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Pregermination Treatment Hastens Emergence of Loblolly Pine Seedlings

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A pregermination treatment in which loblolly pine (Pinus taeda *L.)* seeds were *placed in a warm, lighted, aerated water bath was tested* as a *method* to *hasten germination. The treatment significantly reduced the time between sowing and emergence, but did not affect the variation in emergence timing. Seedling morphology was not significantly affected by the pregermination treatment.* Tree Planters' Notes 39(4):36-38; 1988.

The germination of loblolly pine *(Pinus taeda* L.) can be hastened by seed stratification (2, 3). Rapid germination is necessary to avoid seed loss due to heavy rains, reduce the period of susceptibility to certain diseases, improve crop uniformity, and increase seedling size.

Barnett (1) developed a method to germinate pine seeds to prepare them for "fluid drilling." The objectives of this experiment were (a) to adapt this method to traditional sowing methods used in the nursery and (b) to test the method's effects on the speed and uniformity of seed germination and, in turn, the morphological characteristics and uniformity of the resulting seedling crop. We have termed this treatment "pregermination" because germination is initiated prior to sowing. Because emerging radicles would be damaged using traditional sowing methods, Barnett's procedures were modified so that the germination process was stopped when the seed coat cracked, prior to emergence of the radicles.

Materials and Methods

Loblolly pine seeds used in this test were from two half-sib families provided by International Paper Company (IPCO) One family was from a first-generation seed orchard (family I) and the other came from a second-generation orchard (family II).

All seeds were stratified for 60 days. Half the seeds also were given a pregermination treatment for 3 days, which consisted of an aerated water bath at 24 °C. The water bath was kept under constant fluorescent lighting. Seeds were sown by hand on May 5, 1985, at IPCO's nursery near Bluff City, AK. Plot size was 0.6 m by 1.2 m (bed width), with 240 seeds sown per plot (2

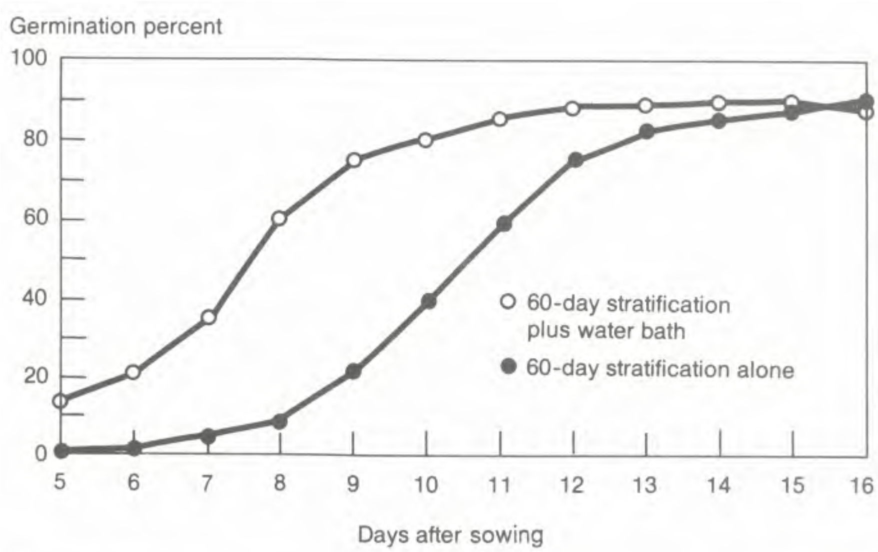

Figure 1—*Cumulative germination curves for family I seed stratified for 60 days, with and without pregermination (warm soak) treatment.*

cm apart in rows 15 cm apart). Treatments were replicated six times. Germination was monitored daily from May 10 until May 21. Seedlings were lifted from each plot in December 1985 and measured for height, diameter, shoot dry weight, and root dry weight. Separate analyses of variance for germination and morphological characteristics were conducted or each family.

Results and Discuss

The pregermination treatment significantly hastened germination for both families (figs. 1 and 2, table 1). Mean time to emergence was reduced by 3 days for family I, and by about 2 days for family II. Despite the more rapid germination, the uniformity of emergence was not affected. The standard deviation for days to emergence was not reduced by the pregermination treatment (family I, SD = 1.76 and 1.71 for pregermination and control, respectively; family II = 1.62 and 1.62). Therefore, placing seeds in the warm water bath was equivalent to "sowing" 3 days earlier. Because the uniformity of emergence was not improved by the pregermination treatment, seedling uniformity was not affected (SD for diameter, family I = 1.01 and 1.02 for pregermination and control, respectively; family II = 1.16 and 1.06). Therefore, results from this and other studies (4) suggest that in order to improve seedling uniformity, the uniformity of emergence must be increased.

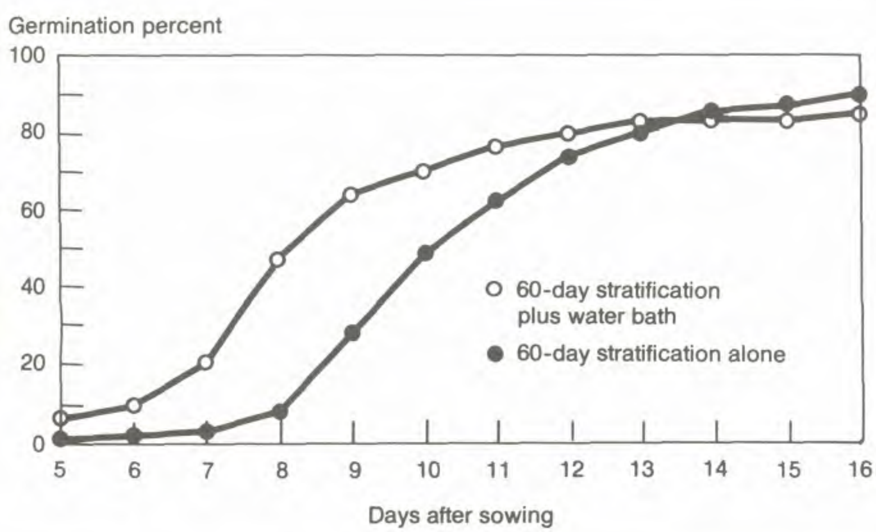

Figure 2—*Cumulative germination curves for family II seed stratified for 60 days, with and without pregermination (warm soak) treatment.*

In a previous study, a similar pregermination treatment increased seedling diameter by 1.4% for each day emergence was accelerated (3). In this study, however, while diameters of pregerminated seedlings averaged 1.5 and 2.3% higher per day for family I and family II, respectively, these differences were not significant at the 5% level (table 2). Root dry weight and shoot—root ratio showed even greater relative increases for both families, but were not significant at the 5% level.

Summary and Conclusions

The pregermination treatment (aerated, lighted, warm water bath) tested in this experiment significantly reduced the time required for germination when computed as days after sowing. However, if one considers day 0 to be the day seeds were placed in warm water, the pregermina-

Table 1—*Seed germination and seedling survival results for pregermination treatment (60-day stratification followed by warm soak) and control (60-day stratification alone)*

	Family I			Family II		
Variable	Warm soak	Control	P>F	Warm soak	Control	P>F
G–50 (field)*	8.2	11.0	0.0001	8.8	10.5	0.0041
G–50 (total)†	11.2	11.0	0.3632	11.8	10.5	0.0103
Germination %‡	91.5	92.0	0.7174	85.6	89.2	0.0291
Tree percent§	86.9	86.7	0.9744	76.1	88.0	0.1454

G_{50} = number of days required for 50% of the seed to germinate.
*Days counted from sowing for both treatments.
†Days counted from beginning of warm soak for pregermination treatment.
‡Total germination 16 days after sowing (percent of seed sown).
§Total live trees at end of season (percent of seed sown).

Table 2—*Seedling morphology results for pregermination treatment (60-day stratification followed by warm soak) and control (60-day stratification alone)*

	Family I			Family II		
Variable	Warm soak	Control	P>F	Warm Soak	Control	P>F
Diameter (mm)	3.80	3.64	0.0674	3.81	3.65	0.3844
Height (cm)	22.9	22.9	0.9445	22.4	22.9	0.5613
Shoot wt. (g)	2.75	2.69	0.6837	2.83	2.94	0.6131
Root wt. (g)	0.90	0.67	0.1043	0.85	0.78	0.2893
Total wt. (g)	3.65	3.35	0.1749	3.69	3.72	0.9011
Shoot/root (g/g)	3.29	4.07	0.0644	3.37	3.77	0.0571

tion treatment did not hasten germination. Rather, the warm water bath caused the germination process to begin sooner. Although early field emergence may influence seedling morphology, the differences were not significant in this study. This treatment may, however, reduce the time between sowing and seedling establishment, which would make a washout by heavy rain less likely. This procedure will be most effective if the pregermination treatment is coordinated with proper field conditions. If rainy weather delays field sowing, the "pregerminated" seeds will either have to be chilled or redried in order to delay germination until the seedbeds dry out.

Literature Cited

1. Barnett, J.P. 1985. Fluid drilling —a technique for improving nursery seedling establishment. Proceedings, third biennial southern silvicultural research conference; 7-8 November 1984; Atlanta, GA. Shoulders, E., ed. Gen. Tech. Rep. 50-54. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station.
2. Barnett, J.P.; McLemore, B.F. 1984. Germination speed as a predictor of nursery seedling performance. Southern Journal of Applied Forestry 8(3):157-162.
3. Boyer, J.N.; South, D.B.; Muller, C.; Vanderveer, H.; Chapman, W.; Rayfield, W.1985. Speed of germination affects diameter at lifting of nursery-grown loblolly pine seedlings. Southern Journal of Applied Forestry 9(4):243-247.
4. Boyer, J.N.; Duba, S.E.; South, D.B. 1987. Emergence timing affects root collar diameter and mortality in loblolly pine seedbeds. New Forest 1(2):135-140.