DIFFERENTIAL GROWTH RATE OF YOUNG PROGENY OF INDIVIDUAL SLASH PINE TREES

by

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Difference in the vigor of progeny of individual trees is of great interest to workers engaged in forest tree improvement and forest genetics research. Trees that produce fast-growing offspring may become the basis for a superior strain, which may produce superior seed in volume for large scale nursery planting. They would also be valuable breeding stock for intra- and inter-specific hybridization.

If it can be shown that progeny of individual trees vary in vigor, then source of seed becomes an important factor in racial variation studies, nursery selection studies and in investigations of the effect of seed size on seedling vigor. Observation at the Ida Cason Callaway Tree Improvement Project near Chipley, Georgia, of slash pine progenies through their 5th year indicate that such differences in vigor actually exist.

Description of Studies

By intensive scouting in plantations and natural stands of the 35,000 acre Callaway estate, individual trees that have twice the wood volume of the average tree in the same stand at the same age have been located. On a basis of diameter and height, crown form, limb size, and apparent resistance to disease, slash, loblolly, longleaf and short leaf pine have been selected. These trees are being used to answer several questions; will wind-pollinated seed from these fast-growing trees (that is to say, a superior mother and unknown father) produce fast-growing progeny; and when two superior trees are control-pollinated and crossed, will the off-spring be even more vigorous (superior mother plus superior father)?

In the studies by the Callaway Foundation, open-or wind-pollinated seedlings of about 40 selected slash pine trees have been planted since the spring of 1952. The progeny are out-planted in plots of 25 to 100 trees at 10 x 10 ft. spacing with 3 or 4 replications. These field test are designed to compare growth and other traits such as form, resistance to fusiform rust etc., of the progeny. For certain trees it was possible to make .plantings from different seed crops for three successive years. It is this group consisting of the progeny of six different selected trees that will be discussed here and not results for all plantings of all species. The group contains two trees that produce what we will refer to as slow-growing progeny, C-6 and C-51. Four trees produce progeny which are somewhat faster growing, C-10, C-37, C-50, and C-63. Height data is available for two of the plantings in their fifth year from seed and for the remaining planting during its third year.

Table 1 - Relative seedling heights for several progeny groups at one through five years in relation to a slow growing group.

Progeny group	Total Trees	Thousand seed weight	Relative heights. Progeny of C-6 equals 100 at --					5-year height
			1 year	2 years	3 years	4 years	5 years	
	Number	Grams	---	---	Percent	---	---	Feet
Slow growing								
C-6	39	26	100	100	100	100	100	7.67
C-51	141	33	163	117	119	109	95	7.32
Fast growing								
C-10	180	40	122	129	140	124	116	8.79
C-37	149	39	129	116	122	114	102	7.80
C-50	142	40	120	118	125	119	116	8.88
C-63	40	40	115	120	138	127	114	8.78

Results

1st. slide: When seedling heights are compared for each year it can be seen that some progeny groups have maintained about the same degree of superiority, expressed on a percentage basis, each year throughout the 5-year period. (Table 1) The progeny of C-10, for example, were 22 percent taller than the progeny of C-6 in the nursery bed. At the end of the succeeding growing seasons they were 29, 40, 24 and 16 percent taller than C-6.

Progeny of C-51, which we consider to be slow growing were very.fast growing in the 1951 nursery and were 63 percent taller than those of C-6. In the following years they were 117, 119, 109 and 95 percent of the height of C-6. The high vigor in the nursery of C-51 progeny was not observed in 1952 and 1953.

The superiority of the four fast-growing progeny groups was somewhat less in the fifth year than in the fourth. This is due, largely, to a slight increase in growth rate of the C-6 progeny rather than to a decrease ingrowth rate of the others.

2nd. slide: The relative vigor of seedlings from seed lots collected from the same tree in different years remains roughly the same for some trees but varied for others. At the end of the fifth year of growth for plantings made in the spring of 1952 and 1953 and the third year for plantings made in the spring of 1954, the progeny of C-51 were 95, 104 and 95 percent respectively of those of C-6.

For C-10 the relative heights were 116, 114, and 116, For C-63 they were 114, 116 and 111. These three groups were quite uniform. The others were more variable. C-37 was 102, 124 and 106 while C-50 was 116, 128 and 95.

For these six progeny groups, the seed weight was lower in slow-growing progeny which may have handicapped them iniatially but subsequent growth rate has not been rapid enough for them to catch up with other groups. In general, we do not find a strong relationship between seed size and seedling growth when seed is kept seperate by maternal parent.

We have both fast and slow progeny from maternal parents with low seed weight as well as from trees that have high seed weight. However, a complete discussion of this problem is beyond the scope of this paper as well as a discussion of differences in branch length and susceptibility to rust which have appeared in print or at earlier papers at this conference.

Conclusion

As a result of our observations on slash pine progeny groups to 5 years of age, we believe there are important differences in growth rate of the progeny of different trees. Just how much these differences will contribute to the selection of better strains or influence the detection of such strains through progeny tests with one-parent stock, we won't know until the plantings are older. We feel strongly, however, that serious error could

result in many types of studies in tree improvement work if maternal parent is not considered as a possible source of variation.

Table 2 -- Height of proeny groups outplanted in 1952, 1953, 5th year and 54 measured in the 3rd year.

Progeny group	Average height at--			Relative heights. Progeny of C-6 equals 100 at--		
	5 years	5 years	3 years	5 years	5 years	3 years
	Feet	Feet	Feet	Percent	Percent	Percent
Slow growing						
C-6	7.67	7.46	2.11	100	100	100
C-51	7.32	7.73	2.00	95	104	95
Fast growing						
C-10	8.79	8.50	2.45	116	114	116
C-37	7.80	9.24	2.23	102	124	106
C-50	8.88	9.62	2.01	116	128	95
C-63	8.78	8.68	2.33	114	116	111