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TECHNICAL RELEASE
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FELLING SMALL TREES WITH A DRIVE-TO-TREE FELLER-BUNCHER

Surveys/Studies: feller-bunchers *May 2008*
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INTRODUCTION: Conventional forestry equipment is often used to harvest small-diameter trees. The typical ground-based logging operation is highly mechanized, with the most common using feller-bunchers, grapple skidders, and a chipper or grinder. But these machines may not be economical when used in pre-commercial or unmerchantable thinning operations in which the number of trees to be removed per acre is high but volume per tree is low. Published studies commonly find that feller-buncher productivity (tons/productive machine hour) is directly proportional to tree diameter. As tree diameters increase, the tons produced per hour increase, resulting in a lower cost per unit of wood produced.

Fig. 1: Loblolly plantation before harvest.

In a logging operation in which a loblolly pine plantation was being converted to a longleaf pine stand, small-diameter trees were removed and processed into fuel chips. A time study analysis was performed to determine the productivity of a drive-to-tree feller-buncher clear-cutting a 14-year-old loblolly pine plantation on the Shoal Creek Ranger District of the Talladega National Forest in Alabama. This analysis was part of a larger study that used a whole-tree harvesting system to produce fuel chips for co-milling with coal in a power plant.

Fig. 2: Hydro-Ax 670 feller-buncher at work.

Pre-harvest trees averaged 4.1 inches dbh and had a mean total height of 30.6 feet. The trees ranged in size from 1 to 8-inches dbh. Stand volume was estimated to be 90.13 tons/acre, including all stems measuring 1-inch dbh and larger. The stand also contained scattered oak, poplar, sweetgum, red maple, and longleaf pine. However, loblolly pine was responsible for 97% of the estimated volume. The operational terrain was mostly flat with gentle slopes ranging from 0 to 15%.

A 2003 Hydro-Ax 670 drive-to-tree feller-buncher was used to fell trees. The machine was equipped with a 205-horsepower diesel engine and a 2003 model Waratah FD-22 saw head. The feller-buncher had 9,039 machine hours at the beginning of this study. The operator had over 20 years of experience in operating logging equipment.

A continuous time study was performed by observing 48 cycles of the machine to determine the number of trees per drop and total cycle time. No other cycle elements were recorded. Each cycle was composed of 5 accumulations dropped on the ground, for a total of 240 accumulations, with time (in 0.01 minute increments) recorded by a stopwatch.

FINDINGS: The number of observations (48) proved to be a statistically large enough sample size to determine the average number of trees per drop and average time expended (minutes) per drop (***Table 1***). Using an average weight per tree of 0.091 green tons, the feller-buncher productivity achieved 59 green tons/productive machine hour.

Table 1: *Time study results of the Hydro-Ax 670 when felling small diameter trees.*

Parameters	Avg. No. Trees / Drop	Time (min) / Drop
Estimate	9.0	0.827
Standard Deviation	1.689	0.125
Coefficient of Variation (%)	18.77	15.11

CONCLUSION: Existing literature often reports low feller-buncher production rates in stands with smaller trees (3-inch average dbh or less). The feller-buncher productivity observed in this study was higher than expected. The gentle topography, uniform plantation, and operator experience created an environment conducive to high feller-buncher productivity. This study focused on using conventional, readily available equipment in a unique application that was not related to short-rotation woody crops. The machine tested does not represent a special alternative or technique for felling smaller trees.

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