Diameter, length, and planting site important in Georgia study

Furrow planting American sycamore cuttings

by
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Planting hardwood cuttings can offer several advantages over planting seedlings. Laying cuttings of relatively uniform diameter and length in a furrow poses fewer problems to machine planting than setting seedlings, especially since one axiom of successful hardwood plantation establishment seems to be: The larger the seedlings, the better. Cuttings can be custom grown to desired sizes, and clonal lines can be multiplied in short order leading to faster field testing and use of genetically improved stock. Furthermore, if two or more nodes are present on a cutting, the sprouts arising from each node can give rise to several sprouts or sprout clumps for each cutting planted. This is useful when trees are to be grown at close spacing, like those used in the short rotation hardwood concept (1, 5). Many techniques for mass production of hardwood cuttings are already available from studies with cottonwood (3).

American sycamore *(Platanus occidentalis* L.) is easily propagated vegetatively by cuttings obtained from young sprouts. Nelson and Martindale (4) planted various sizes of 1-year-old sprouts vertically in the ground during fall and spring. Cuttings larger than t/a inch in diameter survived and grew better than smaller ones, although survival was generally poor, ranging from 10 to 65 percent. The position on the sprout from which the cutting was obtained did not seem to make much difference. No statistical difference was found between fall and early spring planting with regard to first year survival and height growth. However, some root formation was observed on the fall planted cuttings during the following winter, a fact which might become important on some drier sites or in droughty years.

McAlpine *et al.* (2) laid 4-foot-long cuttings from 1-year-old sycamore sprouts horizontally in 3- and 6-inch deep furrows and covered them with soil. Planting depth did not make much difference in the relatively moist creek bottom in which they were planted. But weed control was critical. About 90 percent of the cuttings in plots with weed control had at least one sprout as compared to only about 50 percent in the plots without weed control. Some form of apical control was also observed in the sprouting pattern of the 4-foot cuttings. More sprouts emerged from their apical 12-inch portion than in the successive foot intervals toward the base.

The study reported here was designed to compare the survival and first year growth of cuttings of different diameters, lengths, and two ages on one favorable and one unfavorable sycamore site in the Georgia Piedmont.

Methods

In early February 1971, 1- and 2year-old sycamore stump sprouts grown under comparable conditions were cut near the ground line. Within 24 hours of harvest they were cut up into 12- and 18-inch cuttings on a hand saw. The *butt* (first) and second cuttings were retained and sized into those larger or smaller than 0.8 inches in diameter at the small end, except for those 1-year-old and 18 inches long. The available 1-year-old sprout material did not yield enough large cuttings so the diameter limit was dropped to 0.7 inches in that age-length category. Cuttings over 2 inches in diameter were not used. All cuttings were wetted and placed in lots of 50 in plastic sacks which were loosely tied and stored in a cooler at 40°F. until planting.

Two planting sites were selected. One was a level first bottom of the Oconee River in Greene County. The well drained Congaree sandy loam of this site had been disked repeatedly so that it was free of competing vegetation at the time of planting and well into the growning season. We considered this bottomland a favorable sycamore site.

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The second site was an abandoned field in the upland Piedmont with gently sloping soils, tentatively identified as a Davison sandy clay to sandy clay loam. It, too, was disked and was clear of competing weeds at planting, but a heavy stand of Johnson grass and annual weeds began growth when the weather warmed. We considered this upland site unfavorable for the sycamore growth.

In mid-March 1971, tractor drawn furrows, 4 feet apart, were opened, and cuttings (their centers also 4 feet apart) were laid flat in them (Fig. 1). The furrows were covered by tractor drawn plows so that the cuttings- were about 5 inches deep in the ground.

A randomized complete block design with four blocks was used on both sites. Each plot consisted of 50 cuttings in five rows of 10 cuttings each. The 2year-old, 18-inch-long cuttings of both diameter classes were not represented on the bottomland site.

Survival and height (groundline to terminal bud to the nearest 1/10 foot) were measured in the first dormant season after planting, the winter months of 1971-72.

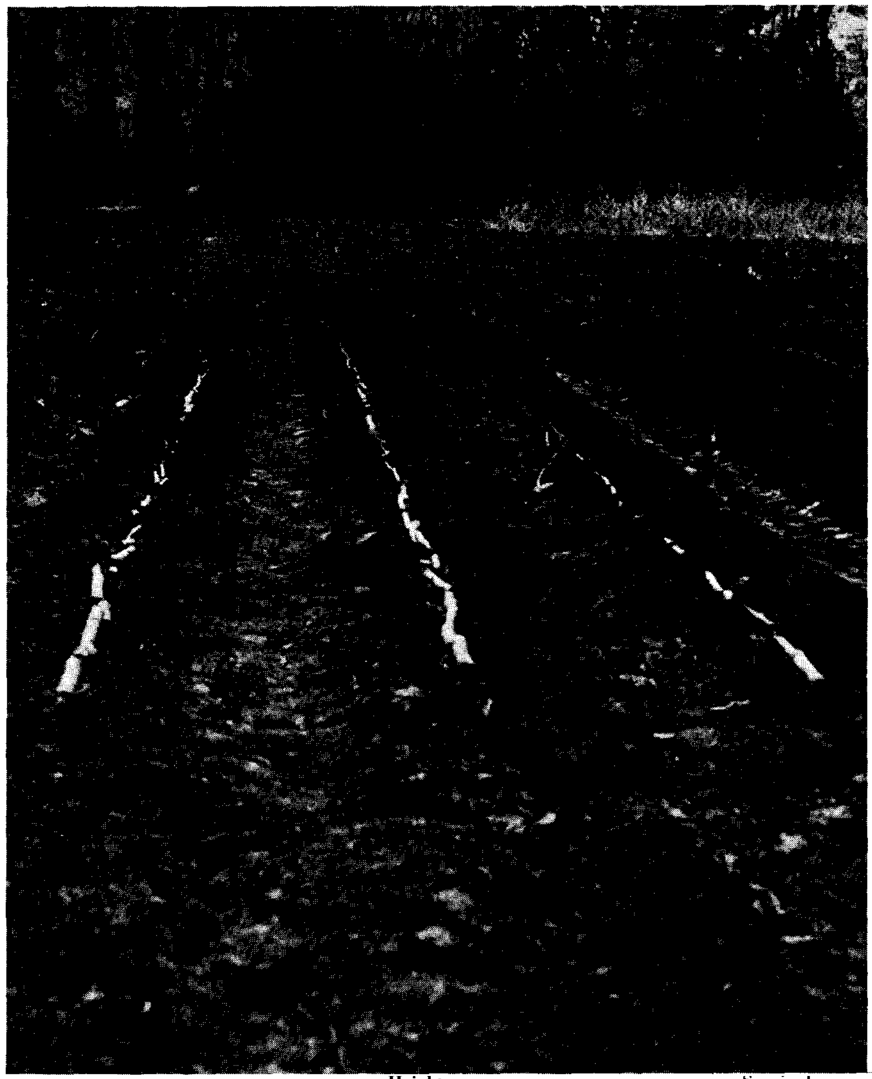

Figure 1.-Cuttings are in furrow ready to be covered with soil.

TABLE 1.—*Average height of the tallest spr*

Type of cutting				Height		Survival	
Age	Length	Diameter at small end limit	average	Upland	Bottomland	Upland	Bottomland
Years	Inches	*Inches*		*Feet*		*Percent*	
1	12	.8	0.91	1.25 ab[1]	4.77 cd	30 bc	72 a
1	12	.8	0.69	1.11 b	4.60 d	20 c	66 a
1	18	.7	0.59	1.40 a	6.27 a	47 a	68 a
1	18	.7	0.74	1.33 ab	5.53 b	20 c	87 a
2	12	.8	0.91	1.37 ab	5.49 b	24 c	86 a
2	12	.8	0.75	1.23 ab	5.09 cd	19 c	92 a
2	12	.8	1.00	1.41 a	–	46 a	–
2	18	.8	0.67	1.41 a	–	40 ab	–
			all				
Over all means			0.78	1.31	5.29	31	78

[1]Values in each column followed by a common letter do not differ significantly (.05 level, Duncan's Multiple Range Test).

Results and Discussion

Both the height of the tallest sprouts and the survival of the cuttings differed so markedly between the two sites (table 1) that no statistical comparison of the sites was necessary. Survival averaged nearly 50 percent more and the height growth nearly 4 feet better on the bottomland site. Speculation about the causes of the site differences would have to center around the more severe weed competition and the drier soil conditions of the upland site.

All cuttings survived equally well on the favorable bottomland site. Cutting characteristics did become important, however, on the adverse upland site. Three of the four 18-inch-long cutting categories survived significantly better than the shorter ones. Those of the larger diameter survived significantly better than the smaller ones, although these differences were overshadowed by the effects of differences in length. The age of the cuttings made little difference; the average survival of all 1-year-old cuttings was 29 percent, versus 32 percent for the 2-year-olds.

In contrast to survival, height growth on the bottomland was affected by cutting size. The largest 1-year-old cuttings grew significantly better than any other size-unfortunately the long 2-year-olds were not represented on this site-and the short 1-year-olds grew least. Height growth differences in the upland site were not very pronounced. Again, differences which might have been caused by cutting diameter were over-shadowed by the effects of cutting length. Age made very little difference, the 2-year-olds grew an average of 1.35 feet and the 1-year-olds 1.27 feet.

Both the volume (roughly $\frac{1}{4}\pi$ x diameter^2 x length) and the surface area (roughly π x diameter x length) of the cuttings are important to survival and growth. Volume is indicative of the stored starch reserves available for sprout growth until the new leaves can produce carbohydrates. The surface area of the cutting is important to its initial water household and, therefore, survival. Within the diameter and length parameters of this study, cutting length affected surface area and volume more than diameter.

Because diameter growth of sprouts is relatively limited during their first few years, it will be easier to manipulate cutting surface area and volume by changing cutting length rather than diameter. Limited field observations indicate, furthermore, that large diameter cuttings do not root and sprout as well as smaller ones. Perhaps the dormant buds responsible for new root and stem growth get buried deeply under the bark. A diameter of about 1 inch seems a reasonable optimum. Because cutting age had little effect on growth and survival in this study, it would seem best to grow sprout material for 2 years because of the higher percentage of useable cuttings obtainable from the older material. Previous research (2) with regard to the length of cuttings has shown that inhibitory mechanisms are active when the cuttings are 4 feet long and not all the nodes which could sprout actually do sprout. The technical difficulties in mechanically planting long cuttings also seem more formidable than those for shorter cuttings. So a cutting length of more than 12 inches and less than 48 is indicated and a compromise would be around 2 feet. These cutting dimensions are more important on marginal sites than on favorable ones.

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