

THE EFFECTS OF PLANTING DENSITY AND CULTURAL INTENSITY ON LOBLOLLY PINE CROWN CHARACTERISTICS AT AGE TWELVE

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Twelve-year old loblolly pine (*Pinus taeda* L.) stands were analyzed for the effects of planting density and cultural intensity on tree and crown attributes. Four study installations were located in the Piedmont and Upper Coastal Plain regions of the U.S. South. The treatments included six planting densities (740, 1480, 2220, 2960, 3700, 4440 trees per hectare) and two levels of culture (intensive and operational). The intensive cultural treatment included frequent fertilization and complete sustained chemical competition control. The operational cultural treatment included less frequent fertilization and early chemical competition control. Density and cultural treatments were combined to make a total of twelve plots per installation. Destructive sampling methods were used to obtain detailed tree and crown measurements. Trees planted at the lower densities (especially 740 and 1480 trees per hectare) had significantly ($\alpha=0.05$) higher values for crown width, live crown length, foliar biomass, leaf area, and foliar nitrogen content at the tree level (Table 1). Greater individual crown size and nitrogen content at the lower densities corresponded with larger individual tree size (dbh and height). These attributes indicate that individual trees

planted at lower densities are in better condition to respond to thinning. Specific leaf area (SLA) was measured as leaf area per unit leaf mass at the individual needle level. SLA increased significantly with increasing density, illustrating the effect of increased shading in the higher density stands. Surprisingly, foliar nitrogen concentration was the only crown measurement significantly affected by cultural regime. Trees grown under the intensive regime exhibited a higher percentage of nitrogen concentration in the crown. Even trees grown at the operational level, however, had foliar nitrogen percentages of at least 1.22 percent, above the critical level for loblolly pine (Allen 1987). The absence of a major cultural effect on crown attributes can most likely be attributed to the nature of the treatments, with even the operational cultural regime receiving considerable fertilization and competition control. Further research will include crown analysis by tree size to test for treatment effects on trees of a given dbh-class.

LITERATURE CITED

Allen, H.L. 1987. Forest fertilizers: nutrient amendment, stand productivity, and environmental impact. *Journal of Forestry*. 85(2): 37-46.

Table 1—Mean sampled tree crown characteristics measured at age 12 for loblolly pine stands growing at different planting densities

Planting Density (trees ha ⁻¹)	Crown width (m tree ⁻¹)	Crown length (m tree ⁻¹)	Foliar biomass (g tree ⁻¹)	Leaf area (m ² tree ⁻¹)	Foliar N content (g tree ⁻¹)
740	4.4 (a)	8.2 (a)	8507 (a)	91.5 (a)	117 (a)
1480	3.4 (b)	7.4 (b)	5228 (b)	58.1 (b)	76 (b)
2220	3.0 (c)	6.4 (cd)	3344 (cd)	36.7 (cd)	47 (c)
2960	2.7 (c)	6.6 (c)	3426 (c)	38.5 (c)	48 (c)
3700	2.7 (c)	5.9 (de)	2983 (ce)	33.1 (ce)	43 (cd)
4440	2.3 (d)	5.6 (e)	2303 (de)	26.0 (de)	34 (de)

Means in the same column with the same letters are not significantly different (Fisher's LSD multiple comparison test; $\alpha=0.05$)

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