# Shape of root systems influences

# survival and growth of loblolly seedlings

by

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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.

pine (Pinus Ineda L.) seed. lings were dug with machine planting because of the at random from a 2-year-old plantation and seedling dragging in the slit prior to its classified on the basis of their root release. configurations:

"J." and "balled." Oven dry weights of roots, was graded to provide stem lengths of  $12 \pm 2$ stems. and foliage were significantly inches. A random sample established a base greater for "balled" roots than for others (P<0.01). Height and diameter were made at regular intervals (luring the means were not significantly different. first growing season. These results suggested that root deformation may stimulate stem growth, from each block was harvested in which is contradictory to generally accepted ideas (5, 4, 1). It is also possible that the seasons after planting. Heights. diameters smaller trees had shorter root systems which at root collar, and dry weights of roots, were not bent when planted, while the larger stems, and foliage were subjected to analyses seedlings had root systems too large for the of variance. planting slit which were twisted or bent when planted: however. the large number of root systems that were excavated somewhat lessens this probability.

generalization that taproots must always he were almost 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 In an exploratory study. 155 loblolly slanted" configurations commonly occur

To reduce variation in planting "straight." "single twist," "double twist." stock size. a large number of 1.0 seedlings for growth measurements. Survival counts

> At random, one plot (seven seedlings) September of the first and second growing

#### Results

Survival of seedlings with "Jshaped" mewhat lessens this probability. Reassessment of the widely-accepted season. "Straight" and "very slanted" roots

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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. 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.

season (fig. 1).

# Discussion

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

In another study, loblolly seedlings Although there were no significant with Jshaped roots had growth rates comdifferences among treatment growth means parable with normally rooted seedlings after either growing season (P < 0.01), (6). Some northern species, however, severely deformed root systems did not 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 elliottii 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 he the cause

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

abundance of small lateral roots in the upper

# Conclusions

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.

# Literature Cited

#### 1. Gruschow, G. F.

1959. Observations on root systems of planted loblolly pine. J. For. 57:894896.

2. Hay. R. I... and F. W. Woods 1968 Distribution of available carbohydrates in planted loblolly pine root systems. Forest Sci. 14:301-303.

3. Koenig. R. L.

1962. Comparison of early development of planted and direct seeded slash pine. Woodland Res. Note No. 13. Union Camp Corp.

4. Rudolf. P. O. 1939. Why forest plantations fail. J. For.

37:377-383

5. Smith. D. M. 1962. The practice of silviculture, p. 270278 John Wiley and Sons, New York

6. Ursic, S. J.

1963. 'codification of planting technique not recommended for loblolly pine on eroded soils. Tree Planters' Notes 57:13-17.

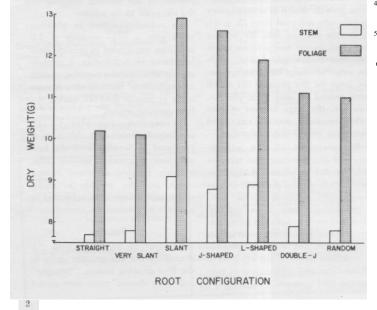


Figure 1.-Growth increases for loblolly pine seedlings after two growing seasons; hand

planting treatments are in order of increasing deformation severity.