

Shape of root systems influences survival and growth of loblolly seedlings

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Seedlings with curled roots sometimes exhibit greater shoot growth than those which have been carefully planted. Root excavations in North Carolina Piedmont plantations revealed that larger trees were frequently supported by deformed root systems while small trees of the same age had normal roots. Consequently, a study was made to assess root deformation in relation to growth of loblolly pine seedlings.

In an exploratory study, 155 loblolly pine (*Pinus Ineda L.*) seedlings were dug at random from a 2-year-old plantation and classified on the basis of their root configurations:

"straight," "single twist," "double twist," "J," and "balled." Oven dry weights of roots, stems, and foliage were significantly greater for "balled" roots than for others ($P < 0.01$). Height and diameter means were not significantly different. These results suggested that root deformation may stimulate stem growth, which is contradictory to generally accepted ideas (5, 4, 1). It is also possible that the smaller trees had shorter root systems which were not bent when planted, while the larger seedlings had root systems too large for the planting slit which were twisted or bent when planted; however, the large number of root systems that were excavated somewhat lessens this probability.

Reassessment of the widely-accepted generalization that taproots must always be planted straight for best growth seemed desirable. Is root deformation acquired (luring hand planting detrimental to seedling survival and early growth? In pursuit of answers to this question, experiments were carried out to reveal possible correlations between the top growth of seedlings and deformation of supporting root systems.

Methods

Loblolly pine seedlings were planted with root configurations that commonly occur when seedlings are planted (2). One

hundred blocks were established each containing two plots. Each plot had seven seedling types, i.e., "straight," "slanted," "very slanted," "shaped," "J-shaped," "double-J" and "randomly balled" configurations. The "slanted" and "very slanted" configurations commonly occur with machine planting because of the seedling dragging in the slit prior to its release.

To reduce variation in planting stock size, a large number of 1.0 seedlings was graded to provide stem lengths of 12 ± 2 inches. A random sample established a base for growth measurements. Survival counts were made at regular intervals (luring the first growing season).

At random, one plot (seven seedlings) from each block was harvested in September of the first and second growing seasons after planting. Heights, diameters at root collar, and dry weights of roots, stems, and foliage were subjected to analyses of variance.

Results

Survival of seedlings with "Jshaped" roots was greatest early in the first growing season. "Straight" and "very slanted" roots were almost

as successful. By September "straight" and either first-year survival or growth rates seasons growth, the dry weights of seedlings "J-shaped" seedlings both had 90 percent during the first 2 years. However, with deformed roots were increasing at a survival rate. Average survival rate for neither were there any stimulating faster rate than those of seedlings with all treatments was 88 percent. Although effects after just two growing seasons. straight roots. This was due to the total survival did not show statistically Treatments that simulated hand planting and proliferation of shallow lateral roots. The significant differences, an analysis of the machine planting did equally well. abundance of small lateral roots in the upper data showed that some treatments In a Virginia study with loblolly pine, soil zones would greatly increase the suffered more accelerated mortality as Grushow (1) did not find height growth potential of a seedling for nutrient and water the growing season progressed than did differences among seedlings with normal. J-absorption. The net effect would be increased the "straight" root control. Rainfall was shaped. L-shaped, or twisted root systems. dry weight accumulation. plentiful during the summer months.

In another study, loblolly seedlings Although there were no significant with Jshaped roots had growth rates com- differences among treatment growth means parable with normally rooted seedlings after either growing season ($P < 0.01$), (6). Some northern species, however, trends were evident. For each measured showed reduced height growth increments variable, the mean for all treatments was if the roots were deformed (4). Also direct greater than the mean for the "straight" seeded slash pine (*Pinus elliotii* Engelm.) root treatment, and differences were showed early height growth advantages over even greater after the second growing planted seedlings (3). The disturbance of planted root systems was thought to be the cause.

Discussion

It is evident that root deformation incurred at planting did not reduce

With increased time in the ground, there may well have been some different results. Based on two

Conclusions

Planting loblolly pine seedlings with severely deformed root systems did not produce significant growth response differences over two growing seasons. A reorganization of root type development was observed. i.e., lateral roots developed profusely in the severely deformed treatments, seemingly at the expense of the more "normal" taproot. Increased root surface area in the upper soil zones may enhance the nutrient and water absorption capacity of the seedling.

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