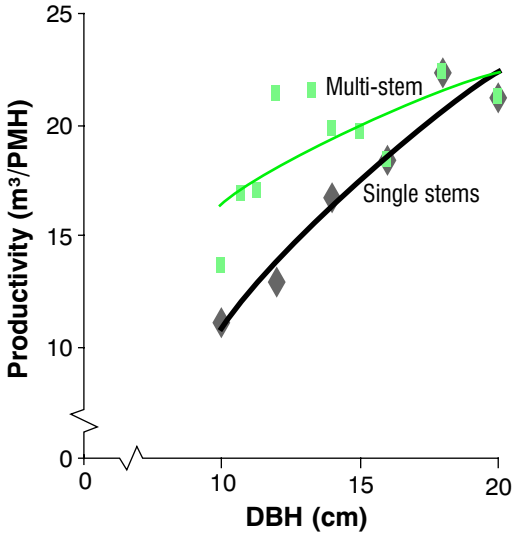

Figure 3. Effect of stem diameter on productivity with and without multi-stem processing.

equipment on the head (Figure 4). A larger wheel typically increases measurement accuracy since it is less affected by stem movements within the head during processing (Makkonen 2001).

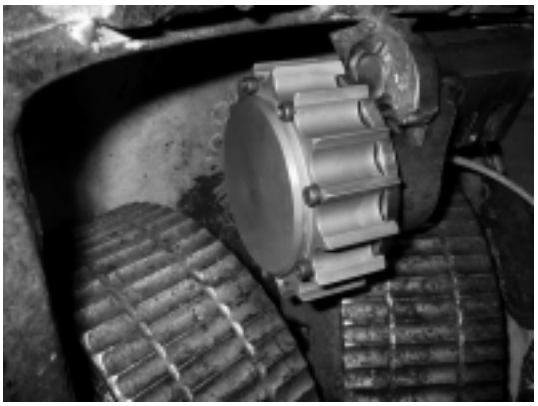

Figure 4. The large measuring wheel used for multi-stem application (photo courtesy of Y. Beaulieu, Waratah Forestry Attachments).

Implementation

Our studies clearly demonstrated the benefits of the Waratah HTH-470HD head's multi-stem technology, particularly the increased harvesting productivity with small trees. At a cost of around $160 000 (installation included), the head doesn't cost much more than other heads in its class, and thus represents an attractive option when purchasing a new or replacement head. Its relatively low weight (1285 kg) also makes it suitable for installation on most 16- to 20-tonne carriers.

It's not essential to handle stems of the same dimensions (DBH or length) during multi-stem processing cycles. However, large differences in DBH (more than 4 cm) can create problems during processing of the top-end logs, since the point at which the minimum utilization diameter arises may not occur at the same position on the stem.

Despite the head's good design, multi-stem processing poses the risk of quality losses, particularly in terms of length measurement; thus, operators should remain vigilant and conduct frequent quality checks of the logs produced by the head.

Since the head also works like a conventional head and suffers no penalties when it handles a single stem at a time, operators should avoid "forcing" multi-stem cycles under more difficult conditions such as occur in the spring, when branches are very flexible. As well, little time is saved by trying to harvest widely separated stems within the same cycle.

The greater productivity of the HTH-470HD head with small stems compared with conventional heads makes it an attractive tool in commercial thinning or in clearcutting in the boreal forest.

The accumulator that keeps felled stems vertical also provides benefits where the goal is to protect tall regeneration or in harvesting with the protection of small merchantable stems, since it allows the operator to control the fall of the felled stems.

When this report was written, approximately ten HTH-470HD heads had been sold in eastern Canada.

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