SIX-YEAR RESULTS FROM A MARYLAND PLANTING OF LOBLOLLY PINES FROM DIFFERENT SEED SOURCES

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In 1951 a Subcommittee on Geographic Source of Seed launched a Southwide study of longleaf, slash, loblolly, and shortleaf pines. This subcommittee, including men from some of the State Agricultural Experiment Stations, State Forest Services, and pulp companies, is chairmaned by Philip C. Wakeley of the Southern Forest Experiment Station.

In general, the objective of the study was to determine for each species not only the zones or territories within which seed can be moved freely from collecting points to planting sites, but across the boundaries of which seed should be moved cautiously, if at all. Thus, the objective really is to determine the geographic limits of suspected geographic races in each species. Since there is not at present sufficient manpower or funds available to determine precise boundaries, the study used a moderate number of seed collections and test plantations to learn which factors, such as temperature, rainfall, and the like, may be associated with geographic races. At present the plan is to use the resulting information, along with climatological data, to prepare tentative maps of seed collection zones.

According to Wakeley's plan, this study tests four conflicting hypotheses. They are:

1. That distinct geographic races of southern pines are associated primarily with temperature zones, and. that within such a zone they are independent, or nearly so of differences in rainfall, soil, and other environmental factors.
2. That within or independent of temperature zones distinct geographic races of these pines are associated with differences in rainfall, soil, and other environmental factors.
3. That distinct geographic races of southern pines bear less relationship to present temperature and rainfall zones, major soil types, and the like than to origin upon or migration from different ancient land masses, which formerly were separated by seas covering the present coastal plains.
4. That distinct geographic races of southern pines do not exist.

As two of the pines under study extend into the Northeast, the Northeastern Station and the State Foresters of Maryland, New Jersey, and Pennsylvania were asked to cooperate. Pennsylvania and New Jersey are engaged in the shortleaf pine phase, and Maryland in the loblolly pine phase. State forestry departments in all three states have greatly aided in the local tests by helping with seed collections, by growing the necessary stock in the state nurseries, by providing planting sites, and by helping in the actual planting.

In the Northeast, five plantings have been made. Four are shortleaf pine plantations and one is a loblolly pine plantation. The initial plantings of 2-0 shortleaf pines failed, and so in 1958 second plantings of this species were made in New Jersey and Pennsylvania. Thus, the 1953 plantings of 1-0 loblolly pine on Maryland's Pocomoke State Forest are the oldest local ones in this study and the subsequent discussion will be confined chiefly to these plots.

STUDY METHODS

Source of Seed

Our plots contain loblolly pine from 9 sources. One source is eastern Somerset County, Maryland, about 12 miles from our planting site. The other sources are Onslow County, North Carolina; Pamlico County, North Carolina; Wilcox and Crisp Counties, Georgia; Cullman County, Alabama; Jefferson County Alabama; Livingston Parish, Louisiana; Clark County, Arkansas; and Angelina County, Texas.

These sources were selected principally to test the hypothesis that geographic races of loblolly pine are associated primarily with temperature zones. For this reason, the sources are spread throughout the range of the species. Still there is a spread of only 10 degrees in the approximate average annual temperature., with a minimum of 57 degrees F. for the Maryland source, 62 degrees F. for the North Carolina, Alabama, and Arkansas sources, and a maximum of 67 degrees for the Georgia, Louisiana and Texas sources. There is also little difference in the average July temperature.

Of course, average annual temperatures do not show so great a difference as average January temperatures or length of the frost-free season. There is a difference of about 16 degrees in the average January temperature, from 37 degrees in Somerset County, Maryland, to 51 to 53 degrees at the sites in Georgia, Louisiana, and Texas. Length of the frost-free season varies still more with a maximum difference of 74 days. It is 181 days at the Maryland source, 199 in Cullman County, Alabama, about 222 in Clark County, Arkansas, 255 in Livingston Parish, Louisiana and between 230 and 250 at the others (U. S. Department of Agriculture, 1941).

Precipitation also varies at the collection points. The Maryland, Georgia, and Texas sites have about 45 inches annually, and the others from 49 to 58 inches (U. S. Department of Agriculture, 1941).

Nursery

All stock used in the Maryland plots was raised in the Maryland State Forest Nursery near Harmans. It was lifted as 1-0 seedlings in early March 1953.

By the time the seedlings were received for planting, an appreciable amount of winter injury had occurred on the southern stock. This was especially evident on that from Louisiana,, the site with the longest frost-free season and the highest average January temperature. The southern seedlings were somewhat taller than the others, particularly those from Maryland, but their root systems were in poorer shape. Usually they lacked growing root tips. In this respect, the Maryland stock was in the best condition for it had healthy growing root systems.

Planting

The seedlings were planted, between March 17 and March 26, 1953, with planting bars. As severely damaged seedlings were culled, and because the tips of many of the southern seedlings had been killed, there was little difference among sources in the average living height of seedlings. At time of planting this varied from 1 to 7 tenths of a foot.

Four 0.1-acre plots of each source were planted. Each plot contained 121 trees, with a 6 x 6 foot spacing, except that from the Louisiana source. As there were insufficient trees from this source, only 63 trees were planted in each plot.

with 9 in each of the inner 7 rows. This was advisable since subsequent measurements were to be confined to the inner 49 trees, or 7 rows of 7 trees per row. Each plot usually contained a border strip 2 trees wide where, no measurements were taken.

Site and weather conditions were very favorable for these plantings. The area in which the plantation was established is an old field that had been planted to soybeans the previous year. It is relatively flat, imperfectly drained, and the soil is an Elkton sandy loam with small amounts of Sassafras sandy loam on the knolls. Although the soils are called sandy loam, they contain appreciable amounts of silt and clay. At the time the plantings were made, the soil was very moist, and planting operations were rained out on 3 days.

RESULTS

Survival has been good in all sources tried in the Maryland plantings. By June of the first growing season 8 percent of the Georgia seedlings, 17 percent of the Texas seedlings and 22 percent of the Louisiana seedlings appeared to be dead or dying. This was true of 3 percent, or less, of the seedlings in the remaining 6 sources. The difference was probably a result of the already mentioned initial winter injury. During the summer some of the southern seedlings recovered and the October tally lists only 12-16 percent of the 3 sources as dead. After 5 years in the field (i.e., in the fall of 1957) the mortality varied by sources from 5 to 26 percent, Since 10 percent of the local seedlings had died,, the only sources with appreciably more mortality were those from Georgia and Texas in which 16 percent had died, and the Louisiana source in which 26 percent had died.

After 5 years in the field, the local seedlings were equal to one other source, Pamlico County, North Carolina, for the greatest average height of surviving trees. This was 10.1 feet for these two sources. The shortest seedlings were the Louisiana ones, which had an average height of 6.5 feet. Texas seedlings were 7.6 feet tall; Georgia, 8.2; Arkansas, 8.8 feet; and Alabama and other North Carolina seedlings were on the average 9.3 to 9.6 feet tall.

Part of these small differences in height may be due to differences in tip moth damage. While seedlings of all sources have been damaged, our observations were that longer portions of the shoot were killed on the southern stocks than on the natives. The damage was most severe during the third and fourth growing seasons.

During this past winter heavy wet snows caused an appreciable amount of damage to this plantation. For a while last spring, we had the idea that this damage might limit any future conclusions from this study.

However,, by the middle of July - a month ago - many of the trees had recovered, and the damage was far less. noticeable. Still, at that time 11 to 35 percent of the seedlings were recorded as injured, By sources 30 to 35 percent of the seedlings in the Jefferson County, Alabama, Pamlico County, North Carolina, and stocks were injured, compared to 20 to 25 percent of the Louisiana and other Alabama and North Carolina sources, and 11 to 15 percent of the Texas, Arkansas, and Maryland seedlings.

This damage seemed to be affected by size of trees, and the smallest stems in these plots were apparently less susceptible than the larger ones. In other words, we believe that had the Texas, Arkansas, Georgia, and Louisiana seedlings been as tall as the Maryland ones, their d amage would have been appreciably great er. Even so, only the Arkansas and Texas seedlings fared about as well as the Maryland seedlings.

Although the size of the tree at the time it is exposed to a heavy weight of snow may affect the subsequent damage, a greater resistance of some of the sources to this type of stress cannot at present be excluded. The Maryland and Pamlico County, North Carolina, sources were of equal height; yet the damage in the former amounted only to 12 percent, while in the latter it was 35 percent.

The snow damage took 3 forms (1) top breakage, which was noted only when the main stem or leader was broken (2) bending from some point along the stem above the ground, and (3), perhaps the most serious, bending from the ground. The last usually amounted to partial uprooting. Either form of bending was noted only when the angle from a perpendicular was more than 10 degrees.

Serious top breakage was relatively rare, and affected less than 2 percent of the stems of all stocks. Hence, insofar as breakage is concerned, no difference was noted among the seed sources.

Again, as one might expect from the previous statements, the proportion of bent stems was similar in the Maryland, Arkansas, and Texas stocks - about 10 percent of the first two, and 15 percent of the Texas seedlings. In all the other sources, 19 to 34 percent of the living trees were still appreciably bent in July.

The most southern sources, Georgia, Texas, and Louisiana, have the greatest proportion of trees that are bent from the ground. These trees form 6 to 14 percent of the living stems. Among the other non-native sources this proportion is 2 to 4 percent and in the native Maryland stock, less than 1 percent.

DISCUSSION OF RESULTS

Perhaps you are familiar with the idea that the southern sources of a native species may have greater potential growth than northern sources. In our phase of the study the southern stocks of both the shortleaf and loblolly reached greater heights in the nursery than did the native seedlings. Perry and Wang (1957) showed that the growth of loblolly pines near Gainesville, Florida, decreased markedly with more northern seed sources. In their paper, they show two photographs of Florida, Georgia, North Carolina, and Maryland seedlings with the height of the seedlings decreasing from the Florida to the Maryland sources. Under a Gainesville day-length the Maryland source was only 35 percent as tall as the Florida source, and its growing season was 14 weeks shorter. In a floodlight plot with Maryland day-lengths, the Maryland source increased its growth to 70 percent of the Florida stock, and its growing season by 2 months or more, while the growing season for the Florida stock was not affected by photoperiod.

However, the initial results from our own study seem to indicate that the potentially more rapid growth of southern stocks cannot be realized under northern field conditions. Apparently increases in winter injury in the nursery, in tip-moth damage to terminal shoots, and in snow damage so reduce this potential that local source proves best. We cannot predict that this conclusion will be substantiated by later results; but at the present time it seems justified.

LITERATURE CITED

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