CARBON ALLOCATION TO YOUNG LOBLOLLY PINE ROOTS AND STEMS

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Recent research on sucrose metabolism demonstrated that the seasonal carbon allocation between roots and stems of loblolly pine (*Pinus taeda* L.) can be significantly affected by periods of edaphic or environmental stress. We also reported that root weights of seedlings from 130 half-sib seedlots frequently represent only between 5 to 15 percent of the total seedling biomass during the first year in the nursery and one year after outplanting. During this early development, it is not unusual to have top/root ratios between 7:1 and 12:1. We theorize that loblolly pine seedlings remain competitive in nature with limited root biomass because they are able to become quiescent during stress periods. Little information, however, is available for clarifying how carbon is allocated to loblolly pine roots for several years following outplanting. This study of root biomass with loblolly pine was designed with the following objectives: (1) to measure the root biomass for a range of individual trees between ages of 3 and 10 years on different artificial and natural forest sites and (2) to relate the root biomass to aboveground biomass components.

A commercial tree spade, that excavated a cone 1.22 m x 1.37 m, was used to extract 226 individual trees from seven different locations representing different soil types and tree ages. On one-third of the trees sampled, all lateral roots outside the cone were manually excavated to obtain estimates of total root biomass. Approximately 85 percent of the total root biomass was extracted within the cone. Weights of stem and branches plus needles also were obtained. Equations for predicting root biomass based on both stem diameter and height were developed. The top/root ratios for trees up to 10 years of age are similar to those of seedlings one year after outplanting. Soil types and soil pan layers significantly affected root morphology but not total root biomass. Naturally regenerated trees of comparable age when they are available on certain sites also were excavated. These trees had biomass data and root morphology comparable to the artificially regenerated trees. With either regeneration method, approximately 25 percent of total tree biomass was in roots. From an integrated analysis of our data from nursery seedlings, artificial plantations, and natural forests, we propose that young loblolly pines are able to compete across a range of forest sites because of tree's ability to become quiescent when periodic edaphic or environmental stresses occur as well as the root system's ability to readily adapt to various soil characteristics.