

PLANTING DENSITY AND SILVICULTURAL INTENSITY IMPACTS ON LOBLOLLY PINE STAND DEVELOPMENT IN THE WESTERN GULF COASTAL PLAIN THROUGH AGE 8

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Commercial plantation growers need to know how planting density and cultural regime intensity affect loblolly pine plantation productivity, development and value to make sound management decisions. This knowledge is especially important given the diversity of traditional products, such as pulpwood, chip-n-saw, and sawtimber, and potential products, such as bioenergy feedstock and carbon, from plantations. While there has been considerable research reported on general effects of planting density alone and of cultural intensity alone, relatively limited research has been reported on how plantation performance may be affected by combinations of planting density and cultural intensity across a range of planting densities and silvicultural regimes on representative soils (Carlson and others 2009, Quicke and others 1999, Rahman and others 2006, Zhao and others 2011).

A regional trial was established to examine planting density and cultural intensity effects and interactions in the Western Gulf Region (Arkansas, Louisiana, Texas, and Mississippi) from 2001 to 2003 by a consortium of large commercial growers and Texas A&M University. The Plantation Management Research Cooperative (PMRC) assumed responsibility for this study in 2008. A total of 18 installations were located on soil groups defined for the study based on drainage class and surface horizon depth. Each installation included 10 plots, each plot representing a unique combination of planting density and cultural intensity. Five levels of planting density (200, 450, 700, 950, and 1200 TPA) were tested in combination with two levels of silvicultural intensity, intensive and maximum. The intensive regime included mechanical site preparation specific to soil groups, tip moth control during the first two growing seasons, and competition control and fertilization during the first growing season. The maximum regime

included intensive culture treatments plus additional competition control and fertilization treatments.

At age 8, averages across all plots were 92 percent survival, 33 feet height, 35 feet dominant height, 6 inch DBH, 112 square feet of basal area per acre, 1940 cubic feet of total stem outside bark volume per acre, 49 tons of total stem outside bark green weight per acre, 256 stand density index, 0.30 relative spacing, 20 feet of live crown, 60% live crown ratio, and 5 percent Cronartium infection rate.

Density dependent mortality was not pronounced although the slight reduction in percent survival with increasing age on maximum culture plots at 700 to 1200 planting densities suggests that intra-specific competition had begun.

Planting density and cultural regime had marked impacts on age 8 individual tree and stand attributes. Average tree diameter increased with decreasing planting density. Per acre basal area, volume and green weight, and stand density index increased with increasing planting density. Average height and dominant height for the 200 planting density were generally about 2 ft less than for the 450 planting density. Maximum culture increased average tree height and DBH and per acre basal area, volume, and green weight as well as stand density index. Relative spacing decreased with increasing planting density and was not significantly affected by cultural regime. At age 8, effects of planting density on tree and stand attributes were generally consistent across cultural regimes and effects of cultural regime on tree and stand attributes were generally consistent across planting densities. Soil group, as defined for this study, did not significantly affect plantation attributes at age 8. Live crown length was most affected by planting density, being about 9 ft longer on the 200 planting density than the 1200

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planting density. Live crown length was affected to a lesser degree by cultural regime, being only one foot longer on maximum culture plots than on intensive culture plots. Incidence of *Cronartium* on stems throughout the study was low, averaging 5%. Incidence was significantly elevated (9%) on low planting density (200) maximum culture plots.

Cultural regime and planting density combinations offer loblolly pine plantation managers opportunities to significantly influence individual tree and stand level attributes as warranted by objectives and markets. Greater intensity of culture offers opportunities to increase per tree and per acre growth rates over a range of densities while increased planting density provides opportunities to increase per acre production in the period prior to significant density dependent competition.

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