LOBLOLLY PINE SEEDLING RESPONSE TO COMPETITION FROM EXOTIC VS. NATIVE PLANTS

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Abstract—A field study was conducted in Santa Rosa County, FL to test the hypothesis that an exotic understory would exert a higher degree of competition on tree seedling establishment and growth than native vegetation. The study site was a 60 ha cutover area infested with the invasive exotic cogongrass [*Imperata cylindrica* (L.) Raeusch.]. A completely randomized design was set up with five replications of three treatments: (1) control- plots that were kept weed free, (2) plots with only native vegetation, and (3) cogongrass infestation. On March 6, 2003, 1-year-old bare-root loblolly pine seedlings were planted at 1.8 x 1.1 m spacing, and initial root collar diameter (RCD) and height were measured. The seedlings were harvested in December, and final RCD, height and above- and below-ground biomass were measured. Seedlings had the lowest biomass growth in the cogongrass treatment and the highest in the control. The results of the study demonstrate that the exotic cogongrass is far more competitive than native vegetation.

INTRODUCTION

Several studies have examined the impact of weeds on the growth and survival of pines all around the world. Radiata pine (*Pinus radiata* D. Don) in New Zealand grew more rapidly with the removal of Italian ryegrass (*Lolium multiflorum* Lam.), white clover (*Trifolium repens* L.), and sorrel (*Rumex acetosella* L.) (Mason and Kirongo 1999). Exclusion of bunchgrass [*Agropyron spicatum* (Pursh) Scribn. & J.G. Sm.] roots from 0.15-m and 0.30-m deep root zones of ponderosa pine seedlings resulted in 40 and 80 percent reductions in mortality, respectively (Kolb and Robberecht 1996). Martin and Jokela (2004) found control of competing vegetation resulted in dramatic increases in almost every measure of productivity investigated of loblolly pine in north-central Florida, including height, basal area, stemwood biomass accumulation, foliar nitrogen concentration, and leaf area index. Zutter and others (1999) demonstrated that decreases in woody and herabaceous competitors resulted in increases in foliar biomass of 2-year-old loblolly pine (Pinus taeda L.) in the Southeastern United States. Few studies have examined the impact of invasive plants on pine survival and growth in the Southeast.

Cogongrass [*Imperata cylindrica* (L.) Raeusch.] is a subtropical alien invasive grass which is spreading throughout natural and disturbed ecosystems in the Southeastern United States and Southeast Asia, infesting 500 million acres worldwide. The grass spreads mostly through rhizomes, which are resistant to breakage and heat: it can grow 1 m deep and in every direction, forming extensive rhizome networks (Holm and others 1977). These networks lead to dense monocultures in a forest understory, displacing all native vegetation and altering the structure and function of an ecosystem. Cogongrass infestation is suspected to play a major role in affecting the productivity of forest trees as well. The objective of this study was to quantify the effect of cogongrass on the survival and growth of loblolly pine seedlings.

MATERIALS AND METHODS

Study Site

This field study was conducted on an industrial cutover site in Santa Rosa County, FL. The area quickly became infested with cogongrass after harvesting. A completely randomized design was set up with five replications of three treatments: (1) control - plots that were kept weed free by hand weeding, (2) plots with only native vegetation, and (3) plots with cogongrass infestation. In March, 2003, 1-year-old bare-root loblolly pine seedlings were planted at 1.8 x 1.1 m spacing. There were 4 rows of 8 seedlings in each plot (32 seedlings per plot).

Measurements

The initial root collar diameter (RCD) and height were measured for every seedling at planting. The seedlings grew for one full growing season. In December, 2003, the RCD and height were re-measured, and survival of seedlings was assessed. Analysis of variance within the framework of a completely randomized design was used to analyze the data.

RESULTS AND DISCUSSION

After one full growing season, it was evident that the presence of native and exotic weeds greatly impacted the productivity and establishment of 1-year-old loblolly pine seedlings. Survival was 72.5 percent in both the native and weed-free treatments after a full growing season, while it was only 55 percent in the cogongrass treatment. Some mortality was expected after planting for all treatments; however, cogongrass exerted a higher competitive pressure for soil water and/or nutrients, resulting in greater mortality in this treatment.

The presence of cogongrass greatly impacted the overall growth of the seedlings after one growing season. The pine seedlings growing in the cogongrass treatment showed the least amount of growth, with only a 30 percent increase in RCD and a 26 percent increase in height (table 1). The native vegetation exerted moderate competitive pressure on the seedlings. Seedlings in this treatment had a 64 percent increase in RCD and a 30 percent increase in height at the

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Table 1—Mean root collar diameter (RCD) and height of loblolly pine seedlings after 9 months under different treatments

Treatment	RCD	Height
	mm	*cm*
Weed free (control)	12.77	47.64
Native vegetation	6.95	36
Cogongrass	5.52	34.96

end of 9 months. The weed-free treatment resulted in the largest seedlings, with a 200 percent increase in RCD and 72 percent increase in height after 9 months.

Our preliminary data clearly show that cogongrass is far more aggressive competition for loblolly pine seedlings than native vegetation. If cogongrass grows unchecked in plantations, productivity and sustainability can be severely impacted. Integrated control strategies recommended for cogongrass control (Jose and others 2002) need to be followed to ensure plantation success when cogongrass infestations are detected on cutover sites.

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