Ninth-Year Performance of Slash and Loblolly Pine Nursery Selections in Georgia [1/]

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One of the various methods of individual tree selection which has been suggested for use in tree breeding is the selection of outstanding seedlings from nursery beds. It is an intensive selection method because it involves the examination of large numbers of trees. It is also an extensive selection technique because a relatively large number of trees can be selected in a short time. The principle criticism of nursery selection has been the lack of data showing a good correlation of juvenile height growth with mature tree characteristics. The objective of this study was to test the utility of nursery selection, and to provide trees for future applied breeding by selecting seedlings of outstanding vigor from the Georgia Forestry Commission nurseries.

Nursery selections were made for several consecutive years by the Tennessee Valley Authority in loblolly pine (**Pinus taeda L.), shortleaf pine** (**Pinus echinata Mill.),** and eastern white pine **(Pinus strobus L.)** (Ellertsen, 1955, 1957). In all species and age classes, the average height at the end of the 1956 growing season for the super-seedlings was at least 0.7 of a foot taller than the control s.

Zobel, Goddard, and Cech (1957) reported on a loblolly pine nursery selection study conducted by the Texas Forest Service. These selections were from nursery beds where the seed had been graded; within the medium size seed class, three types of selections were made: (1) better than average seedlings; (2) average seedlings; and (3) inferior seedlings. After five growing seasons, the outstanding seedlings were about 25 percent taller than the average seedlings, and the inferior seedlings were about 20 percent shorter than the average selections.

Bengtson (1963) reported from Florida on selections from slash pine (**Pinus elliottii** Engelm.) nursery beds. After 8 years in the field, the select seedlings averaged 23 percent taller than the control s.

STUDY HISTORY

In 1954, approximately 85 million slash pine seedlings and 25 million loblolly pine seedlings were grown in the four Georgia Forestry Commission nurseries. All of the beds in each of the nurseries were examined in November, at the beginning of the lifting season. Seedlings which appeared to be superior in height, diameter, or any other obvious form of outstanding vigor, in relation to the surrounding seedlings, were marked. These candidates were later re-examined and final selections made. When a select seedling was lifted, an average adjacent seedling to be used as a check was lifted and the two tied together. Of the 110 million seedlings examined, 582 slash and 571 loblolly seedlings were selected, which gave a selection ratio of 1:146,000 and 1:44,000, respectively.

The study was planted on sandy upland old fields in Twiggs County in central Georgia. The trees were planted in three separate fields with the paired seedlings planted side by side within the row. Field I contained 25 rows of 28 loblolly seedlings; Field II contained 11 rows of 40 loblolly seedlings; and Field III contained 35 rows of 34 slash seedlings.

At the end of the fourth growing season, the loblolly pine and slash pine select seedlings were 16 and 19 percent taller, respectively, than the controls (Barber and VanHaverbeke, 1961). The select seedlings for both species had a higher average number of fusiform rust (**Cronartium fusiforme** Hedgc. & Hunt ex Cumm.) infections per tree than the controls. This was attributed to the fact that the select trees were larger and had more crown exposed to the fusiform rust infection. Barber and

1/ Cooperators in this study were the Georgia Forestry Commission, the Georgia Kraft Company, and the Georgia Kraft Company.

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VanHaverbeke also reported that, except for the loblolly controls, the percentage of rust-free trees in all height classes was similar, indicating that the more vigorous trees were not more susceptible to rust.

In December 1963, after nine growing seasons, the plantations were severely damaged by ice. As a data-salvaging operation, height and diameter at breast height were measured in April 1964. The trees that were broken into one or more pieces were reconstructed and measured, and the trees that were bent over were measured in sections or with a flexible tape. Individual tree volumes (outside bark) were calculated as that of a cone with a height equal to total tree height and a basal area equal to that at breast height. The study was terminated because of the severe ice damage. The plantation will continue to be maintained for the possibility of using some of the trees in a breeding program.

Differences between the select seedlings and their checks at 9 years were compared by t-tests calculated separately for each field. The results showed that the superiority of the select trees over the control trees for height, d.b.h., and cubic-foot volume was highly significant for all fields. The t-value for all tests was significant with 99 percent confidence.

In field 1 (loblolly) 39 percent of the paired trees survived. Among these 135 pairs, the select trees averaged 2.1 feet taller, 0.6 inch larger in d.b.h., and 0.5 cubic foot more volume than the controls (figure 1A). In Field II (loblolly), 39 percent of the paired trees survived. Among these 86 pairs, the select trees averaged 1.7 feet taller, 0.5 inch larger in d.b.h., and 0.4 cubic foot more volume than the controls (figure 1B). In Field III (slash), 41 percent of the paired trees survived. Among these 237 pairs, the select trees averaged 1.6 feet taller, 0.5 inch larger in d.b.h., and 0.4 cubic foot more volume than the controls (figure 1C). Based on the paired trees, the select loblolly and slash trees had 20 and 22 percent more cubic-foot volume, respectively, than the controls.

After four growing seasons, the difference in average height between the select and control trees

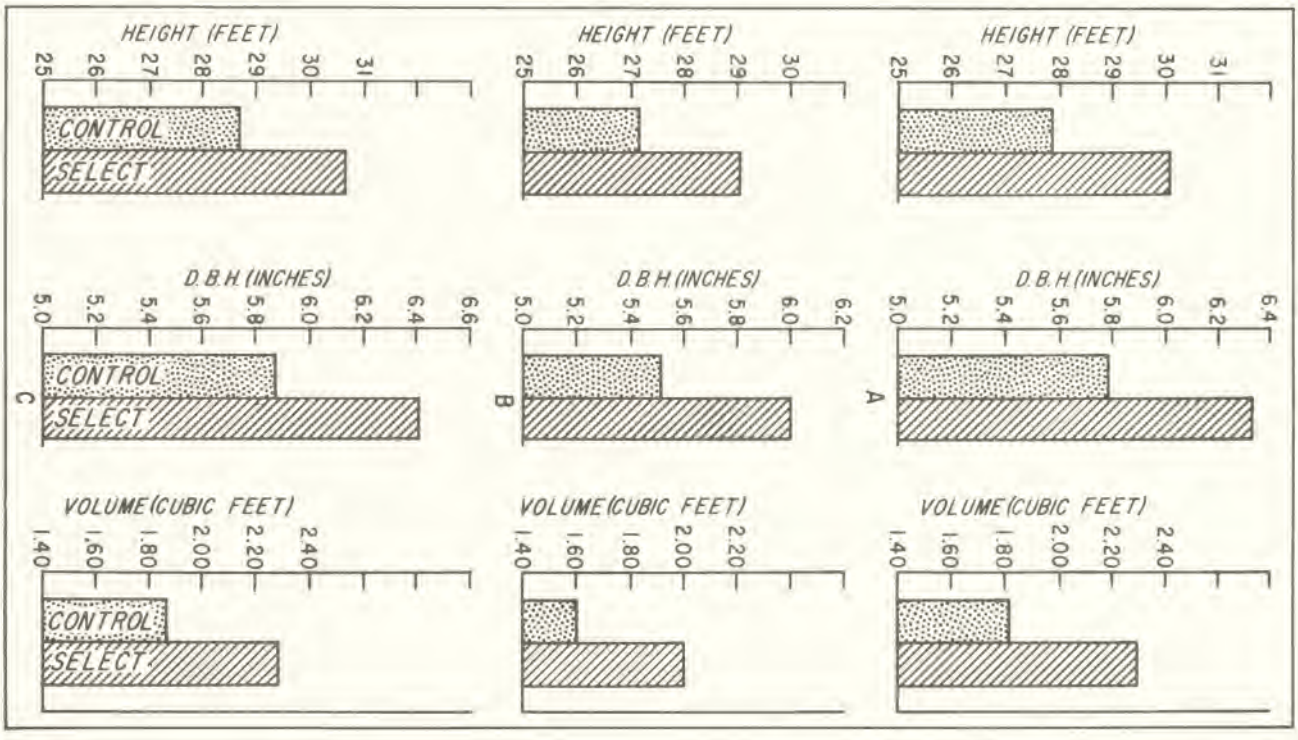

Figure 1.-- The average height, d.b.h., and cubic-foot volume for all paired trees in loblolly pine, Field 1 (A); loblolly pine, Field 11 (B); and slash pine, Field III (C).

had increased yearly in both species (Barber and VanHaverbeke, 1961). After 9 years, the data show that the select loblolly trees were still increasing their height advantage and averaged 1.9 feet taller than the checks, compared to 1.3 feet at 4 years.

Conversely, the height advantage of the select slash decreased slightly from 1.8 feet at 4 years to 1.6 feet after 9 years.

From observation, some of the selected trees were superior in other qualities, such as crown form and pruning ability. There were also indications that some trees were resistant to fusiform rust because they were uninfected after 9 years, even though the rate of infection in the study as a whole was very high. Not all of the select trees were superior to their paired check trees; in some cases, the controls had above-average qualities.

CONCLUSIONS

The selection of outstanding loblolly and slash pine seedlings in the nursery was shown to be a feasible means of locating trees potentially outstanding in vigor for use in future breeding work. This method of selection could also be considered for the establishment of seed production areas or seedling seed orchards.

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