PROGRESS IN TREE IMPROVEMENT RESEARCH AT THE SOUTHEASTERN FOREST EXPERIMENT STATION

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The Southeastern Forest Experiment Station territory consists of Virginia, North and South Carolina, Georgia, and Florida. Three great soil physiographic regions make up the bulk of the area. These are the deep sands of the coastal plain with their slash, longleaf, and loblolly pine forests, the rolling red clay country of the Piedmont Plateau with loblolly and shortleaf pines, plus hardwoods, and finally the Southern Appalachian highland with hardwood forests and an admixture of shortleaf, Virginia, and white pines. About 60 percent of the Station's territory is forested.

The elevation in the Southeastern states varies from sea level, where, in South Florida, mangrove grows with its roots in salt water, to over 6 000 feet in the Appalachians where Fraser fir, red spruce, and yellow birch and other hardwoods develop in a climate approaching that of areas long distances to the north, We have about 300 species and varieties of trees of which 12 are pine<

The South is a tremendous user of wood and planter of trees. Most land can be machine planted, so pine seedlings are planted in astronomical numbers each year--a cool 185 million in our Station territory last year. Nevertheless, the timber cut still exceeds growth in most areas, and the size of the average tree is decreasing.

Thus, the stage is set for a large and active program in tree improvement, We have the forest resource, ever-expanding industry anxious to grow and use more and better trees, land to be planted, huge tree nursery facilities, and a vigorous planting program,

Our tree improvement work is aimed at improving the genetic quality of seed now planted and at producing better strains for the future. We are concentrating largely on pines but are working with a few of the important hardwood species.

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The Station has major tree improvement projects at its Lake City Research Center in Florida and the Athens-Macon Research Center in Georgia. It has several studies at each of the four other Research Centers. Our work is coordinated with that of the Southern Institute of Forest Genetics and numerous public and private agencies,

THE LAKE CITY PROGRAM

The Lake City Research Center genetics program includes research in single tree selection and controlled breeding in studies of gum yield inheritance, racial strains of slash pine, superior tree selection in the nursery, and techniques for managing seed-production areas and seed orchards, The heritability of gum yield in longleaf pine has been demonstrated in 17-year-old, one-parent progeny in a study started by T. A. Liefeld in 1935. Another major step was verification of the inheritance of gum yield in 9-year-old trees from cross-pollinated and open-pollinated slash pines of high and average gum yield. A third plantation of several hundred seedlings from the same slash pine parents and later selections is not yet old enough for gum-yield determination.

Approximately a dozen trees were selected in 1942, and additional trees later, which were producing about twice as much as average trees on the same site. Control-bred offspring of these trees produced about 1.8 times as much as the average tree, Open-pollinated offspring produced less than the control bred. The viscosity of the gum was found to be strongly controlled genetically, but, in young saplings, the size and number of resin ducts in the wood were not. When the trees mature, characteristics of the resin ducts may follow a definite pattern.

The Lake City Center is one of the cooperators in the southwide pine seed source study directed by P. Cu Wakeley of the Southern Forest Experiment Station for the Committee on Southern Forest Tree Improvement_ The Center also has a study involving 16 geographic sources of slash pine. Foresters from industry and other groups collected seed and made outplantings for this study. The Lake City Center is also cooperating with the Athens-Macon Center in a test of loblolly pine races in Georgia and Florida,

A slash pine ecotype study has been started to see if there is any difference in progeny of slash. pine from wet and dry sites.

Research in techniques of vegetative propagation has been stepped up greatly in the past few years to provide the methods needed to perpetuate superior strains, Rooting of cuttings still. is difficult. However, fairly efficient methods were developed by Francois Mergen for air-layering and grafting slash pine.

The Lake City program includes several. tests of techniques for managing seed production areas and seed orchards, One test. compares 2 fertilizers. 2 rates of application, 2 types of stem injury, and 1 type of root injury with the object of stimulating seed production in 6-year-old and 20-year-old plantations of slash pines,

THE ATHENS-MACON RESEARCH CENTER. PROGRAM

The Station's genetics efforts in Georgia started in 1950, when cooperation was begun with the Ida Cason Callaway Foundation at Hamilton, Georgia, The objective was to produce by selection a superior strain of pine for planting in the middle South,

In local pine stands and plantations, 119 plus trees have been selected, Another hundred or so selections are tentative. Starting in the spring of 1952, one-parent tests have been made with 30 slash, 22 loblolly, 17 shortleaf. and 15 longleaf mother trees.. Approximately 27,000 seedlings have been planted, A few plantings have been made of different geographic races of loblolly and slash pines.

Comparisons are made between progenies of plus trees, and between those of plus trees and seedlings of commercial. seed Progeny of some mother trees are growing as much as 35 percent faster than others. Progeny of some mother trees, in tests replicated for 4 years, grow consistently faster than the controls, In slash pine, progeny of wide-crowned mother trees are as much as 50 percent wider at one-third the height of the tree than those from well-formed trees, The controls and two lots of randomly collected slash pine average 86 percent more trees infected by rust than progeny of fast-growing, rust-free trees in a plantation where, at age 15, 75 to 80 percent of the trees were infected. These seedlings have been in the field 3 years and are 6 to 7 feet tall, This year, several acres of seed orchard were outplanted with open-pollinated seedling stock of the better parent trees. Additional seed orchard plantings are planned with grafted stock and seedlings from control-bred and open-pollinated seed.

In 1954 the Athens-Macon Research Center began a formal forest genetics project in cooperation with the Georgia Forest Research Council and the Georgia Forestry Commission. Laboratory, greenhouse, lath house, and nursery facilities have been constructed by the Commission and Council. Over a thousand "super" seedlings of slash and loblolly pines have been outplanted. Seedlings of 14 Georgia loblolly seed sources and 3 from Florida are being raised for a racial variation study. Seedlings of 15 separate trees of each of 3 sources are being grown for a between-tree variation study in connection with the racial variation study. In addition, a number of superior phenotypes have been selected and open-pollinated seed and grafted stock are being grown.

The Center is giving technical direction to the Georgia Forestry Commission's seed orchard project which has the objective of establishing about 500 acres of grafted slash and loblolly pines from superior phenotypes. In January 2,500 potted seedlings were grafted. About 60 percent were successful at Athens, Georgia, and 80 percent at Macon where we had better humidity control. About 7,500 seedlings were potted this summer for grafting in January and February of 1956.

At the University of Georgia at Athens, forest pathologists of the Southeastern Station are selecting and breeding for resistance to littleleaf disease in shortleaf pine. Six apparently resistant trees growing in heavily infected stands have been selected and grafted to seedling stock. Although one-parent progenies exposed to attack by the root fungus responsible for littleleaf have shown some differences between trees in susceptibility, they averaged less infection than progeny from littleleaf diseased trees. Control-pollinated seed of the selected trees was planted this year. Test plantations of 12 geographic sources of shortleaf pine on severe littleleaf sites in 3 states were established a year ago and are now growing well.

The Athens-Macon Research Center works very closely with projects in forest genetics at the University of Georgia. The School of Forestry has two men working on vegetative propagation and fundamental problems in variation and inheritance as part of the program of the Georgia Forest Research Council. Also, the school has a graduate student part time on a study of variation and inheritance of fiber length in slash pine. This work is a station-supporting subproject under a regional Research and Marketing Act project of the Southern State Agricultural Experiment Stations. Alabama and Texas also have station-supporting subprojects. At the present time I happen to be chairman of the technical committee for the regional project.

A new hardwood management and utilization research project, initiated in 1954 at Athens, Georgia, will have some genetics work in the program--probably studies of variation in wood quality as related to polyploidy.

TREE IMPROVEMENT STUDIES AT OTHER RESEARCH CENTERS

The Southeastern Station's Tidewater Forest Research Center at Franklin, Virginia, has a one-parent progeny test of the inheritance of stem form in loblolly pine. The progeny are nearly 3 years old. In cooperation with the South Carolina Forestry Commission, the Santee Research Center in. South Carolina is testing eight local seed sources of longleaf pine for planting on the droughty soils of the sandhills. The Cordele Research Center in Georgia has a project in the selection of superior slash pine trees, particularly in its many acres of planted stands on the George Walton Experimental Forest. These selections are now being utilized in two of the Station's genetics projects.

The Southern Appalachian Research Center at Asheville, North Carolina, has a cooperative test with the Central States Forest Experiment Station of the performance of planted yellow-poplar of 16 different geographic origins. The seedlings were planted in the spring of 1954. The same research center has a test of six geographic strains of northern red oak that were planted early in 1953, in cooperation with the Cabot Foundation, and a small 20-year-old test of hybrid poplar clones. A plantation of five promising clones of Chinese chestnuts was established in 1953 by the Division of Forest Disease Research. A cooperative study in racial variation in white pine is being arranged with the Lake States, Central, and Northeastern Forest Experiment Stations and other research agencies.

The Division of Forest Insects Research of our Station has been selecting longleaf and slash pines for resistance to black turpentine beetle at Lake City, Florida.

A major accomplishment of the Station was the development by selection and vegetative propagation of wilt-resistant strains of the mimosa tree by the Division of Forest Disease Research. Two resistant, named varieties have been turned over to the nursery trade. This project has now been transferred to the Agricultural Research Service.

Forest insect and disease specialists at both the Southeastern and Southern Stations have joined hands in a thorough annual check of most of the plantations in the southwide pine seed source study. This study involved the collection of seed from 50 sources, production, and shipment of 1,824 lots of stock from 19 nurseries and their establishment in 66 separate plantations in 16 states. About 220,000 seedlings were planted.

In addition to the program in which the Southeastern Station is involved, the University of Florida has a cooperative project in forest tree improvement with forest industries. Foresters of nine companies are selecting superior phenotypes from which scions are to be grafted to wild stock by the University technicians. Also, a number of pulp and paper companies have converted natural stands to seed-producing areas from which to obtain seed for their privately operated nurseries, and their research foresters are conducting studies in the field of tree improvement.

This has been a brief summary of our program in forest tree improvement. Additional details can be obtained from publications and annual reports of the Southeastern Forest Experiment Station.