CLAY SLURRY ROOT DIP IMPAIRS SURVIVAL OF LOBLOLLY PINE SEEDLINGS IN MISSISSIPPI

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In this 2-year study in northern Mississippi, a kaolin clay root dip reduced survival of normally planted seedlings. The dip was helpful when seedlings were exposed to sun and air for 30 to 60 minutes before planting, but survival of all exposed seedlings was inferior to unexposed ones.

Dipping pine planting stock in a clay slurry prior to packaging for shipment has been suggested as a means of improving survival (1, 2, 4). The treatment is aimed primarily at reducing root desiccation during planting, but benefits during dry weather after planting have also been suggested. Slocum and Maki (4) reported that in North Carolina a slurry dip significantly improved survival of loblolly pines whose roots were unexposed, as well as of those exposed to sun and air for as much as 2 hours.

Ursic (5), however, found indications that dips might lessen the survival of loblolly seedlings in northern Mississippi, where the species is extensively planted for erosion control. The 2-year study reported here was accordingly established to further appraise dips as a means of improving the efficiency of pine establishment on sites in this area.

The Study Procedure

Loblolly pine seedlings from a Mississippi seed source were packed in kraft-polyethylene bags (1,000 per bag) at the Ashe Nursery, Brooklyn, Miss., and shipped to Oxford on March 9, 1965, and March 18, 1966. The roots of half the seedlings in each shipment were dipped in a kaolin clay slurry prior to packing. The remaining seedlings were packed bare-rooted with a small amount of sphagnum moss in each bag. At Oxford the seedlings, still in bags, were immediately stored in a refrigerator at about 34°F.

On April 12, 1965, and April 27, 1966, 1,000 each of the slurry-treated and bare-rooted seedlings were spread out individually and exposed to sun and air for 30 minutes. Additional double lots of 1,000 were similarly exposed for 60, 120, and 240 minutes. After exposure, seedlings were replaced in the bags and returned to refrigeration overnight. One thousand slurry-treated and' 1,000 bare-rooted seedlings were left unexposed. Thus there were 10 treatment combinations: 0, 30, 60, 120, and 240 minutes of exposure for both bare-rooted and dipped seedlings.

Conditions over the 4-hour exposure periods were roughly similar in both years:

	1965	1966
Air temperature (°F)	80-86	70-82
Solar energy (Langleys)	1.00-1.30	1.10-1.35
Wind (m.p.h.)	4-6.6	1.4-5.3
Relative humidity (percent)	15-45	46-70

After even the 30-minute exposure the roots of all the undipped seedlings were dry. The slurry was wet on the seedlings exposed for only 30 minutes, sticky on those exposed for 1 hour, and powdery on those exposed for 2 and 4 hours.

The day following exposure, 600 seedlings randomly chosen from the 1,000 assigned to each of the 10 treatments were planted on six sites on the Tallahatchie Experimental Forest. Two of the sites were on loam and silt loam soils in a river bottom, two on Tippah soils (silty clay and silty clay loam), and two on deep sand and sandy loam. One of the Tippah sites was bare, the other five sites were covered with sod.

Fifty seedlings were bar-planted at a spacing of 2 by 2 feet on each of 20 plots, 10 plots to a block, on each of the six sites. All 10 treatment combinations were randomly assigned to plots within each of two blocks at each of the six sites. Living

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seedlings were removed from the plots in late 1965 and the same plots were planted in 1966.

Height and survival were recorded 2 weeks after planting, survival 8 weeks after, and height and survival at the end of the growing season. Soil moisture was measured three times during the 1965 growing season and five times during 1966.

Significance of survival differences was evaluated by Scheffe's test (3), at the 0.05 level.

Results

In the 1965 growing season, May, June, and July were dry; in 1966, June, July, and August were dry. Soil moisture was below the wilting point in May 1965 on the Tippah soils and on the sandy sites, and on all six sites in July 1965. In 1966, soil moisture fell below the wilting point in June on the Tippah soils and the sandy sites, and on all six sites for most of July and August. Thus the seedlings were _subjected to a variety of moisture regimes that tested their ability to survive drought.

Unexposed seedlings survived best both years, and, with one minor exception, on all sites (table 1). Unexposed, bare-rooted seedlings averaged 44 percent survival in 1965 and 54 percent in 1966, as contrasted to 34 and 26 percent respectively, for the unexposed dipped seedlings. The average difference for the 2 years was significant. On the loam and silt loam sites, where moisture stress was moderate, survival of unexposed bare-rooted seedlings during the 2 years averaged 68 percent significantly better than the 48 percent survival of unexposed slurry-treated seedlings. On the sand and sandy loam sites, where moisture stress was extreme, survivals were not significantly different, averaging 14 percent for bare-rooted and 7 percent for slurry-dipped seedlings.

Obviously the dip did not ameliorate the effects of either moderate or severe drought. On the contrary, it appears to have rather uniformly reduced survival, regardless of drought severity.

Survival decreased as the period of exposure increased. Only a small percentage survived after 2 hours, and only an occasional individual seedling after 4 hours' exposure. In both years, and on almost all sites, survival of both dipped and bare-rooted seedlings was reduced by exposure, even for as little as 30 minutes.

For 30 or 60 minutes of exposure, dipped seedlings survived better than bare-rooted stock. On the loam and silt loam sites, where exposure effects were least obscured by subsequent drought, barerooted seedlings exposed for 30 minutes averaged only 21 percent survival, while dipped seedlings similarly exposed averaged 42 percent. Though a significant improvement, this is still much below the 68 percent survival of unexposed bare-rooted stock.

Survival counts 2 weeks and 8 weeks after planting were of little value in distinguishing mortality due to exposure from that due to drought. In many cases, seedlings whose root systems must have been damaged beyond recovery maintained normal looking tops for more than 8 weeks.

Height growth was not significantly affected by the slurry treatment.

Conclusion

Dipping their roots in a clay slurry substantially increased the ability of loblolly pine seedlings to survive after 30 to 60 minutes of exposure to sun and wind. Survival of such seedlings, however, was much below that of bare-rooted seedlings which had not been abnormally exposed.

Survival of unexposed dipped seedlings was consistently and substantially lower than that of comparable bare-rooted seedlings. This reduction in survival occurred in two successive years and on sites that developed a wide range of moisture stress. The cause of this adverse effect is unknown.

On no site was there any indication that the dip improved ability of undamaged seedlings to survive drought. The only benefit attributable to the slurry dip in this study was a partial reduction of the damage caused by exposure to air and sunlight.

Root exposure comparable to that tested can easily be avoided by adherence to accepted planting procedures. Hence this test indicates no advantage of the slurry dip over bare-root packaging, at least for seedlings to be packed in K-P bags. On the contrary, the results suggest that, for properly conducted field planting, survival would be reduced by dipping.

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