The Influence of Collection Time and Storage Temperature on Populus Hardwood Cutting Development

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Rooting and bud break of cuttings of Populus hybrids occurred more rapidly the later they were harvested during the dormant season. Storing cuttings harvested in November at certain temperatures could partially fulfill *chilling requirements for normal rooting and bud break.*

Hybrid poplar plantations in the northern Lake States are commonly established from dormant cuttings collected in midwinter and stored in unheated shelters or cold rooms for several months until spring. However, little is known about the effects of collection time or storage temperature on cutting performance after planting. Studies by Farmer (*1*) with cottonwood *(Populus deltoides* Marsh.) and Gemperle (*2*) with white poplar *(Populus alba* L.) showed that rooting performance was better for cuttings taken in late winter than for those collected in early winter. Smith and Wareing (*3*) found bud development and rooting of dormant cuttings of *Populus* x 'Robusta' Schneid. were significantly affected by certain constant or variable temperature regimes.

We tested cuttings from four hybrid poplar clones to assess the importance of collection time and storage temperature on root and bud development after planting. We also tested them to determine whether chilling requirements of fall-collected cuttings could be satisfied by certain cold storage temperatures.

Materials and Methods

The clones chosen for the study were:

Parentage	*Source No.*
1. *Populus x euramericana* (Dode) Guinier cv. Wisconsin # 5	5377
2. *Populus x euramericana* (Dode) Guinier	5323
3. *Populus* spp.	5351
4. *Populus alba* L. x P. *grandidentata* Michx. cv. Crandon	5339

The first three of these are easy to root and the last is difficult to root.

To test the effect of collection time, 1-year-old shoots from stool beds were collected from several trees of each clone on November 9, December 9, January 9, February 9, and March 9. Cuttings approximately 8 to 12 millimeters in diameter and 20 centimeters long were made from the middle third of the shoots. Sixteen cuttings were taken on each collection date from each clone. Within a day after collection, the cuttings were planted 10 centimeters deep in Spencer-Le Maire Rootrainers containing a 3:1:1 mix of peat moss, perlite, and vermiculite and placed in a greenhouse. An 18-hour photoperiod was maintained by supplementing the daylight period with 150-watt incandescent flood lamps. A minimum air temperature of 21° C was maintained and cuttings were watered as necessary. Cuttings received no fertilizer.

To test the effect of storage temperature, additional cuttings from each of the four clones were taken on November 9. Batches of 16 cuttings of each clone were stored in plastic bags for 4 months at temperatures of -17.8° C, -3.9° C, and 2.8° C. In a fourth treatment, cuttings were stored for 2 months at 7.2° C followed by 2 months at 2.8° C. On March 10, the cuttings were removed from storage, potted, placed in the greenhouse, and treated in the same manner as cuttings for the time-of-collection test.

Measurements of rooting percentage, number of roots per cutting, and root growth (as measured by the longest root) were made periodically after planting for all cuttings. Because the test was exploratory in nature, treatments were not replicated; and no attempt was made to determine statistically significant differences among treatments or clones. The batches of cuttings were shifted on the greenhouse bench every week to reduce environmental differences.

Results

Generally, all aspects of rooting increased the later the cuttings were collected. Time-of-collection differences were especially evident at the first measurement, 10 days after potting (table 1). About 20 days after potting, all cuttings of the easy-to-root clones had rooted except for 6 to 20 percent of those collected in November. As expected, "Crandon" showed the least response with no detectable rooting at the 10-day measurement for any collection date. At the 20-day measurement, however, "Crandon" cuttings collected in March had the highest rooting percentage (44 percent) of any collection date.

As with rooting, bud break of all clones occurred more rapidly in the later collections. Bud break in relation to rooting varied by clone. Clones 5377 and 5323 began to root before any sign of bud break was evident, whereas both rooting and bud break of 5351 took place by the 10-day measurement. Bud break of "Crandon" was the slowest of any clone, especially in the early collections with no perceptible development before 2 to 3 weeks after potting.

Storage temperature also affected root and bud development (table 2). As in the time-of-collection test, the degree and rate of response varied by clone. By 10 days after potting, almost all cuttings of the easy-to-root clones stored at the two higher temperatures had rooted, while comparatively few stored at the lower temperatures had rooted. By 22 days, however, at least 90 percent of all cuttings had rooted and broken bud. The average number of roots per rooted cutting did not appear to be affected by storage temperature.

A comparison of rooting performance among November cuttings potted immediately, November cuttings stored for 4 months at2.8°C, and March cuttings potted immediately indicated a consistently slower rate of rooting for the unstored November cuttings in both the number of rooted cuttings and the number of roots per rooted cuttings (tables 3 and 4). March

Table 1.—*Rooting performance (10 days after potting) of Populus cuttings collected in December, February, and March*

Clone	Rooted cuttings			Average roots per rooted cutting			Average longest root length		
	Dec.	Feb.	March	Dec.	Feb.	March	Dec.	Feb.	March
	Percent			*Number*			*Millimeters*		
5377	6	50	69	1.0	2.9	3.1	3	6	14
5323	13	25	56	2.5	2.8	3.0	3	7	16
5351	56	56	100	1.8	5.2	7.4	3	6	25

Table 2.—*Rooting and bud flush of several Populus clones (10 days after potting) cut in November and stored for 5 months at various temperatures*

Clone	Percentage of rooted cuttings				Percentage of cuttings with one or more flushed buds			
	-17.8° C	-3.9° C	2.8° C	7.2° C+ 2.8° C	-17.8° C	-3.9° C	2.8° C	7.2° C+ 2.8° C
5377	19	6	81	69	0	0	100	100
5323	0	0	56	56	0	0	100	32
5351	62	38	100	69	6	0	100	94
5339	0	0	8	4	0	0	71	71

Table 3.—*Rooting percentage of stored and unstored cuttings of several* Populus *clones*

	Clone 5377			Clone 5323			Clone 5351			Clone 5339		
Days after potting	November Stored 2.8° C	November Not stored	March Not stored	November Stored 2.8° C	November Not stored	March Not stored	November Stored 2.8° C	November Not stored	March Not stored	November Stored 2.8° C	November Not stored	March Not stored
10	81	—	69	56	—	56	100	—	100	8	—	0
15	—[1]	75	—	—	56	—	—	81	—	—	0	—
22	100	—	100	100	—	100	100	—	100	30	—	44
32	—	94	—	—	80	—	—	94	—	—	25	—

[1]Not applicable.

Table 4.—*Average number of roots of stored and unstored cuttings of several* Populus *clones*

	Clone 5377			Clone 5323			Clone 5351			Clone 5339		
Days after potting	November Stored 2.8° C	November Not stored	March Not stored	November Stored 2.8° C	November Not stored	March Not stored	November Stored 2.8° C	November Not stored	March Not stored	November Stored 2.8° C	November Not stored	March Not stored
10	2.0	—	3.1	2.0	—	3.0	4.4	—	7.4	1	—	0
15	—[1]	1.3	—	—	1.6	-	—	2.7	—	—	0	—
22	5.3	—	10.1	16.2	—	21.4	8.8	—	13.7	1.6	—	1.6
32	—	2.4	—	—	4.8	-	—	5.1	—	—	2.8	—

[1]Not applicable.

cuttings had the highest average number of roots of any treatment, but differed little in number of rooted cuttings from the stored November cuttings.

Bud development of all clones was most rapid on the November cuttings stored at 2.8° C and was slowest on the unstored November cuttings.

Summary

Dormant cuttings collected in late winter developed more rapidly than those collected in early winter. This more rapid development should benefit early growth and survival of field plantings. How late in the winter dormant cuttings might practically be collected and processed will depend on how early the spring is and the demands of other nursery operations. In areas where deep snow and low temperatures during midwinter and late winter make collection difficult during that period, it appears from our study that cuttings can be collected in early November and then stored at certain temperatures to fulfill, at least partially, the cold-conditioning requirement for normal rooting and bud development. Cuttings collected in November and stored at2.8°C generally developed more rapidly than cuttings stored at below-freezing temperatures. However, it is doubt

ful that cuttings could be stored above freezing for extended periods without breaking dormancy, depleting food reserves, or being damaged by fungi. If cuttings are collected in late winter, it may be necessary to store them at below-freezing temperatures because they tend to develop rapidly. Further study of various storage temperature regimes such as raising the temperature above freezing for a short time before the end of the storage period may overcome the delay in root emergence and bud break caused by subfreezing storage temperatures. However, additional testing under a more closely controlled environment would be needed to compare more precisely the performance of stored versus nonstored cuttings. Subsequent field tests are also needed to evaluate these treatments fully as potential nursery and planting practices.

Literature Cited

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