

Whole-Tree Harvesting Of Pines With Taproot Attached

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The taproot of a 15- to 30-year-old slash pine, with lateral roots pruned away, weighs about 20% as much as the bark-free merchantable stem to a four-inch top (dry-weight basis). Maximum taproot diameter, a few inches below ground level, is 1.5 to two times stem diameter at breast height. Length in sandy loam soils is commonly three to five feet.

The fibers in such taproots are about one mm. longer, and the fiber cell walls are thinner, than those in wood above stump height. Chemical constituents do not differ greatly from those of stemwood. The taproot should therefore be suitable for pulping by the kraft process. (For additional details on roots, see pages 379-383, 535-574, and 1540-1543 of Agriculture Handbook 420, *Utilization of the Southern Pines*.)

It seems, then, that wood yields from a Southern pine stand could be considerably increased by harvesting the taproot. To this end, I advance the concept of first shearing the lateral roots close to the taproot, and then plucking the entire tree from the ground like a carrot.

It appears that the laterals are best left in the ground. They comprise less than one-third the weight of the total root system, and they greatly increase the difficulty of extraction. Further, their bulk would cause severe problems during handling, transport, and chipping.

Most laterals on Southern pines are within 18 inches of the surface. I visualize that they could be severed with a tubular shear sharpened on its lower edge and hinged like a clam-shell to encircle the tree.

To try the idea, an order was placed with Rome Industries of Cedartown, Georgia, to make a prototype tubular shear and to utilize a JD544A prime mover as a crane to lift the tree. The prototype was

Note: Mention of trade names in this article is solely for information, and does not imply endorsement by the U. S. Department of Agriculture.

tested during September 1973 with 15-year-old plantation-grown pines on dry, hard Georgia clay.

"Worked As Planned"

The concept worked as planned. During the first stage of harvesting the tubular shear was driven into the ground to sever the laterals.

Then the stem and taproot were lifted through the shear. The hole left by the root was small and quickly caved in as the felling machine traveled about the area.

Table 1 gives data illustrative of the trees harvested.

Considerably more force is required to shear the laterals than is needed to lift the tree after the laterals have been severed. With the tubular shear, it is likely that forces approaching 200,000 pounds will be needed to cut away the laterals of trees 30 years old. In the Georgia trials, dagger-like subsoil plows did a fairly good job and appeared to require less force than the tubular



Top: Taproot of 15-year-old slash pine as it appeared when lifted free of the ground still attached to the stem. Usual stump line is about where area of skinned bark begins.

Bottom: Hole left when tree was lifted. Surrounding the hole is slot cut by tubular shear that severed laterals prior to lifting.

shear. In current design efforts, both avenues are under study.

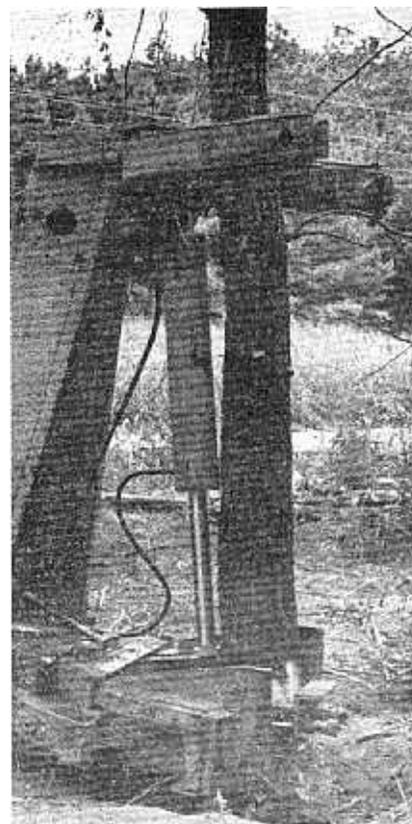
Once lifted free of the ground, stems with taproots attached can probably be yarded in the customary manner, but loaded for transport with root-ends alternated for compactness. On arrival at the mill mer-

chandizing deck, taproots will probably be severed from stems for special washing and chipping procedures. This special handling appears necessary because considerable dirt remains attached as the taproots come from the ground. Harvesting and handling will remove some bark,

Table 1.—Taproot dimensions and lifting forces for 15-year-old slash pines in hard clay soil

<i>D.b.h.</i>	<i>Taproot diameter at below-ground swell</i>	<i>Taproot length</i>	<i>Lifting force after laterals were sheared</i>
<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Pounds</i>
5-3/4	9	54	20,000
6	9	34	16,000
10	20	44	25,000

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This prototype whole-tree harvester grips a young pine near ground level and lifts it free with taproot attached. To minimize lifting forces, lateral roots must be sheared off first. The harvester is mounted on, and powered by, a rubber-tired prime mover.

and washing will take off additional amounts. It is probable, however, that significant quantities will remain on the roots when chipped.

A second prototype of the tree harvester is currently being designed. Should the research prove successful, it will permit owners of plantations in rock-free soil to harvest 20% more wood weight per acre than is customary.