Seedling Size Influences Early Growth of Longleaf Pine

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*Survival was not affected by seedling size in this study of longleaf pine (*Pinus palustris *Mill.) grown in northeast Florida. Planting seedlings with root collar diameters greater than $^{7}/_{16}$ inches resulted in improved tree height, percentage of trees out of the grass stage, and brown spot resistance.* Tree Planters' Notes 38(3):16-17; 1987.

Successful regeneration of longleaf pine (*Pinus palustris* Mill.) depends both on first-year survival and the length of time trees remain in the grass stage after outplanting. Past studies have shown that survival and early growth are influenced by seedling size (1-3).

This test was established to determine if the root collar diameter of longleaf pine seedlings at the time of planting affects early growth and survival. Survival, height, and the level of brown spot infection are reported through the end of the third growing season.

Methods

Longleaf seedlings were hand-lifted from the nursery bed at the ITT Rayonier nursery located in Glennville, GA, in January 1983. Their roots were immediately dipped in a clay slurry. After dipping, the seedlings were separated into size classes based on root collar diameter. There were six $^{1}/_{8}$-in. size classes starting with a root collar diameter of $^{3}/_{16}$ in. and ending with the largest size class that consisted of seedlings with root collar diameters greater than $^{3}/_{16}$ in. The seedlings were placed in seedling storage bags and stored in a seedling storage shed for 11 days before they were outplanted on January 24, 1983.

The test site is located in Nassau County, FL, on a somewhat poorly drained Ridgewood fine sand. The Ridgewood series consists of somewhat poorly drained, rapidly permeable soils on slightly elevated ridges in the flatwoods that formed on thick beds of sandy marine deposits. 11 is a thermic uncoated Aquic Quartzipsamment. Competition from hardwoods is minimal, and they consist predominantly of oaks.

A randomized complete block design was used in which the seedling size-class was randomly assigned to each planting space within a given block. Twenty longleaf seedlings were handplanted for each size class in each of three blocks. Each of the blocks was planted by a different person and the order of planting for different size classes was randomly assigned by block. Soil moisture was high at the time of planting since 5 in. of rain had fallen in the 4 preceding days.

The trees were measured for height and survival at the end of the second and third growing seasons. Brown spot infection, which is caused by *Scirrhia acicola* (Dearn.) Siggers, was noted at the end of the second growing season. Since the level of infection seemed to be related to tree size and tree size was related to treatment, trees were classified at the end of the third growing season by the degree of brown spot infection. This was done by classifying each tree into one of five classes based on the percentage of needles damaged by brown spot disease. These classes were reduced during the analysis of the data into two classes that consisted of trees with less than 25% of their needles damaged by brown spot or trees with more than 25% of their needles damaged. Longleaf seedlings were considered to be in the grass stage if they were less than 0.5 ft. in height.

Results

Seedling size did not have any significant effect on survival although there was a trend for lower survival in both the smallest and the largest seedling classes. Poor vigor was noted for the smallest class, and large, difficult to plant root systems for the largest seedling class. Seedling size had a significant effect on the height (average of all trees) and the percentage of seedlings out of the grass stage at the end of both the second and third years (table 1).

The percentage of trees that had greater than 25% of their needles damaged by brown spot

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Table 1—*Average survival and growth of longleaf pine seedlings by seedling size-class after 2 and 3 years*

Seedling size class (in.)	After 2 years Height (ft)	After 2 years Percent out of grass	After 2 years Percent survival	After 3 years Height (ft)	After 3 years Percent out of grass	After 3 years Percent survival
3/16 to 5/16	0.2 a	15 a	82 a	0.9 a	55 a	82 a
6/16 to 7/16	0.4 a	30 a	87 a	1.5 ab	71 ab	87 a
8/16 to 9/16	0.6 ab	61 b	88 a	2.2 b	87 b	88 a
10/16 to 11/16	1.1 bc	76 b	93 a	3.2 c	98 c	92 a
12/16 to 13/16	1.6 c	95 c	92 a	4.0 c	98 c	90 a
>13/16	2.2 d	94 c	83 a	5.1 d	96 c	83 a

Means in columns with the same letter in common do not differ significantly at the 0.05 level of probability. Comparisons of percentages used the arcsine $\sqrt{\%}$ transformation but actual percentages are reported.

Table 2—*Percentage of longleaf pine seedlings with more than 25% of their needles damaged by brown spot disease*

Seedling size class (in.)	Percent
3/16 to 5/16	20 ab
6/16 to 7/16	31 a
8/16 to 9/16	9 abc
10/16 to 11/16	9 abc
12/16 to 13/16	6 bc
>13/16	2 c

Means in columns with the same letter in common do not differ significantly at the 0.10% level of probability. Comparisons of percentages used the arcsine $\sqrt{\%}$ transformation but actual percentages are reported.

differed significantly by seedling size at the 10% level. These percentages are summarized in table 2.

The high survival, which was over 80% for all six seedling size-classes, may not have occurred during a year with less favorable weather conditions or on more severe sites. Nonetheless, seedlings with root collar diameters less than $^{7}/_{16}$ in. were slow to initiate height growth and a high percentage were damaged by brown spot disease.

Trees with initial root collar diameters greater than $^{7}/_{16}$ in. had acceptable growth with at least 87% out of the grass stage after 3 years and future stunting by brown spot disease expected to be minimal. Tree height increased with seedling size, but nursery, handling, and planting considerations also need to be evaluated to determine the size desired for production seedlings.

Literature Cited

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