
EFFECT OF CULTURE AND DENSITY ON ABOVEGROUND BIOMASS ALLOCATION OF 12 YEARS OLD LOBLOLLY PINE TREES IN THE UPPER COASTAL PLAIN AND PIEDMONT OF GEORGIA AND ALABAMA

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We destructively sampled a total of 192 12-year-old loblolly pine trees from four installations established by the Plantation Management Research Cooperative (PMRC) to analyze the effects of planting density and cultural intensity on tree level biomass allocation in the Piedmont and Upper Coastal Plain of Georgia and Alabama. Each installation had 12 plots, each plot representing a unique cultural intensity (intensive and operational) and planting density (741, 1482, 2223, 2964, 3705 and 4446 trees ha⁻¹) combination. The plots with the operational culture received chemical site preparation, first growing season competition control and fertilization, and fertilization at ages 7 and 11 while the plots with intensive culture received the operational treatments plus complete and sustained competition control and fertilization about every two years. Previous analysis of plot inventory information determined that at age 12, mean tree DBH increased with intensive culture and decreased with increasing planting density. The objectives of the research reported here were to determine effects of planting density and cultural intensity and their interaction on aboveground biomass accumulation and allocation at the tree level. Biomass in stemwood, stembark, dead branches, live branches, and foliage was examined.

The main effect of culture was significant ($p < 0.05$) for stemwood, stembark, dead branch and total aboveground biomass with more biomass on intensively cultured than operationally cultured trees. The effect of planting density on biomass was significant ($p < 0.001$) for each component and for total aboveground biomass with greater biomass on trees on lower than higher planting density plots. The interaction between culture and planting density was only significant for dead branch biomass. The amount of dead branch biomass was especially great on trees planted at lower planting densities and grown with intensive culture.

Mean tree-level biomass allocation for each cultural intensity and planting density combination is presented in Figure 1. Culture had a significant effect on dead branch, live branch and foliage biomass allocation. Trees grown under intensive culture had a greater proportion of biomass in dead branches and a smaller proportion of biomass in live branches and foliage than trees grown under operational culture. Planting density had a significant effect on allocation for all the aboveground biomass components. Trees planted at higher planting densities (2223 trees ha⁻¹ and above) allocated a greater proportion of biomass to stemwood and stembark than their counterparts at lower densities. Trees planted at lower planting densities (741 and 1442 trees ha⁻¹) allocated a greater proportion of biomass to branches and those planted at the lowest density (741 trees ha⁻¹) allocated a greater proportion of biomass to foliage than trees at greater densities. The culture by density interaction had no significant effect on aboveground biomass allocation.

Both cultural intensity and planting density affected tree-level biomass amount and allocation to aboveground components of 12-year-old loblolly pine. The differences in biomass allocation patterns observed among planting densities from 741 to 2223 ha⁻¹ should be considered when estimating plantation yields for components additional to the stem. Biomass amount and allocation among components did not vary significantly for planting densities in the 2223 to 4446 trees ha⁻¹ range. Additional analyses of this data is planned to examine if biomass amounts and allocation to components are fully explained by tree size (DBH, height, DBH² x Height) alone or if culture, planting density and their interaction affect biomass amount and allocation beyond their effect on tree size. Although, belowground biomass is a very important component of total tree biomass, we only examined aboveground biomass.

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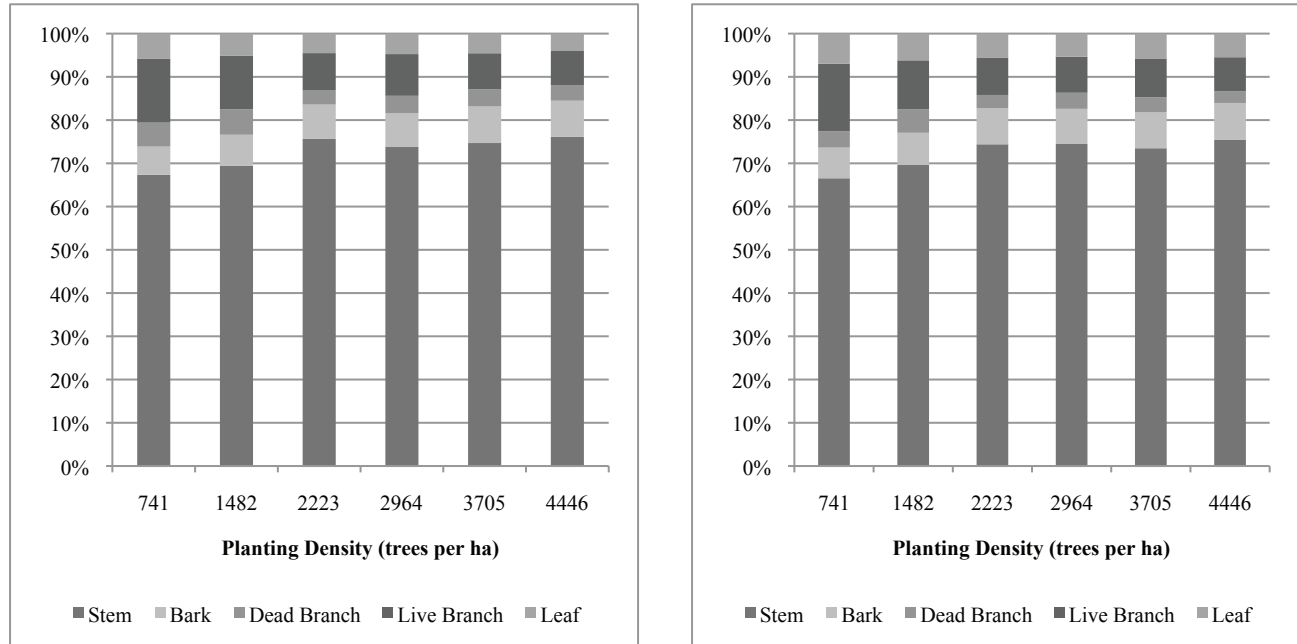


Fig 1 —Mean per tree biomass allocation for loblolly pine at age 12 by component and planting densities for intensive (left) and operational (right) culture.