SUMMARY OF FOREST TREE IMPROVEMENT WORK IN THE SOUTH [1]

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Since 1950, tree-improvement activity in the South has increased to such an extent that a mere listing of the agencies and individuals engaged in research or constructive application would require most of the time allotted for this paper. More than 30 organizations are engaged in such activities--not counting 5 geographically distinct Research Centers at the Southeastern and 5 more at the Southern Forest Experiment Station. Probably 80 or more individuals are devoting part or full time to tree improvement research, basic or applied. Their publications and releases are beginning to appear at the rate of one or more a week. Any summary of these activities, to be grasped, must be in very general terms.

What follows is a sketch of recent and current work by types of agencies, drawn largely from Wright's "Directory of Forest Genetics and Education in the United States and Canada, 1955," but supplemented so far as possible from the more recent literature and from personal acquaintance with workers and their projects.

Educational Institutions

At least 12 southern colleges and universities are taking part in tree-improvement work.

The schools of forestry at North Carolina State College, the University of Georgia, and the University of Florida have two men apiece devoting full time to forest genetics research, teaching, or both. North Carolina State and Texas A and M College have industry-supported graduate fellowships in the subject, those at Texas A and N in cooperation with the Texas Forest Service. North Carolina State and the University of Florida have ambitious seed-orchard projects in cooperation with, and financed by, industry; in the past 2 years, T. O. Ferry and Chi-Wu Wang, of the University of Florida, have helped establish 15 seed orchards with approximately 10,000 grafts from selected slash and loblolly pine trees. All four of the institutions mentioned stress basic as well as applied research. Two forest genetics short courses for Federal, State, and private foresters have been given at the University of Florida, and one each at the University of Georgia and at Texas A and M College, with a total attendance of about 180.

In addition to other tree improvement research, Alabama Polytechnic Institute, Louisiana State University, and the University of Tennessee have research projects in forest genetics under the federal Agricultural Marketing Research Act, in cooperation with their respective State Agricultural Experiment Stations. The project at Alabama Polytechnic Institute includes relative nutrient requirements and efficiency of progenies of "plus" pines and of their checks, and has recently been expanded to permit, work on hardwood genetics.

[1] To be presented at the Fifth Northeastern Forest Tree Improvement Conference, Orono, Rine, August 22-23, 1957, for the Committee on Southern Forest Tree Improvement.

R. N. Allen, of the Southern Institute of Forest Genetics, has just completed 2 years graduate work at Duke University, under Drs. Kramer and Naylor, on the contrasting growth-substance complexes of longleaf pine, its hybrids, and loblolly and slash pines. This bears directly on one of the most challenging genetics problems in the South--shortening or eliminating the notorious stemless or "grass" stage of juvenile longleaf pine.

At Newcomb College of Tulane University, Dr. Willis A. Eggler has completed 2 years' work, in cooperation with A. J. Hodges Industries, Inc., and the Southern Institute of Forest Genetics, on the anatomy and phenology of pine reproductive processes, including the date of formation of the primordia of female and male strobili. Under a recent grant from the National Science Foundation, he is extending this study to slash and shortleaf pines. The Biophysics Laboratory at Tulane University is cooperating with the Southern Institute of Forest Genetics in studies of the effects of irradiation on pine seed.

The University of Arkansas is cooperating with the Crossett Research Center of the Southern Forest Experiment Station, and with the Crossett Company, in tests of local races of loblolly pine seed. Mississippi State College is cooperating with the Station in tests of hybrids made at Placerville.

The University of Tennessee is cooperating with the Tennessee Valley Authority on several seed source tests (including a study on Virginia pine sponsored by the Maryland Board of Natural Resources), improved nut tree variety tests, and pine propagation investigations.

Federal Agencies

The very considerable activities of the Southeastern and Southern Forest Experiment Stations may be dismissed briefly, as they have been adequately described in annual reports and other publications.

At the Southeastern Station, the major tree improvement programs are at the Lake City and Athens-Macon Research Centers, in Florida and Georgia, respectively, the later in cooperation with the Ida Cason Callaway Foundation., the University of Georgia, the Georgia Forestry Commission, and the Georgia Forest Research Council. Less extensive programs are under way at the Franklin., Virginia (single-parent loblolly progeny tests), Asheville, North Carolina (yellow-poplar, red oak, and white pine racial variation tests, and hybrid poplar and blight-resistant chestnut studies), Santee, South Carolina (edaphic races of longleaf adapted to the sandhills), and Cordele, Georgia, Research Centers (selection in slash pine plantations).

The Lake City and Athens-Macon programs have included some interspecific hybridization, but have stressed mainly selection of slash and longleaf pines for high gum yield, of slash and loblolly pines for form and growth rate, of slash pine for resistance to black turpentine beetle and fusiform rust, and of shortleaf pine for resistance to little leaf disease. Local geographic races of slash and loblolly pines, nursery selection of slash and loblolly pines, and seed orchard management have been or are being emphasized, and both Centers have made notable contributions to techniques of vegetative propagation.

At the Southern Forest Experiment Station the main program, including such basic work as pollen handling, is concentrated at the Southern Institute of Forest Genetics, Gulfport, Mississippi. The Institute has a technical staff of six (a geneticist, a pathologist, a geneticist-pathologist, a physiologist, a wood technician, and a silviculturist), plus an entomologist detailed full-time. There is also a full-time man at the Crossett, Arkansas, Research Center, financed cooperatively by industry. Some work on interspecific hybridization and racial variation is done at the Alexandria, Louisiana, Research Center, and some on hardwood selection, vegetative propagation, and breeding at the Delta Research Center, Stoneville, Mississippi. The Station has a small but highly effective cooperative project, industry financed, with A. J. Hodges Industries, Inc., at Many, Louisiana, which has greatly advanced its work in interspecific hybridization.

The Southern Station has done less work than the Southeastern in vegetative propagation, and none in selection for high gum yield. Its selection for growth and form is more recent and less extensive than the Southeastern's --except that it possesses an invaluable legacy of experimental plantations more than 30 years old in which outstanding phenotypes were marked as potential breeders in 1928 through 1931. It has done considerably more hybridizing, with special attention to longleaf hybrids and to slash-shortleaf crosses. (It has several score four-way or "quarter-horse" hybrids made by applying pollen of the Placerville shortleaf x slash hybrid to Sonderegger pine.) At Crossett, it has 17 separate tests of nursery selections of slash, loblolly, and shortleaf pines, established in four different years, many of them with stock from size-graded seed. In cooperation with the Forest Products Laboratory at Madison, Wisconsin, and with the Southern Forest Survey, the Institute is exploring the wood quality of pines throughout Mississippi. The Station's racial-variation studies go back to the loblolly pine seed crop of 1925, and the Station is the Chairman organization of the Southwide Pine Seed Source Study sponsored by the Committee on Southern Forest Tree Improvement.

The Tennessee Valley Authority has a large and varied tree improvement program dating from before 1948. It includes, or has included, much work on racial variation of pines and on vegetative propagation, individual-tree and nursery selection of pines and eastern red-cedar, and related work such as development of thornless honeylocust, selection of honeylocust with pods suitable for cattle feed, selection of black walnut for nut production, and some work on figured grain of wood. Most of this work has been done in cooperation with various State Agricultural Experiment Stations, Federal Forest Experiment Stations, and other organizations, including the University of the South, Tennessee State Department of Conservation, Tennessee Fish and Game Commission, Maryland Board of Natural Resources, and Coosa River Paper Company. The TVA was one of the principal promoters of the First Southern Conference on Tree Improvement in 1951, and E. G. iesehuegel, of its Division of Forestry Relations, is the present Chairman of the Committee on Southern Forest Tree Improvement.

Region 8 of the U. S. Forest Service has established a number of seed production areas on National Forests throughout the South. Its outstanding contributions in the field of tree improvement, however, have been the organization of the First and Second Southern Tree Improvement Conferences, in Atlanta, in 1951 and 1953, and its unremitting campaign to get State and industrial nurserymen to procure seed from suitable geographic sources.

State Departments or Commissions of Forestry

At least three state forest service programs of forest tree improvement deserve special mention.

The Texas Forest Service started active research in tree improvement about 1950, and established its Forest Genetics Laboratory in 1951, with strong industrial support and in close cooperation with Texas A and M College. The Laboratory has a professional staff of three, plus two graduate fellows; a fine laboratory building and greenhouse; space in the State forest nursery; a large outplanting area, with residence, at Fastrill, Texas; and other experimental areas. A. J. Hodges Industries, Inc., at Many, Louisiana, with whom the Laboratory has a cooperative contract, built its greenhouses especially to fit the needs of the Texas program, and has done much work in vegetative propagation and outplanting in cooperation with the Texas group. Bruce Zobel was in charge of the work from 1951 until his move to North Carolina State College in 1957, when he was succeeded by Claud Brown.

The research in Texas has been concentrated upon selection and breeding of loblolly pine for form, growth rate, drought resistance, and wood qualities--especially high and low specific gravity. Outstanding use has been made of loblolly from the so-called "Lost Pines" area in a region of low rainfall and high evaporation rate some 120 miles west of the main loblolly pine belt. Important basic contributions have been made to the problem of inheritance of specific gravity. Vegetative propagation has led the way to active work in seed orchard management. Another important phase has been introduction of exotic pines from Mexico. Some work has been done in hybridization, racial variation, and nursery selection.

The Georgia Forestry Commission's program is one of financial and organizational assistance and support rather than of direct research. In cooperation with the Southeastern Forest Experiment Station, the Georgia School of Forestry, and the Georgia Forest Research Council, it has greatly advanced work on selection of superior slash and loblolly pines and on large-scale seed orchard establishment.

The Mississippi Forestry Commission had for several years a program of forest tree improvement with one full-time man and ample support. It stressed selection of both pines and hardwoods and did considerable work in vegetative propagation. A by-product of the work was the remarkable documentary film, "Developing Pedigreed Trees," on possibilities and means of forest tree improvement. Financial difficulties terminated the program at the end of 1956, but steps are being taken to preserve and use its data and plant material.

Industrial interest and participation in, and generous financial support of, the various tree improvement programs have been one of the outstanding features of work in the South. The North Carolina State College, University of Florida, and Texas Forest Service programs have been made possible in large part by contributions from 26 pulp, lumber, and land companies, 1 endowed foundation, and 3 individuals. Several corporations have contributed annually to two of these three programs, and two corporations have contributed to all three. About

20 companies not only support financially the North Carolina State and University of Florida seed orchard projects, but participate in the technical work. Many of these concerns also have additional tree improvement projects of their ow of greater or less extent.

The tree improvement programs of at least 5 industrial and other organizations which are not included among the 26 just mentioned) deserve special mention.

The West Virginia Pulp and Paper Company's Westvaco Experimiental Forest, at Georgetown, South Carolina, devotes part time of three technical men to tree improvement research. The staff has pioneered in the development of "seed-producing areas" (as an interim substitute for planted seed orchards). Other lines of work include selection, interracial and interspecific hybridization studies of racial variation, and testing of exotics.

The Ida Cason Callaway Foundation, at Hamilton, Georgia, has furnishe outstanding facilities in trees, land, and labor to the Southeastern Forest Experiment Station, and has augmented the Station's tree improvement work with the full- or part-time efforts of two of its own technical men. Emphasis has been on selection of the four principal southern pines for growth rate, form, and disease resistance.

The Gaylord Container Division of Crown-Zellerbach Corporation, at Bogalusa, Louisiana, has a research staff of more than a dozen men. Its program includes considerable work on racial variation and on selection, and a small but important study of growth and disease resistance of shortleaf pine hybrids. The Southern Forest Experiment Station's original 1925 study of racial variation in loblolly pine and its "documented" plantations, now being converted to "breeding blocks" with the company's help, are on Gaylord lands. The company is starting active work on seed orchards, with nearly 150,000 acres of plantations and thousands of acres of even-aged natural stands from which to select superior trees. (The plantations include 12,700 acres older than any other extensive plantations in the South; the natural stands include a 10,000-acre block of longleaf pine from the 1920 seed crop from virgin timber.) Gaylord has been the largest single cooperator in the Southwide Pine Seed Source Study, and T. E. Bercaw$ Chief of the company's Forest Management Section, was Wiesehuegel's predecessor as Chairman of the Committee on Southern Forest Tree Improvement.

A. J. Hodges Industries, Inc., at Many, Louisiana, has a forester working nearly full-time on tree improvement research, with a field assistant and ample labor. In addition to an adequate research budget, facilities include a 4,000-acre fenced area, access to thousands of acres of plantations and natural stands, a 25- by 25- by 25-foot air-conditioned greenhouse with an 18-foot loblolly established in it (for grafting experiments), a smaller greenhouse that can be held at 65^{0} F. even in midsummer (for vegetative propagation), extensive progeny-testing areas, and a remarkable 10-acre longleaf-loblolly pine hybrid swarm. As previously noted, A. J. Hodges Industries have cooperative research agreements with the Texas Forest Service, Louisiana State University, and the Southern Forest Experiment Station. Main lines of work have included interspecific hybridization, vegetative propagation, racial variation, and the establishment of an 80-acre arboretum of native and exotic pines and hardwoods. Game management research and ornamental gardens are included in the experiment tract, which often draws, 1,500 to 2,000 visitors on a Sunday.

The Crossett Company, at Crossett, Arkansas, in addition to financing a full-time researcher in cooperation with the Southern Forest Experiment Station, has a tree improvement program of its own, with emphasis on loblolly pine and ultimately on shortleaf pine seed orchards.

Committee on Southern Forest Tree Improvement

Although much of the research and other tree improvement activity just outlined arose through the initiative of the organizations and individuals engaged in it, some at least owes its start to the Committee on Southern Forest Tree Improvement. The Committee definitely has served a useful function in coordinating the work.

The Committee was an outgrowth of the First Southern Conference on Forest Tree Improvement, held in 1951. It has 18 members. Seven of these represent the Southeastern Forest Experiment Station, the Southern Forest Experiment Station and its Southern Institute of Forest Genetics, Region 8 of the U. S. Forest Service, the Tennessee Valley Authority, and the professions of forest pathology and forest entomology, and are appointed for indefinite terms. The remaining 11 serve 6-year terms, beginning at staggered intervals; 3 represent schools of forestry, 3 represent state forestry organizations, 3 the pulp and paper industry, and 1 each the softwood and hardwood lumber industries. Geographic coverage coincides with Region 8 of the U. S. Forest Service. The Committee meets every summer, and also in conjunction with the Southern Conferences on Forest Tree Improvement that are held in January of each odd-numbered year.

The Committee sponsors and arranges the biennial Southern Conferences, and has produced, prompted, or approved a total of 17 publications by personnel of its member agencies.

Perhaps the most ambitious direct research undertaking of the Committee is the Southwide Pine Seed Source Study, coordinated by its Subcommittee on Geographic Source of Seed, of which I have the somewhat arduous honor of being Chairman. Over and above all the tree improvement activities previously mentioned, the organizations already listed and many other organizations and individuals have been cooperating since 1951 in a 16-State provenance test of longleaf, slash, loblolly, and shortleaf pines. The study extends from Pennsylvania and New Jersey south almost to Lake Okeechobee in Florida, and west to Missouri, Arkansas, Oklahoma, and Texas. Literally hundreds of individuals cooperated in collecting seed throughout this territory in 1951, 1952, and 1955. Nineteen nurseries cooperated in producing and shipping nursery stock. Fifteen research centers of Li. forest experiment stations, 3 national forests, L schools of forestry, 5 state forestry commissions and 1 state wildlife service, 1 state agricultural experiment station, 4 pulp companies, 2 lumber companies, an oil company, and a fertilizer company have established 125 test plantations with the stock, ranging in size from 2.4 to 3.6 acres apiece, and totaling 490,000 trees. Routine measurements by the cooperators have been supplemented over a wide area by special "pest" examinations by pathologists and entomologists of the Southeastern and Southern Forest Experiment Stations. Fifth-year reexaminations of nearly half the plantations will be made this coming winter.

The Committee has stressed this research on geographic sources of seed not only for its obvious benefit to the southern pine planting program, but also from a conviction that virtually all tree improvement research must, for best effect, be carried out within the framework of geographic race.