Rooting Cuttings of Cottonwood, Willow, and Sycamore[1]

Abstract. Cuttings of *Populus deltoides, Salix nigra,* and *Platanus occidentalis* were collected monthly. All species rooted every month, but March was best and June was worst. Butt-cuts rooted better than second-cuts. Willow rooted and grew faster than cottonwood, which grew faster than sycamore.

During their early years, cottonwood (*Populus deltoides* Bartr.), willow (*Salix nigra* Marsh.), and sycamore (*Platanus occidentalis* L.) are among the fastest-growing American trees. Also, they are suitable for a wide variety of uses and grow over a wide geographical range. For these reasons, these species merit study of their silviculture and genetics, and an essential for both is an understanding of their vegetative propagation.

Previous studies (*1, 3, 4, 5*) have indicated that all these species reproduce from cuttings. There has been some indication that cuttings with a large diameter survive and grow better than smaller ones, and that long cuttings survive better than short cuttings.

Although Maisenhelder (*3*) advised that cuttings be collected in January and February the effect of the month of preparing cuttings has actually received little attention, other than the general assumption that cuttings should be made during the dormant season.

Another facet of vegetative reproduction which has received little attention for these species is the effect of the position in the stem of the cutting, although Nelson and Martindale (*5*) did find the butt-cut of sycamore grew more rapidly than upper cuttings.

Procedures

Cuttings were collected on the first Saturday of each month from October 1957 through September 1958 except that no cuttings were collected in August. Collections were made in natural seedling and sapling stands in the first bottom of the Atchafalaya River, in southern Louisiana.

Trees were cut near the ground line with a machete. From each stem, the basal 16-inch length was the butt-cut and the second 16-inch length was the second-cut. Only these two cuts were taken from each stem, regardless of total length. Diameter inside bark at the top of the cuttings varied from 0.2 to 1.9 inches, with the majority 0.3 to 0.8 inches.

Cuttings were set in a nursery bed on the same day they were collected. Each row four feet long in the bed was divided in two. One half-row, randomly selected, was planted with six butt-cuttings of one species and the other half was planted with six second-cuttings of the same species.

The total number of rows in a bed were separated into groups of three, and, in each group of three rows, one row was assigned at random to each of the three species. Enough rows were set in each bed to provide one row of each species to be lifted each month through June or for six months after planting, whichever was later.

Cuttings were set 12 inches into

TABLE 1.—ROOTING PERCENTAGE OF CUTTINGS

Month cut & planted	Position in stem: Butt-cut				Second-cut			
	Cottonwood	Willow	Sycamore	Mean[1]	Cottonwood	Willow	Sycamore	Mean[1]
	Percentage rooted							
October	92	98	94	95	75	67	96	81
November	92	98	83	92	81	73	73	76
December	88	85	69	81	77	77	62	72
January	78	72	67	72	61	75+	67	68
February	83	83	83	83	78	81	83	81
March	83	100	100	98	83	87	100	93
April	58	72	78	70	36	53	69	53
May	39	50	8	30	17	17	0	8
June	11	39	17	21	6	3	0	2
July	37	70	30	46	27	20	13	20
August	—	—	—	—	—	—	—	—
September	44	94	61	69	44	83	22	50
Mean[1]	67	82	66	72	53	57	52	54

[1]Because percentages are based on less than 100 observations (6-8 replications of 6 samples each) means were obtained by converting each percentage to the angle = Arc sin √percentage (as given by Bliss, 1937 [Snedecor, 1953]), calculating the arithmetic mean of the angles, and converting the mean to the corresponding percentage.

[1]The observations reported here were made while the author was assistant professor, Louisiana State University School of Forestry.

TABLE 2.—ANALYSIS OF VARIANCE, PERCENTAGE ROOTED

Source of variation	Degree of freedom	Sum of squares	Mean square	Variance ratio	Significance
Position	1	1,876.26	1,876.26	37.52[1]	High
Month	10	22,604.07	2,260.41	45.20[1]	High
P × M	10	500.07	50.01		
Species	2	624.11	312.06	8.38	High
S × M	20	3,061.17	153.58	4.12	High
S × P	2	183.01	91.50	2.46	No
Residual	20	745.11	37.25		
Total	65	29,593.80			

[1]Based on P × M mean square.

TABLE 3.—INTERACTION OF SPECIES AND MONTH OF COLLECTION

Period	Species		
	Cottonwood	Willow	Sycamore
	Percentage rooted		
October-December	84	83	80
January-March	78	83	83

the ground, leaving a 4-inch top above ground.

A group of three rows, one row of each species, was lifted from each bed each month after setting the cuttings out. Top diameter of the cutting and total stem length of the longest shoot were measured, in addition to noting whether rooting had occurred.

Results

As shown in Table 1, the percentage of cuttings which rooted was high from October through March, dropped abruptly in April to a minimum in June, then began to increase. Some cuttings rooted regardless of month of collection, and the best month yielded nearly 100 percent rooting for all three species.

The apparent differences between month of collection, species, and position are all highly significant (Table 2).

Less apparent is the significant interaction between species and month of collection. Close inspection of Table 1, however, shows that the best month for cottonwood collection was November, whereas March was best for willow and sycamore. Similarly (Table 3) cottonwood collected during the October-December period rooted better than when collected in January-March; willow averaged the same for both periods; sycamore rooted slightly better when collected in January-March.

Growth (Table 4) was best for cottonwood cut December through March; willow cut December through April; and sycamore cut November through April. Willow grew fastest; sycamore slowest.

Growth differences between species and months were highly significant (Table 5); differences associated with position in the stem were significant.

Although inspection of the data indicated that stem growth was directly related to top diameter of the cutting, the correlation was not statistically significant for either butt-cut or second-cut for any of the three species, except the butt-cut of willow for which the relationship was barely significant at the 95-percent level of confidence.

TABLE 4.—LENGTH OF SURVIVING STEMS JUNE 1 OR FIVE MONTHS AFTER PLANTING, WHICHEVER IS LATER

Month cut & planted	Position								
	Butt-cut				Second-cut				
	Cottonwood	Willow	Sycamore	Mean	Cottonwood	Willow	Sycamore	Mean	Month mean
	Length in feet								
October	1.7	2.0	1.1	1.6	0.5	2.1	0.8	1.1	1.4
November	2.0	2.9	1.9	2.3	1.2	2.0	1.2	1.5	1.9
December	3.2	3.8	1.7	2.9	3.2	3.3	1.4	2.6	2.8
January	2.6	3.3	2.6	2.8	3.8	3.9	1.5	3.1	2.9
February	3.9	3.8	2.1	3.3	4.0	4.4	1.6	3.3	3.3
March	3.8	4.8	2.2	3.6	4.4	4.4	1.4	3.4	3.5
April	1.4	5.1	2.5	3.0	3.9	2.9	2.0	3.0	2.0
May	2.0	3.2	0.0	1.7	2.4	0.0	0.0	0.8	1.3
June	0.6	1.5	0.0	0.7	1.3	0.8	0.0	0.7	0.7
July[1]	1.4	1.4	0.5	1.1	1.2	1.4	0.0	0.8	1.0
August	—	—	—	—	—	—	—	—	—
September[1]	0.4	1.3	0.2	0.6	0.0	1.6	0.2	0.6	0.6
Mean	2.1	3.0	1.4	2.2	2.4	2.4	0.9	1.9	2.0

[1]Growing season after planting less than five months.

TABLE 5.—ANALYSIS OF VARIANCE, SHOOT LENGTH

Source of variation	Degree of freedom	Sum of squares	Mean square	Variance ratio	Significance
Position	1	1.03	1.03	5.28[1]	Yes
Month	10	72.15	7.21	37.00[1]	High
P × M	10	1.95	0.20		
Species	2	28.50	14.25	28.16	High
S × M	20	9.56	0.48	0.90	No
S × P	2	2.19	1.10	2.05	No
Residual	20	10.68	0.53		
Total	65	126.07			

[1]Based on P × M mean square.

Discussion

The experimental design had two flaws. Since all cuttings collected in one month were planted in one nursery bed the effects of month of collection were confounded with bed. Although bed effect is unlikely to have been of any appreciable importance, the apparent dip in rooting percentage and lag in growth of the January collection may possibly have been associated with the nursery bed used. The question can only be resolved by further studies, which the writer is no longer in a position to make.

Another difficulty, probably with more effect, is that cuttings planted before May were not allowed a full growing season before lifting. Quite possibly all cuttings planted before February would have been as tall as, or taller than, the February, March, and April cuttings if growth comparisons had been made

at the end of the growing season, a period of more practical significance than the five months used. Again, the question can be resolved only by additional studies.

In spite of the foregoing, however, the results obtained are very encouraging. Rooting was obtained from a substantial percentage of cuttings collected throughout the year, for all three species. Doubtless the use of refined greenhouse techniques could produce even better results.

Although rooting percentage and growth of the second-cut were significantly less than those of the butt-cut for all three species, each stem did produce more than one cutting. An informal trial which accompanied the study indicated that at least as many as eight 16-inch cuttings can be rooted from a single stem.

Summary

Cuttings of cottonwood, willow, and sycamore were collected monthly through the year and set in nursery beds.

Every species yielded an appreciable percentage of rooted cuttings every month. The best month was March; the worst month was June.

Willow rooted more cuttings than cottonwood or sycamore, and those which rooted grew faster. Cottonwood grew faster than sycamore.

Butt-cuts yielded more rooted cuttings than second-cuts, and those which rooted grew faster.

Shoots on cuttings with larger top diameters appeared to grow more rapidly, but only for butt-cuts of willow was the correlation statistically significant.

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