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The effect of weed control and fertilization on survival and growth of four pine species in the Virginia Piedmont

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Abstract

The growth response of loblolly pine *(Pinus raedn),* shortleaf pine *(Pinus echinata* Mill.), Virginia pine *(Pinus virginiana* MU), and white pine (*Pinus simbus* L.) to weed control and fertilization in the Piedmont of Virginia was assessed. Four different silvicultural treatments were evaluated: (I) check (no treatment); (2) weed control; (3) fertilization; (4) weed control plus fertilization. The weed control treatment included a series of herbicide and mechanical treatments to eliminate competing hardwoods. The fertilizer treatments added N, P, K, and S. Survival and growth was measured annually through age 5. There were significant differences in survival and growth among species. Survival was greatest for loblolly pine, lower in short leaf and Virginia pine, and lowest in white pine. Fertilization without controlling the competing hardwoods decreased survival in all planted pines due to the increased hardwood competition. Loblolly pine was tallest through the 5-year period, shortleaf and Virginia pine were shorter and white pine was shortest. Silvicuitural treatments had no impact on tree height hut significantly affected DIM. Weed control increased DHH while fertilization did not. When applied in combination with weed control, there was no additional increase in growth of the pines dire to fertilization beyond that front weed control only, Fertilization stimulated the growth of the competing hardwoods which were significantly taller in the fertilized plots.

Keywords: Loblolly pine; am-deaf pine; White pine; Virginia pine; Hardwoods; Invasive species; Ailanthus

I. Introduction

Plantations account for only 16% of the forestland in the southern United States but they produce around 29% of the softwood timber in the region (Wear and Greis, 2002). The productivity of plantations will need to increase in order to meet the increasing demand for timber and still enable large areas of forest to he preserved for conservation, aesthetics and wildlife purposes (Sedjo and Botkin, 1997; Howard and Stead, 2001). Fortunately, intensive silvicultural regimes can substantially increase the growth of pine plantations in the South (Fox et al., 2005), Mean annual increments approaching 30 m ha^{-1} yr-1 have been reported for intensively managed loblolly pine plantations in the South (Borders and Bailey, 2001).

Unfortunately, growth rates in most plantations in the South are well below their potential. averaging much less than 10 in/ha/yr (Allen et al., 2005). The growth of many of these pine plantations are limited by nutrient deficiencies, primarily nitrogen (N) and phosphorus (P) (Jokela et al.. 1988; Fox et al., 2005). Fertilization can substantially increase biomass production in these nutrient deficient stands (Allen et al., 2005). Consequently, over 450,000 ha of southern pine stands have been fertilized annually since the mid-1990s (FNC, 2005), Competition for light, water and nutrients from woody and herbaceous vegetation also negatively impacts growth of many pine plantations in the South (Clason. 1993L Controlling

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