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Growth of Longleaf and Loblolly Pine Planted on South Carolina Sandhill Sites

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ABSTRACT

Performance of longleaf (*Pinus palustris* Mill.) and loblolly pine (*P. taeda* L.) were compared 15–19 years after outplanting on 10 different sites in the sandhills of South Carolina. The study was established from 1988 to 1992 with bareroot seedlings artificially inoculated with *Pisolithus tinctorius* (Pt) or naturally inoculated with mycorrhizae in the nursery. A containerized longleaf pine treatment with and without Pt inoculation was added to two sites in 1992. Effects of the Pt nursery treatment were mixed, with a decrease in survival of bareroot longleaf pine on two sites and an increase in survival on another site. The containerized longleaf pine treatment substantially increased survival, which led to greater volume compared with bareroot longleaf pine. Loblolly pine yielded more volume than longleaf pine on all sites but one, where survival was negatively affected by fire. Depth of sandy surface horizon affected mean annual height growth of both loblolly and longleaf pine. Height growth per year decreased with an increase in sand depth for both species. Multiple regression analysis of volume growth (ft^3/ac per year) for both species indicated a strong relationship to depth of sandy soil and survival. After 15–19 years, loblolly pine has been more productive than longleaf pine, although longleaf pine productivity may be equal to or greater than that of loblolly pine on the soils with the deepest sandy surface layers over longer rotations.

Keywords: *Pinus palustris, Pinus taeda, Pisolithus tinctorius,* mycorrhizae, volume, containerized seedlings

Longleaf pine (*Pinus palustris* Mill.) was once the dominant pine species on dry upland soils of the southeastern United States, where a greater tolerance of fire and drought allowed longleaf pine to out-compete other, more aggressive species (Wahlenberg 1946, Outcalt 2000). Loblolly pine (*Pinus taeda* L.) has replaced longleaf pine as the dominant forest species in the South during the 20th century in part because of fire control and its rapid growth on a wide variety of sites (Schultz 1997). Although the commercial value of longleaf pine was high, foresters found the species difficult to regenerate both naturally and artificially (Wahlenberg 1946). The slow early growth and lower survival rate of longleaf pine led land managers to choose loblolly or slash pine for reforestation (Brockway et al. 2005); however, methods in longleaf pine seedling production and planting techniques have improved considerably in the past 40 years (Kush et al. 2004). These improvements were necessary before a large program to restore longleaf pine to the South was possible. Restoration of longleaf pine began on federal and state lands, which later expanded under incentive programs and state cost-share programs for private landowners (Brockway et al. 2005).

The Savannah River Site (SRS) is a National Environmental Research Park located near Aiken, South Carolina. The physiographic provinces of the SRS are predominately upper coastal plain and sandhills. Historically, most of the site was once a fire-maintained longleaf pine savannah that was cut over and farmed until the 1950s when the U.S. Atomic Energy Commission acquired the land (Kilgo and Blake 2005). The site was reforested with seed and seedlings that were available at that time, and much of the site was planted with loblolly pine and, to a lesser degree, slash pine (*Pinus elliottii* Engelm.). Reforestation of SRS with longleaf pine was limited because of low availability of seed, poor seedling quality, and low survival. It was not until the 1980s that techniques in longleaf pine production and establishment had improved enough to convert off-site slash pine to longleaf pine on excessively drained soils (Kilgo and Blake 2005).

One cultural technique tested during the 1980s was the addition of *Pisolithus tinctorius* (Pers.) Coker and Couch (Pt) ectomycorrhizae to seedlings for reforestation. These studies suggested that inoculating seedlings with Pt in the nursery provided positive responses in survival and growth for both longleaf pine (Hatchell and Marx 1987) and loblolly pine (Marx et al. 1988). An expanded study was installed from 1988 to 1992 on the SRS to assess the survival and growth of both longleaf and loblolly pine seedlings artificially inoculated with Pt on 10 different sites. An additional containerized longleaf pine treatment was added to the last two sites, established in 1992. The 4-year (5-year for site 5) results of this study were reported earlier (Cram et al. 1999); they showed that seedlings with naturally occurring mycorrhizae performed as well or better than seedlings inoculated with Pt. A comparison of growth between the tree species was not performed on the previously reported data because of physiological differences in early growth. Loblolly pine is recognized to have faster early growth, but with longer rotations,

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