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DIFFERENTIAL RESPONSE OF SLASH PINE FAMILIES TO DROUGHT

Abstract.—First-year survival and growth of superior and commercial slash pine seedlings, grown on both high and low beds, were compared on a typical north Florida flatwoods site. Average survival of the commercial seedlings was 80 percent, and that of the superior seedlings was 60 percent. Four of the fourteen superior families survived better than did the commercial seedlings, but four others had less than 50 percent survival. Most mortality occurred during a severe drought shortly after planting. The superior seedlings were 0.27 foot taller than the commercial seedlings at outplanting and 0.33 foot taller after the first year in the field. Neither survival nor growth was significantly affected by bed height. Results suggest that it may be feasible to select slash pine for both drought resistance and superior growth rate.

In the foreseeable future thousands of acres of the Southeastern Coastal Plain will be planted to superior slash pine (*Pinus elliottii* Engelm. var. *elliottii*) of known genetic characteristics. Although genetically superior trees grow rapidly under experimental conditions,[1 2] their actual performance under commercial management conditions is not well established.

A study was installed in 1967 to compare survival and growth of commercial seedlings with that of 14 superior families, under field conditions. A severe drought, shortly after outplanting, resulted in highly variable survival. This paper reports survival and growth at the end of the first growing season.

Materials and Methods

The study is located in Baker County, Florida, on an imperfectly drained flatwoods site of Leon fine sand. The area was cleared of a sparse stand of longleaf pine (*P. palustris* Mill.) in 1965, then disk-harrowed twice and bedded on 12-foot centers during the spring of 1966. Twenty completely randomized plots were installed to compare survival and growth of superior slash pine seedlings with that of commercial seedlings on high and low beds.

Low beds (6 inches above normal ground line) were constructed with a bedder-packer on 10 randomly selected plots comprising one-half of the total area. High beds (15 inches above normal ground line) were constructed on the other 10 plots by turning up pairs of mounds with a fire plow and then pulling each pair into a single high bed with a bedder-packer. The two bedding treatments were included in this study because general observations indicated that on beds of uneven height, seedlings were tallest on the highest sections of the beds.

Fourteen lots of control pollinated slash pine seed were collected in Georgia and north Florida from trees which had been selected for outstanding growth or oleoresin yield (table 1). A mixture of commercial slash pine seed was collected in Florida by the Florida Forest Service.[3] All seed were sown in April 1966 in an experimental forest nursery in Baker County, and the seedlings were raised at a density of about 35 per square foot.

A total of 1,000 superior and 1,000 commercial seedlings were lifted in January 1967,

[1]Webb, C. D., and Barber, J. C. Selection in slash pine brings marked improvement in diameter and height growth plus rust resistance. Eighth South. Conf. on Forest Tree Impr. Proc. 1965: 67-72. 1966.

[2]Nikles, D. G. Progeny tests of slash pine (*Pinus elliottii* Engelm.) in Queensland, Australia. Eighth South. Conf. on Forest Tree Impr. Proc. 1965: 112-121. 1966.

[3]In an unpublished study comparing these two groups of seedlings under intensive cultural treatments, the superior families averaged 28 percent taller than the commercial seedlings 1 year after outplanting.

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Table 1.—Survival and heights of superior and commercial seedlings 1 year after planting

Family	Seedlings planted	Survival	Height
	Number	*Percent*	*Feet*
Dodge 11 X Mix[1]	60	93	1.4
Ware 8 X Charlton 1	50	90	1.6
G-28 X Mix[2]	90	83	1.6
McIntosh 5 X Mix[1]	50	82	1.7
Worth 1 X McIntosh 3	40	67	1.7
G-2 X G-133	70	66	1.4
Worth 1 X Charlton 1	50	62	1.5
G-2 X G-198	100	61	1.6
Dodge 11 X McIntosh 3	40	55	1.4
G-2 X G-146	100	51	1.4
G-112 X Mix[2]	120	47	1.4
Appling 1 X Mix[1]	70	44	1.3
Telfair 38 X McIntosh 3	60	40	1.7
G-4 X G-198	100	36	1.4
Average for families	—	60	1.50
Seedlings from northwest Florida commercial seed	1,000	80	1.17

[1]Mixture of pollen from 12 to 15 trees selected for rapid growth and good form.
[2]Mixture of pollen from 21 trees selected for rapid growth or high oleoresin yield.

transported to the field in buckets of water, and handplanted at 10- by 12-foot intervals in 100-tree plots. Five high-bed and five low-bed plots were planted with the superior seedlings; the remaining five high-bed and five low-bed plots were planted with the commercial seedlings. Although the number of superior seedlings per family was unequal (see table 1), the seedlings in each family were evenly distributed among the 10 plots of superior seedlings. On each of these plots, the seedlings were randomly assigned to the planting positions; and their locations were recorded by family. Around all plots, isolation strips were planted with 1-0 seedlings obtained from the Florida Forest Service nursery in Levy County. Good planting conditions prevailed: soil moisture was near field capacity, the beds were firmly packed, and competing vegetation had recovered little since the site was prepared.

Results and Discussion

One year after planting, the commercial seedlings averaged 80 percent survival, and taken together, the superior families averaged 60 percent survival (table 1). This difference is significant at the .005 level. Most mortality occurred during a drought shortly after planting. Only 1.75 inches of rain (7.50 inches below normal) fell during the 12-week period between mid-February and early May 1967.

Of more importance than the overall low survival of the superior seedlings is the survival of the individual families, which ranged from 36 to 93 percent. Four families, known to be faster growers than the commercial seedlings, also surpassed them in first-year survival. These results indicate (1) that an inherently fast growth rate is not necessarily incompatible with high resistance to water stress and (2) that it may be feasible to select slash pine for both drought resistance and superior growth rate.

Survival was slightly higher on the low beds (73 percent) than on the high beds (68 percent). Although not statistically significant, the difference may be real, for seedlings on the high beds probably were subjected to greater moisture stress during the spring drought.

Although some of the families in this study were originally selected as being superior solely upon their high oleoresin-yielding ability, all 14 families were taller than the commercial seedlings (table 1). This height superiority was not unexpected, because rapid height growth and high oleoresin-yielding ability are genetically correlated in slash pine.[4]

After outplanting, the superior seedlings averaged 0.95 foot tall and the commercial seedlings averaged 0.68 foot tall. After 1 year in the field, the superior seedlings averaged 1.50 feet tall and the commercial seedlings averaged 1.17 feet. The 0.27-foot advantage the superior seedlings gained in the nursery was significant

[4]Squillace, A. E. Combining superior growth and timber quality with high gum yield in slash pine. Eighth South. Conf. on Forest Tree Impr. Proc. 1965: 73-76. 1966.

at the .005 level. The 0.06-foot advantage they gained during the first year in the field was not statistically significant. The failure of the superior seedlings to grow significantly more than the commercial control during the first year in the field may have been the result of establishment and the drought, and they may well resume a more rapid growth rate in subsequent years. Bed height did not affect first-year growth of either the superior or commercial seedlings.

More planting trials are needed to confirm the relationships between survival and genetic growth superiority. If superior material continues to show poorer survival, then closer spacing will be necessary to maintain comparably stocked stands. On the other hand, if some genetically superior strains survive better than ordinary nursery stock, spacing can be increased to take this superior survival into account.

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