Survey of drum debarkers in roundwood chipping yards of southeastern United States

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ABSTRACT: A survey of roundwood chipping facilities throughout the southeastern United States was undertaken, and the results pertaining to information collected on drum debarkers were summarized. The survey covered 76 roundwood chipping installations including 53 mill yards and 23 satellite mills. Drum debarkers are summarized by features such as drum size, rotation speeds, and manufacturer. Southern hardwoods did not debark as well as pines. Drum volume had an impact on hardwood debarking quality.

KEYWORDS: Chipping, drum barkers, logs, mills, southeastern USA, surveys, woodyards.

In 1990, the Department of Forestry at Mississippi State University completed an equipment survey of the major machinery components within roundwood chipping facilities throughout the southeastern United States. In conjunction with the equipment survey, samples of chips were collected from each disc chipper within the surveyed yards. The 76 woodyards (including 23 satallites) which participated in the survey were distributed over 12 states ranging from Virginia to Florida and Kentucky to Texas with the bulk of the responses coming from Mississippi, Georgia, Alabama, and Virginia. This paper summarizes the details collected on drum debarkers at that time. Various changes in chip mill design and installation have occurred since then.

Debarking methods

Drum debarking was the most common method of removing bark within the surveyed yards. Of the 76 yards recorded, 69 used rotating drums, 3 used ring debarkers, and 4 did not remove the bark prior to chipping.

Debarking within a drum was assumed to be by log tumbling, if the average log length into the drum was less than the drum diameter. Tumbling debarking occurred in 100 drums and parallel debarking occurred in 26 drums. The number of parallel debarking drums can be expected to increase with time, since this is currently the preferred method of drum debarking in new installations.

In some wood lines, a mixture of both long and short wood was introduced into the drum. Piggot and Thompson[1] have indicated that a mixture of both long and short logs results in a higher flow rate through the drum than either short or long wood used exclusively. When long and short wood were fed simultaneously into a drum, debarking was assumed to be by a parallel action. Also noted were yards where long and short logs were fed in the same line but in separate batch modes.

Drums using parallel debarking were commonly 24–27 meters in length, longer than most of the tumble drums. This additional length increases retention time within the drum to maintain debarking quality.

Yards with multiple lines processing both hardwood and softwood varied in their separation of the two wood types. Many yards put both softwoods and hardwoods through the same lines. Other yards, however, dedicated a line to one or the other of the fiber types. Several yards with a single line separated the fiber types by running the two in batch mode.

Drum dimensions

Drum dimensions varied both in length and diameter as shown in **Fig. 1**. Diameters ranged from 2.7-5 meters and lengths ranged from 13.7-30.5 meters.

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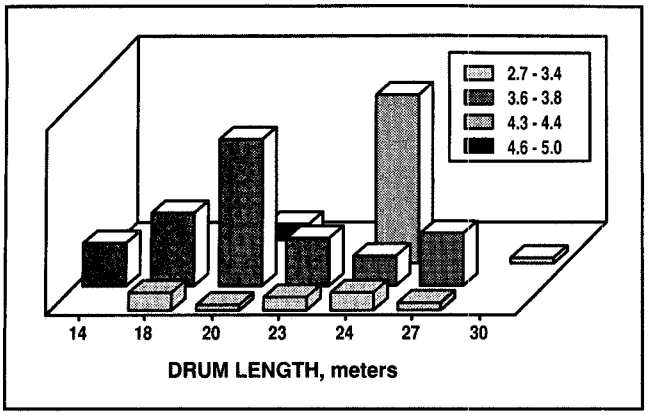
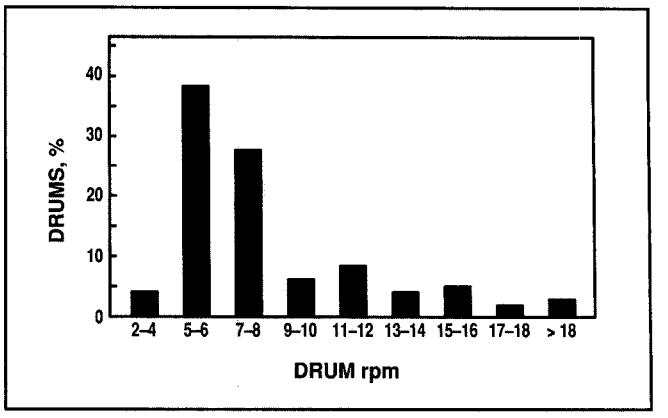
[1]Piggot, R. R. and Thompson, R. A., *Tappi J.* 70(8): 37(1987).

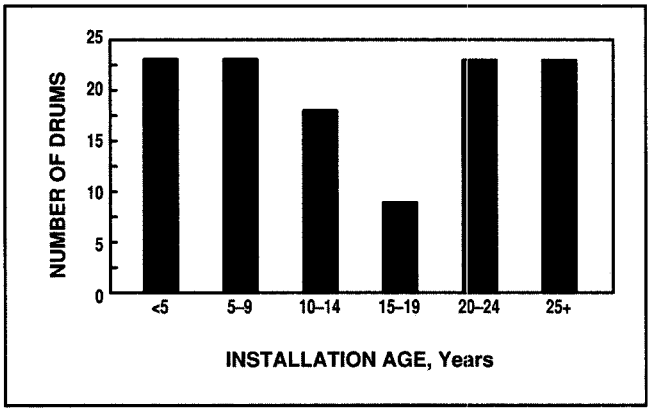
1. Number of variously sized drums



2. Variation in drum revolution speed



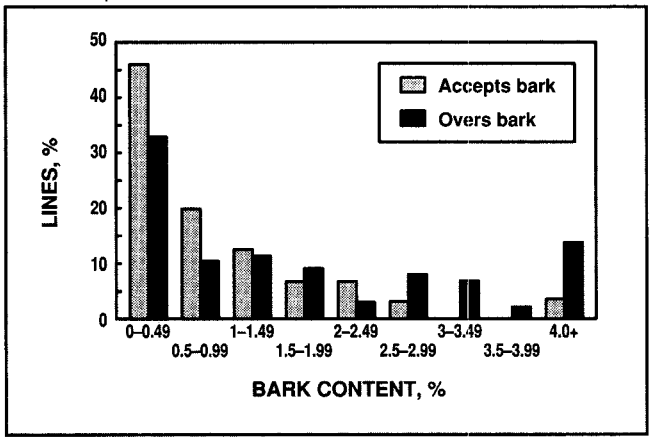
3. Variation in drum installation age



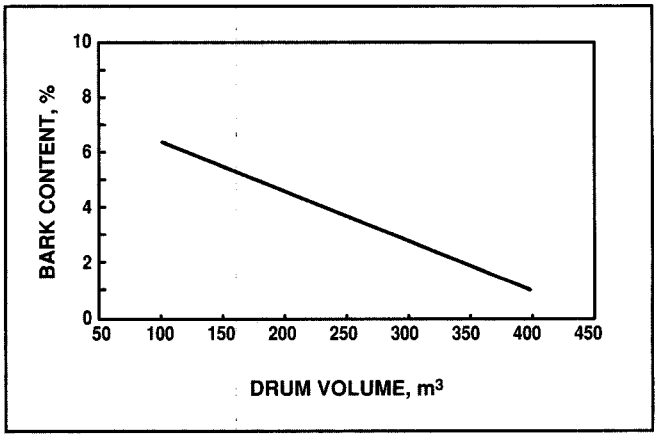
I. Difference in average debarking quality

Parameter	*Softwoods*	*Hardwoods*
Number of observations	64	20
Mean, %	0.8	1.5
Standard deviation	0.9	1.4

4. Distribution in bark samples found after chipping excluding bark fraction in pins and fines



5. Influence of drum volume on debarking of hardwoods



Certain drum dimensions, however, were more prevalent than others, particularly 3.7 x 20.4 meters and 4.4 x 24.4 meters.

Drum revolutions

Drum revolutions fell within the range of 3–21 rpm, with a rate from 5–8 rpm being most common as indicated in **Fig. 2.** No major trends were detected that might indicate the rationale by woodyard operators for selection of drum speed except for the fact that the smaller drums tended to be operated at higher revolutions. Illustrating this variation in drum speed, the set of 3.7 x 20.4 meters drums in the survey operated at speeds ranging from 3–20 rpm

with apparently similar operating conditions. Some of the newer hydraulically driven drums can be run at variable speeds with speed adjusted according to the time of the year.

The 4.4 x 24.4 meters drums were more commonly operated at 6–8 rpm, although there were examples of speeds up to 18 rpm in this drum size.

Drum installation age

Drums are usually built of 2.5–3.7 cm steel plate either as a single shell or in sections to facilitate replacement of individual sections as they wear. For example, the portion of drum at the in-feed end usually wears more quickly than the rest of the drum because it is subjected to a higher loading of grit from the entering logs. These sections may be replaced every 10 years or even as often as every 5 years.

The age of the drum installation was determined from the survey results. **Figure 3** shows that the average age since installation of the 126 drums within the survey was about 15 years, but the actual installation ages were spread from relatively new to 61 years.

Installation ages fell into two broad groups. One group consisted of ages below 10 years and the other comprised ages over 20 years. Fiber Making Process (FMP) manufactured 50% of the 126 drums included within the survey (primarily at millyards); 17% of the drums in the survey were built by Manitowoc; the rest were supplied by various vendors. Each of the 23 satellites had one drum.

Debarking efficiency

Drum debarking is an imprecise and indirect method of removing bark. The debarking action is not directly targeted at the cambium layer separating fiber and bark. Instead the process places logs in an environment where dynamic forces can act to cause the separation of fiber from bark.

Because of the imprecise nature of the debarking action and the variations in throughput, species, and climate, seldom is all of the bark removed from all of the stems prior to chipping. The chip samples collected from the chipper out-feed showed a range of bark contents with most being less than 1% bark, as seen in **Fig. 5**. The illustrated variation indicates the lack of control of the above variables affecting bark removal and of the changing standard of removal required by different mills.

In this analysis, bark contents for the pins and fines fraction were not measured for the chip samples classified. This was considered too time consuming for the number of samples analyzed. Bark contents of the accepts fraction were lower than for the overs. The overs fraction often had larger fragments of bark, which inflated the bark content proportion of this fraction.

Effect of wood type

An analysis of the chip samples showed that hardwoods had a significantly higher ($P<0.04$) proportion of bark remaining in the accept chips fraction than did softwoods. The average accept bark content for the hardwoods was 1.5%, while the softwood equivalent was 0.8% as shown in **Table I**.

An attempt was made with the available data to determine if any of the information collected within the survey of the drum characteristics could account for the measured variation in bark content. The variables considered in this analysis were drum dimensions and volume, parallel debarking or tumbling, and drum rotational speed. Since most of the samples were collected over the same period, the time of year was not included as an influence.

Previous controlled studies[2] have shown other factors which might be expected to affect debarking quality: drum fill rates (the percentage of drum volume filled with logs at any point in time) and drum retention time (how long the logs were retained within the drum). These could not be obtained, however, because of the method of data collection.

Within this uncontrolled and relatively simplistic study the softwood samples showed no significant relationship with most of the above variables. The hardwood samples, however, did show a significant relationship ($P<0.01$) with drum volume, although there was considerable variation about this trend ($r^2 = 0.32$). An explanation for this trend, as shown in **Fig. 5**, might be that hardwoods require greater dynamic forces to be debarked effectively and that these forces are better provided within the larger drums.

Summary

A survey of equipment in southeastern United States roundwood chipping yards highlighted the considerable variability in the dimensions and operating features of debarking drums. Drums varied not only in length and diameter but also in their rotation speed.

Although bark content of the chips was relatively consistent, softwoods had a greater proportion of their bark removed on the average than did hardwoods. With hardwoods, drum volume showed a relationship with debarking quality. The same relationship was not obtained, however, with softwoods.

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[2]Hedenberg, O., EUCEPA 1990 Conference, EUCEPA, Stockholm, p. 56.