HANDLING PRIOR TO STICKING AFFECTS ROOTING OF LOBLOLLY PINE CUTTINGS

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Abstract. Cuttings taken in December from 6-year-old *Pinus taeda* L. trees rooted 110 percent better when they were stored upright for 48 hours at 35° to 38° F, left intact, and treated with indolebutyric acid (IBA) than when they were oriented horizontally, reclipped at their bases, and treated with IBA without storage or chilling. Mixed with Captan in talc, a 0.6 percent concentration of IBA produced more rooting than concentrations of 0.8 and 1.0 percent. N-dimethylaminosuccinamic acid (B-Nine) at 1,500 and 3,000 ppm in combination with IBA and Captan was detrimental to rooting.

The need to propagate pines from cuttings has increased rapidly as new forms have been selected for ornamental planting, Christmas trees, and forest tree seed orchards. But progress in rooting pine cuttings has been slow, and when a technique has shown promise in one test, results in subsequent tests have often been disappointing.

Part of this inconsistency in rooting may be due to annual variation in rooting ability and differences among trees from which cuttings are selected, but another major cause may be variation in methods of handling from clipping in the field to sticking in the propagation bench. The principal objective of the study described here was to compare the effects of two methods for handling cuttings prior to sticking.

MATERIALS AND METHODS

Cuttings were taken from throughout the crowns of 6-year-old loblolly pines (*Pinus taeda* L.) in mid-December. Half of the cuttings were 4 inches long. They were removed before 9:30 a.m. and stored at 35° to 38° F for 2 days prior to treatment and sticking. These cuttings were held in a vertical position from the time they were taken, and they were not reclipped prior to treatment. The other half of the cuttings were 6 inches long. They were taken between 9:30 a.m. and noon, reclipped to 4 inches, treated, and stuck in the afternoon of the same day. These cuttings were kept horizontal until placed in the bench. They were not chilled.

The rooting medium was a 1:1 mixture of sand and perlite which was kept at 78° F with bottom heat. Minimum greenhouse temperature was maintained at 75° F. Misting duration varied from 4 to 12 seconds per minute during daylight hours, depending upon weather conditions. Fifty percent continuous shading was provided by slatted awnings.

Just before sticking, nine treatments were applied to the cuttings in a split-plot factorial design. Treatments were: three levels of indolebutyric acid (IBA) in talc—0.6, 0.8, and 1.0 percent—times three levels of N-dimethylaminosuccinamic acid (B-Nine)—0, 1,500, and 3,000 ppm. The two methods of handling cuttings served as the major plots. Each subplot contained 9 cuttings. Each major plot was replicated 10 times in a randomized block design. Thus, there were 90 cuttings in each treatment and 1,620 cuttings in the entire study. Because of my success with Captan in previous rooting studies (1), all powders contained 25 percent Captan. The study was concluded at the end of 26 weeks. Differences due to treatment were tested for statistical significance at the 0.05 level in all cases.

RESULTS

The two methods of handling cuttings produced significant differences in rooting success. Cuttings that were initially clipped to 4 inches, kept vertical until stuck, stored for 2 days in a cold room, and not reclipped (Method I) rooted 110 percent better than cuttings that were kept horizontal, reclipped, and treated without chilling or storage (Method II) (Table 1). In none of the nine treatments was this trend reversed.

The IBA and B-Nine treatments significantly affected rooting (Table 2). The best IBA treatment was the 0.6 percent application, which produced 23.3 percent rooting. B-Nine adversely affected rooting (Table 1). The zero level treatment produced 63 percent more rooted cuttings than the 1,500 ppm treatment and 97 percent more than the 3,000 ppm application.

Differences in survival were significant between the two methods of handling cuttings. Those that were vertically oriented and kept in cold storage (Method I) survived best (Table 2). The 0.6 percent application of IBA resulted in more living cuttings than the two higher concentrations.

Although treatment effects on number of roots per cutting were not analyzed, vertical cold storage appeared to produce a better balanced root system than horizontal orientation without storage. Method I resulted in longer roots than Method II.

There were no significant interactions among the treatments.

DISCUSSION

Within the two methods of handling cuttings there are five differences which this study was not designed to measure individually: (1) hour of collection; (2) orientation; (3) storing; (4) chilling; and (5) clipping. A new study is being installed to determine

Table 1. Rooting success with all cuttings receiving each treatment.

Treatment	Total Cuttings	Number Rooted
Handling method I[1]	810	82
Handling method II[1]	810	39
IBA (percent)		
0.6	540	59
0.8	540	30
1.0	540	32
B-Nine (ppm)		
0	540	57
1500	540	35
3000	540	29

[1]Handling methods defined in text.

Table 2. Percent of cuttings living and percent rooted, by treatment, after 26 weeks.

Powder Contents[1]	Handling Method I[2]		Handling Method II[2]	
	Percent		Percent	
	Living	*Rooted*	*Living*	*Rooted*
0.6% IBA + 0 ppm B-Nine	33.3	23.3	16.7	12.2
0.6% IBA + 1500 ppm B-Nine	27.8	11.1	10.0	8.9
0.6% IBA + 3000 ppm B-Nine	16.7	7.8	6.7	2.2
0.8% IBA + 0 ppm B-Nine	14.4	6.7	5.6	5.6
0.8% IBA + 1500 ppm B-Nine	11.1	5.6	8.9	1.1
0.8% IBA + 3000 ppm B-Nine	14.4	11.1	7.8	3.3
1.0% IBA + 0 ppm B-Nine	27.8	10.0	6.7	5.6
1.0% IBA + 1500 ppm B-Nine	18.9	18.9	3.3	3.3
1.0% IBA + 3000 ppm B-Nine	10.0	10.0	5.6	5.6

[1]All powders contained 25 percent Captan.

[2]Methods defined in text.

the effect of each of these. In the meantime, results of previous studies may explain some of the results.

Horizontal and vertical orientations of stored cuttings have been used in horticulture to demonstrate that the naturally occurring root-inducing substances in some cuttings move downward in response to gravity. If cuttings are placed in positions other than upright, or if they are recut, rooting is delayed and often the percent of rooting is reduced. Ridgway (3) mentioned that Cathey had observed this gravity effect after as little as 2 hours of orientation. Cathey[1] reported that if chrysanthemum cuttings are taken and chilled immediately, the rooting cofactors are apparently slowed in their response to orientation. Cathey further stated that softwood cuttings appear to be most sensitive to orientation and chilling and that species vary in their response to this treatment.

While B-Nine was found to inhibit rooting in the present study where it was used in combination with IBA and Captan on hardwood cuttings, Read (2) found similar concentrations of B-Nine when used by itself more beneficial than IBA, or IBA plus B-Nine, in rooting chrysanthemum, geranium, and dahlia cuttings.

LITERATURE CITED

1. Grigsby, H. C. 1966. Captan aids rooting of loblolly pine cuttings. *Proc. Int. Plant Prop. Soc.* 15:147-150.
2. Read, P. E. 1968. The effect of B-Nine and Cycocel on the rooting of cuttings. *Proc. Int. Plant Prop. Soc.* 18:312-318.
3. Ridgway, H. W. 1970. Comments on Maryland meetings. *Geiger News* 6(2):1.

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[1]Cathey, H M. ARS, USDA, Beltsville, Md., Personal communication, 1971

MODERATOR FLEMER: Thank you very much, Hoy, for an interesting and unusual paper. So often in propagation we deal with easily rooted material and don't give much thought to such refinements, but when we begin to deal with the more difficult-to-use materials, modifications and refinements obtain great importance.

BRUCE BRIGGS: Did you try putting the IBA on, then storing them in the cold and putting the B-Nine on when you brought them back out.

HOY BRIGSBY: No, we did not try that. All treatments were done at one time.

BRUCE BRIGGS: I wanted to clarify that because there have been some tests where it has been found that it is better if the B-Nine is put on afterwards.

JIM WELLS: When you gathered the cuttings, were they maintained in an upright position from the moment they were cut until they were rooted?

HOY GRIGSBY: I would imagine that for a few minutes while they were being treated they were laid down.

CARMINE RAGONESE: Did you injure the base of the cuttings in any way and what was the caliper at the base?

HOY BRIGSBY: We used reasonable care but I did notice that the bark was torn on some of them. The caliper at the base of the cuttings was approximately ¼ inch or a little larger.

CASE HOOGENDOORN: Did you take these cuttings at random or is there a clonal difference among the materials you were propagating?

HOY GRIGSBY: Yes, we did take them at random and we have observed a lot of difference between clones in the rootability.

WAYNE MEZZITT: Did you try any of your cuttings without any IBA treatment?

HOY GRIGSBY: In this instance I did not, but in the past I have attempted to root them without any treatment and occasionally I do get a few of them to root.

MODERATOR FLEMER: We are now going to hear from one of our older members on his refinements with the burlap cloud chamber. He took the Society by storm when he first explained it to us a number of years ago in Cleveland and now Leslie Hancock is going to tell us about soil heating in his chambers.