

## Genotype by Environment Interaction Under Optimal and Deficient Nutrient Regimes in Loblolly Pine at Age 12

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Year 12 growth data from the SETRES-2 study site were analyzed for growth differences due to nutrition, provenance, and family effects. Established in the winter of 1993-94, SETRES-2 is a loblolly pine (*Pinus taeda* L.) genotype by environment interaction study located in the Sandhills of Scotland County, NC. The study is a split-split plot experimental design, with nutrition (annual optimum fertilization and non-fertilized) main plots, provenance (Atlantic Coastal Plain and “Lost Pines” Texas seed sources) sub-plots, and family (five OP genetic families per provenance) sub-sub-plots nested in provenance.

Differences in growth traits due to nutrition were highly significant at age 12. Fertilized plots showed a 66.2% increase in height over the non-fertilized plots. Diameter at breast height was 51.2% greater in the fertilized plots. Mean tree volume for fertilized plots was increased 183.0% over non-fertilized, and as a function of the above effects, volume per acre was 157.2% greater for fertilized plots. Genotype by environment interactions in height and diameter at breast height were limited to differences in magnitude of response to fertilization. Current annual increment (CAI) for volume per acre, however, showed a cross-over interaction between the provenances in the fertilized nutrient regime plots beginning at age 10. Prior to age 10, CAI for volume per acre was greater in the Atlantic Coastal Plain (ACP) provenance than in the “Lost Pines” Texas (LPT) plots; after age 10 the volume per acre CAI was larger in the LPT source than the ACP source. This interaction continued through age 12. As survival was beginning to drop more rapidly in the fertilized ACP plots, likely due to competition induced mortality, the increase in individual tree volume growth rates was insufficient to match the volume produced by a greater number of remaining stems in the LPT plots.

Family mean rankings over time were very stable for height and diameter. The greatest rank changes occurred in the CAI for volume, with most families changing rank at least once between ages 5 and 12 in the fertilized treatment. This study is beginning to give insight into the behavior of improved loblolly pine genetic stock in block plots, and as the stand matures, will continue to provide valuable insight into the issues associated with modeling gain in operational improved loblolly pine plantations in the Southeastern U.S.