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Research Note

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First-Year Growth and Survival Of Long Cottonwood Cuttings

W. K. RANDALL AND R. M. KRINARD

SUMMARY

When five Stoneville cottonwood clones were grown in a nursery for one season, lifted with about a foot of root, and planted in 3-foot deep holes, they averaged 9.6 feet in height growth and 92 percent survival after 1 year in the field. Planted height averaged 8.3 feet. The same clonal material planted without roots averaged only 36 percent survival.

These results do not imply that the standard method of planting 20-inch unrooted cuttings in the lower Mississippi River Valley should be changed. But where the aim is to grow large sawtimber and veneer trees at wide spacings (16 by 16 to 24 by 24 feet) or to alleviate deer damage without expensive fencing, or where early season cultivation may prove difficult, planting 1 -year-old rooted cuttings 3 feet deep provides an excellent, although more expensive, alternative.

Additional keywords: *Populus deltoides*, planting techniques, artificial regeneration.

Wide initial spacings in cottonwood (*Populus deltoides* Bartr.) plantations permit large crown development and rapid diameter growth, thus shortening rotation age for sawlogs and veneer and eliminating the need for small pulpwood thinnings. However. wide spacings (16 by 16 to 24 by 24 feet) require at least 90 percent survival of planted material to insure a future stand and full site utilization. The common practice of planting 20-inch-long unrooted cottonwood cuttings does not insure such survival. However, long cuttings-grown one season in a nursery, lifted with about a foot of the below-ground material attached to the stem, and planted in 3-foot deep holes-may provide the high survival needed. Furthermore, tall cuttings are visible during early cultivations when weed competition is heavy, probably require less intensive site preparation than standard cuttings. and need no fencing for deer protection. Obvious disadvantages to long, rooted cuttings are increased nursery and planting costs. This study compared first-year survival and growth of five Stoneville cottonwood clones when planted as four types of long cuttings.

METHODS

Five Stoneville clones were tested: 66, 67. 74, 238, and 240. The first three have been released for commercial use. Cutting treatments were (1) roots, no branches; (2) roots. with branches; (3) no roots, no branches; (4) no roots, with branches. Roots were about a foot long. Where roots were not included. stems were cut at ground level in the nursery. For treatments 1 and 3, branches were pruned before planting. All material had one growing season in the nursery.

The planting was established at 20- by 20-foot spacing on cleared ground at Hooker's Ridge, Warren County. Mississippi. Soil as Commerce silt-loam. considered excellent for cottonwood. Planting stock was lifted one day and planted the next in 3-foot deep holes 6

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inches in diameter made with a tractor-mounted auger. After a cutting was put in a hole, the loose soil was shoveled back in and tamped. Some settling occurred, which necessitated additional fill.

Planting was during the first week of February. and planted height of all trees was tallied. After the first growing season in the field, height and diameter of surviving trees were recorded.

A split-plot statistical design with 10 replications was used for height and height growth analyses. Plots were clones, and subplots consisted of one cutting of each treatment. For survival. a two-way analysis of variance was used with data transformed (arcsin $\sqrt{}$percentage).

RESULTS

At time of planting, the above-ground height of cuttings ranged from 5.0 to 10.7 feet and averaged 7.6 feet. Clonal differences were statistically significant: the mean for all treatments ranged from 7.1 feet for clone 240 to 8.3 feet for clone 238. Mean planted height of all rooted cuttings (8.3 feet) was significantly greater than that of all unrooted cuttings (7.0 feet).

Survival after the first growing season was significant],, better for cuttings planted with roots (92 percent) than for those planted without roots (36 percent) (table 1). Clones 66 and 67 were the only two clones exhibiting greater than 40 percent survival of unrooted cuttings. Branches had no effect on survival of rooted cuttings. Unrooted cuttings without branches survived better than those with branches (46 vs. 26 percent).

Because of the poor survival of unrooted cuttings, analysis of height after one growing season was limited to rooted cuttings. During the first year, height growth was significantly lower for clone 74 (8.8 feet) than for the other clones (9.5 to 10.2 feet) (table 2). By the end of the growing season, mean total height ranged from 16.6 feet for clone 74 to 19.1 feet for clone 238, which was significantly taller than all other clones except 67. Clones ranked the same for total heights as for planted heights.

A significant first-year height growth-clone-treatment interaction was obtained, but in no case was there a difference between rooted stock with or without branches within the same clone. The interaction accounted for 42 percent of the total variation in height growth; clonal differences accounted for only 21 percent of the total variation.

First-year diameters of cuttings planted with roots ranged from 2.1 inches for clone 74-branched to 2.8 inches for clone 240-branched. Maximum diameter of rooted cuttings was 3.0 inches, although an unrooted cutting of clone 240 grew to 3.1 inches.

Table 1 —*First-year survival of long* cottonwood *cuttings planted with* or *without* roots and *with* or *without branches*

Clone	With roots		Without roots	
	Without branches	With branches	Without branches	With branches
No	——————Percent——————			
66	90	90	70	20
67	100	90	60	40
74	90	90	40	10
238	90	100	40	20
240	80	100	20	40
Mean	90a	94a	46 b	26 c

'Means with same letter were not significantly different at the 0 05 level by Duncan s new multiple range test

DISCUSSION

This study indicates increased survival when roots are included on long cuttings, but rooted cuttings may not be necessary with different site-moisture conditions. On wet sites or areas subjected to prolonged flooding, rooted stock is superior to unrooted cuttings (Maisenhelder and McKnight 1968). Phares and White (1972) have shown that deep-planted. large cottonwood seedlings survived better than either 18- or 30-inch unrooted cuttings. Herpka (1974) found no differences in growth by age 11 years when comparing 2-year-old Euramerican hybrids planted with or without roots. but Euramerican clones generaliy have higher rootability than *P. deltoides* clones.

Some benefits of deep planting were demonstrated by Simon (1965). who found that roots developed vigorously at great depths and that root growth continued throughout the winter where soil temperature was 1 0°C. Additionally. deep-planted poplars did not shed their leaves during dry summers: thus. they made excellent second-season growth. Kaszkurewicz (1975) emphasized that survival and growth of cotton-

Randall formerly Silviculturist at the Southern Hardwoods Laboratory is now Geneticist Siuslaw National Forest Corvallis Oreg Krinard is a Mensurationist at the Southern Hardwoods Laboratory which is maintained at Stoneville Miss by the Southern Fores: Experiment Station Forest Service—USDA in cooperation with the Mississippi Agricultural and Forestry Experiment Station and the Southern Hardwood For. est Research Group

Table 2 —*First-year height growth and total height of long cottonwood rooted cuttings planted with or without branches*

Clone	Height growth			Total height		
	Without branches	With branches	Mean	Without branches	With branches	Mean
No.	feet					
66	10 1	92	9.6a	18.0	17.4	177 bc
67	95	95	9 5a	183	186	18.4ab
74	84	91	88 b	17 1	16.2	166 d
238	10 1	103	10.2a	18.7	19.4	19 la
240	92	10.2	9 7a	17.0	180	175 c
Mean	9.5a[1]	9.7a		17.8a	179a	

[1]Means with the same letter were not significantly different at the 0 05 level by Duncan s new multiple range test

wood can be improved when long cuttings are deep-planted, then mulched and bedded.

Presence or absence of branches did not affect survival or height growth of rooted cuttings. Branches reduced the survival of unrooted cuttings, but this reduction is unimportant considering the generally low survival of unrooted stock. In contrast to our observations, Marcel (1973) found that removal of *Populus* 'robusta' branches at time of planting improved first-year height and diameter growth. Admittedly. the true effect of branches is hard to discern because in a l-year-old nursery only border row trees have numerous and large branches and such trees were not included in our study.

The large clone X treatment interaction suggests the opportunity for testing specific clone-treatment combinations to achieve additional growth. However, this difference was not large.

Although good survival was obtained with long, rooted cuttings, mean first-year height growth of about 9 to 10 feet was less than that expected from standard cuttings on good sites. A 30-tree sample of an adjacent planting of standard 20-inch. unrooted cuttings at a closer spacing averaged 12.1 feet in height and 1.1 inches in diameter after the first year.

These results do not imply that the planting method now used in the lower Mississippi River Valley should be changed. They do, however, indicate that for specific situations where the aim is to grow large sawtimber and veneer trees rapidly by starting with wide initial spacings or to alleviate deer damage without expensive fencing, or where early season cultivation may prove difficult, planting l-year-old rooted cuttings 3 feet deep provides an excellent alternative.

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