ROOTING GREENWOOD TIP CUTTINGS OF A DIFFICULT-TO-ROOT POPULUS CLONE

With 76°-85° F media temperature and 2000-4000 p/m IBA-NAA hormone treatment, 70-100 percent rooting was obtained.

Edward A. Hansen, Howard M. Phipps, and **David N. Tolsted**
Forest Service, U.S. Department of Agriculture, North Central Forest Experiment Station, St. Paul, Minnesota

Many *Populus* hybrids show promise for highly productive forest plantations because of their rapid early growth and high yield. Clones are propagated vegetatively to retain their desirable genetic characteristics (*2, 3*). One very promising clone is a *Populus alba* L. x *P. grandidentata* Michx. hybrid (Crandon). Once established, it grows rapidly and produces wood with excellent fiber qualities. However, often less than 50 percent of the cuttings root, making it difficult to establish successful plantings.

Elevated bed temperatures and treatment with rooting hormones are known to favor the rooting of many difficult-to-root species *(5).* Hormones have been found to stimulate rooting of both dormant stem cuttings *(7)* and greenwood cuttings *(1, 4)* of some *Populus*. So we tested the effects of various temperatures and hormone concentrations on rooting performance of Crandon greenwood branch tip cuttings.

Materials and Methods

Stock plants started from dormant hardwood cuttings were winter grown in unsterilized peat-vermiculite-perlite medium in a greenhouse. The 3-4 inch tips of the branches were clipped and the base of each cutting was dipped for 5 seconds in a hormone solution. The hormone treatments were: 0, 2,000, 3,000, 4,000, 6,000, 8,000, and 10,000 p/m of a 1:1 mixture of indolebutyric acid (IBA) and naphthalene acetic acid (NAA) dissolved in a 1:1 ethyl alcohol-water solution. Batches of 7 to 10 cuttings for each hormone treatment were then planted in flats of perlite at temperatures of 72°, 76°, 80°, and 85° F maintained by means of a heating cable or water bath. A normal (unheated) bench temperature of 66° to 72° F served as a control. The cuttings were misted 30 seconds every half hour, and supplemental light extended the day length to 18 hours. The cuttings were removed from the perlite weekly over a 4-week period and the number of rooted cuttings, number of roots per cutting, and length of longest root recorded. Cuttings were replanted after each observation. Limited availability of cuttings required that the study be carried out as a series of selected tests. Not all treatment combinations were tested, while some treatments were repeated in successive trials. A total of 27 batches of cuttings was used.

Results and Discussion

Media temperature had a pronounced effect on rooting. Treatments between 76° and 85° F generally produced the most rapid rooting, highest rooting percent, and longest roots. Rooting in the warm treatments reached 70 to 100 percent and was essentially finished after 14 days (table 1), while rooting at the lower temperatures (66°-72° F) averaged only 9 percent after 14 days and continued to increase until 28 days (fig. 1) by which time most unrooted cuttings had died.

Root growth as measured by the elongation rate of the longest root on each cutting also increased with temperature. For example, growth during the fourth week was 28, 31, and 36 mm for the 66°, 76°, and 85° F temperature treatments, respectively.

Hormone treatments increased rooting percent and number of roots per cutting at temperatures up to 80° F (table 1). Generally, hormone concentrations of 2,000 to 4,000 p/m were most favorable to all aspects of rooting at these temperatures. At higher temperatures, rooting hormones did not appear as important. An interaction between hormone concentration and temperature was also evident. For example, percent rooting at 80° F with 0 and 2,000 p/m hormone was similar to that at 76° F with 2,000 to 4,000 p/m hormone. Rooting was poor with a combination of no hormone at low temperatures and was also poor (with a greater incidence of tissue necrosis) at a combination of high temperature and high hormone concentration.

Rooting continued until at 28 days there was much less difference remaining between treatments than at 14 days. However, even at 28 days the percentage rooted was much more variable and averaged less at the lower temperatures and with the no-hormone dip than it was for the higher hormone-temperature treatments. Fungal and bacterial infections of cuttings, which appeared to contribute to the variable rooting success—a problem also encountered by Farmer *(4)*—were accentuated by slow rooting at cool temperatures.

Rooting percent varied between different trials of the same treatment. Some of this variability was due to mortality from disease. However, because each trial represented a different batch of cuttings, part of the variability may have been due to the vigor or physiological condition of the stock plant from which the cuttings were obtained. Mineral nutrition of the stock plant has been found to be important in the rooting of cuttings of *Populus tremula* x P. *alba* var. *nivea* *(6).* We believe that stock plant nutrition may also have been important in our tests because rooting of cuttings increased when fertilization was increased to two applications per week of a water soluble complete fertilizer.

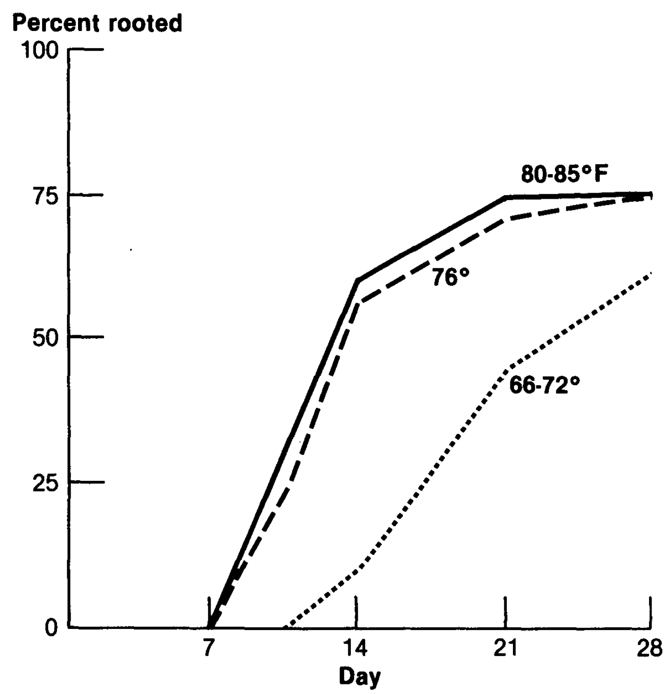

Figure 1.—*Effect of media temperature on rate of rooting (average of all hormone treatments).*

In summary, higher media temperatures accelerated the rooting process, while treatment with IBA and NAA hormone dip generally increased the percentage of cuttings that rooted and the number of roots per cutting. The treatments producing the best and most rapid rooting were a 76° to 85° F media temperature and a 2,000 to 4,000 p/m hormone treatment. Although an acceptable rooting percentage can occasionally be obtained with temperatures in the 60° to 72° F range, there is greater risk of mortality

Table 1.—*Effect of hormone and temperature treatment on percent rooting of Crandon tip cuttings at 14 days*

IBA-NAA Dip Concentration	Percent Rooting Temperature of rooting medium (° F)					
(p/m)	66	70	72	76	80	85
0	(0	0	0)[1]	28-50[2]	100	11-100
2,000			12	100	100	
3,000	25			71		67-75
4,000			12	100	75	
6,000	12			25		30-75
8,000						40
10,000	12			25		12

[1]Control.
[2]Numbers connected by dashes indicate range of results from several tests.

from disease when the rooting process is prolonged. Also, even though good rooting was obtained in some higher temperature tests with no hormone, it appeared that use of hormone resulted in more consistent rooting.

These results may help overcome rooting difficulties of other valuable but difficult-to-root Populus clones of similar parentage.

Literature Cited

1. Barry, W. J. and R. M. Sachs.
1968. Vegetative propagation of quaking aspen. Calif. Agric. 22(1):14-16.
2. Benson, Miles K., and Delmar E. Schwalbach.
1970. Techniques for rooting aspen root sprouts. Tree Planters' Notes 21(1): 12-14.
3. Dawson, David H., and Howard M. Phipps.
1978. Vegetative propagation of Populus for intensively cultured plantations. Proc. 4th North Am. For. Biol. Workshop, p. 8-22.
4. Farmer, Robert E.
1963. Vegetative propagation of aspen by greenwood cuttings. J. For. 61:385-386.
5. Hartmann, Hudson T., and Dale E. Kester.
1975. Plant propagation. Prentice-Hall Inc., Englewood Cliffs, New Jersey, 662 p.
6. Janson, L.
1974. Effectiveness of propagation of hybrid aspen and grey poplar by roof cuttings, in relation to the conditions in which the parent plants were grown. Sylwan 118(2):46-51.
7. Snow, Albert G.
1938. Use of indolebuty ric acid to stimulate the rooting of dormant aspen cuttings. J. For. 36:582-587.