TREE IMPROVEMENT IN THE SOUTH -- A PROMISE FULFILLED

John C. Barber[1/]

Abstract.--Highlights the initiation and successes of tree improvement programs in the South.

Mr. Chairman, ladies and gentlemen, I am happy and honored to participate in this 15th Southern Forest Tree Improvement Conference. Throughout my professional career I've had strong ties with tree improvement in the South. For many years I was an active participant and for many years after that I directed some of the Forest Service work from Washington and New Orleans. With this background I want to comment on some of the events that have led to a remarkable performance and accomplishments that have not been matched in the history of American forestry.

The Early Years

Tree Improvement has been discussed by American foresters since the turn of the century, but nothing much happened until World War II. It was only then that conditions were ripe for major and concerted advances in tree improvement. Efforts initiated in the 40's triggered the major initiatives of the 1950 decade. The Southern Forest Tree Improvement Committee played an important role in these rapid advances. However, there were significant developments in the South that took place earlier and are worthy of note.

In 1927, Phil Wakeley of the Forest Service's Southern Station established the first loblolly pine seed source study at Bogalusa, LA. His interest in geographic variation was carried over from college days and an interest in hybrids was whetted by H. H. Chapman's description of Sonderegger pine. Thus, in 1929, he made the first artificial longleaf x slash pine cross, and 2 years later he back-crossed Sonderegger pine with loblolly and with longleaf pollen. Wakeley did this work outside office hours because Washington overhead disapproved. I quote from Phil's "Biased History of the Southern Forest Experiment Station" written in 1964: "I was criticized for dissipating my efforts even on my own time. Yet, after the hybrids were published by Ernest Schreiner in the 1937 Yearbook of Agriculture, the same man who voiced the criticism wanted to know why the hell I hadn't made more of them:"

In 1934, Lee Chaiken helped design a progeny test with loblolly pine in South Carolina involving 105 half-sib families. Leon Minckler (1942) reported significant differences between families in survival and height growth. After 4 years in the field, however, the test was lost by flooding.

1/ Associate Deputy Chief, U. S. Forest Service, Washington, DC.

In 1936, Ted Liefeld established the first gum-yielding test with longleaf pine. He planted open-pollinated progeny of above-average and of below-average yield. Seventeen years later, Francois Mergen obtained from this test the first definite proof that gum-yield is inherited.

In 1942, during World War II, in Olustee, Florida, a pioneer in tree improvement, Keith Dorman quietly laid the ground work for a naval stores genetics program in slash pine. Before retirement a few years ago Keith wrote the definitive book on genetics and breeding of Southern pines, a fitting final statement in an outstanding career.

Keith's enormous impact on forest genetics in the South belies his apparent frail physique and unassuming manner. For those who know Keith it is hard to imagine that in the early days he built a device of 3 two by fours to brace the very tip of the tall slash pines he climbed so as to pollinate even the uppermost flowers. Thus, Keith established the first true progeny test of known parentage in the South. In those years also, he established the first clonal test from rooted cuttings.

The several hundred offspring from Dorman's controlled crosses and the rooted cuttings plantation furnished the basis for many of the best and most important publications in forest genetics in the 1950's.

In retrospect, these studies appear somewhat amateurish. A couple of hundred crosses, a few dozen rooted cuttings, an acre of provenance test seem small efforts today. They were, however, the stuff that made silviculturists become tree breeders and forest geneticists, and also the stuff that persuaded administrators to fund tree improvement programs.

Cason Callaway, philanthropist, was stimulated by an article he read about southern pine hybrids at the Institute of Forest Genetics, Placerville, California. He financed a project to breed pines to improve Georgia's forests and economy. Under the supervision of Keith Dorman, then at Asheville, Callaway financed work at Callaway Gardens and employed a full-time forester, Jim Greene. Though the financing ceased years ago, Callaway plantations provided much early inheritance information, and perhaps more important, they provided a vivid visual demonstration of the inheritance of many economically important traits of the Southern pines.

There were several events that contributed to the formation of the Southern Forest Tree Improvement Committee (SFTIC). One was the English translation of Bertil Lindquist's "Genetics in Swedish Forestry Practice." Another was the attendance of several prominent American foresters at the Third World Forestry Congress in Helsinki in 1949. Ted Haig, Herb Stone and Len Barrett of the Forest Service were impressed by the forest genetics work in Northern Europe and promoted forest genetics research upon their return.

In 1951, the first Southern Forest Tree Conference was held in Atlanta. Attendance at the conference was expected to be around 25 but nearly 3 times that number showed up to the surprise of the organizers. Ever since that first meeting the work of the Committee has been characterized by deep interest, great enthusiasm, and unstinting, voluntary cooperation by people and organizations. But as some of the "old timers" know, the meetings were not always without emotional argument and sometimes confrontation. In the end, however, the overriding desire to improve Southern forest always dominated. Many were the debates on how much gain to expect and to predict in promoting tree improvement.

Through the years, the Southern Forest Tree Improvement Committee has continued to play its vital role of coordinating activities, sponsoring publication of research results, and providing a forum where tree improvement workers can meet and mingle. Let no one underestimate, however, its sense of mission and its promotion in the early years of public and private funding of tree improvement research and development. This may well have been the Committee's most telling impact. Its conferences were each a landmark in reporting new knowledge - the South having the great advantage of early juvenile growth of its pine species.

The success of the committee inspired the organization of similar groups around the Nation: in the Lake States in 1953, in the Northeast and in Canada in the same year, in the West in 1954, in the Central States in 1958, and in the Rocky Mountains in 1978.

In 1951, the Southwide Pine Seedsource Study was started. Organized by Phil Wakely under auspices of SFTIC it was the first, truly large scale U. S. effort in provenance research and a marvel of cooperation.

You must remember that times were lean in the early fifties. Phil Wakely had $62 for equipment the year he organized the study. The entire 136,000 tree study was put in with the help from cooperators drawn from industrial corporations, State organizations, schools of forestry, and federal agencies.

In 1951, Texas A&M and the Texas Forest Service organized a tree improvement program under the direction of Bruce Zobel. At first the program was strongly research oriented; later the program was reorganized, with emphasis on technical assistance and cooperation, into the Western Gulf Forest Tree Improvement Program carried out by the present 18 members. Claud Brown and Hans Van Buijtenen got their start here.

In 1953, the Southeastern Station began funding forest genetics research at Lake City, Florida, following up on Dorman's earlier work.

Prominent researchers in the early years of that program were Tom Perry, Francois Mergen, Tony Squillace, and Ed Merkel.

The Southeastern Station also started a tree improvement program in Macon, Georgia in 1954 in cooperation with the Georgia Forest Research Council and the Georgia Forestry Commission. That project, under Keith Dorman, already had established ties with the earlier work of the Callaway Foundation, and Bratislav Zak's work on pine grafting and resistance to little-leaf disease at Athens. The Georgia Forestry Commission launched its major seed orchard effort that year.

In 1954, the University of Florida Forest Tree Improvement Program was started under the direction of Tom Perry and Chi-Wu Wang. This was the first of the University Cooperatives with direct participation of the 7 cooperators in research and development, with the objective of providing seed orchards for each cooperator.

In 1955, the Southern Institute for Forest Genetics was dedicated and placed under the direction of Berch Henry. Prominent researchers in the early years were Bayne Snyder, Fred Jewell and Ossie Wells. The Institute was to do fundamental genetics research for application region-wide, and tree improvement studies of an applied local nature. It built on, and eventually assumed the earlier studies of Phil Wakeley.

In 1956, the North Carolina State - Industry Cooperative Tree Improvement Program was organized under the direction of Bruce Zobel. Starting out with 11 members, this has become the largest of the Cooperatives with 32 working units in the pine program and 22 working units in the hardwood program. The cooperative is loosely organized with no charter, written rules or regulations. An advisory committee with a representative from each cooperator meets yearly to receive a report and give guidance.

The year 1956 seems a good year to cut off this list of early initiatives. I've hit only a few of the highlights, and have done grave injustice to individual contributions and to important programs, large and small, that have appeared since 1956. However, I wanted to show how and where the foundation was laid for the present effort in southern tree improvement. Today the South has a total of some 10,000 acres in seed orchards, has started establishment of advanced generation seed orchards, and the various programs encompass all Southern pines and some 2 dozen hardwood species.

The impetus to undertake tree improvement was driven by the enthusiasm and confidence in success of people like Wakeley, Dorman, Ostrom, Zobel, Kaufman, Weisehuegel and Callaway. State foresters like Guyton DeLoach in Georgia, Al Folweiler in Texas, and Hux Coulter in Florida set the pace by committing substantial seed orchard initiatives built on promises but little proof - and as usual in the South, forest industries like Buckeye, IP, Union-Camp, Westvaco, St. Regis, Champion, etc. were waiting to put every piece of knowledge to work.

Impact

While nearly every paper on tree improvement in the early years held out promise of increased growth, straighter stems, greater disease resistance and more, the writers were careful never to predict just how much the characteristics could be improved in quantitative terms. An air of conservatism prevailed, lest the future be jeopardized by "snake-oil salesmanship." Tree improvement was never presented as a panacea--only a good silvicultural tool. Perry and Wang in a 1958 Journal of Forestry article came the closest to making quantitative predictions. They calculated the value of pine seed over a range of genetic improvement for growth. It is this range that is of interest to us now; 1/2 percent to 50 percent. Of course 50 percent was the timorous hope of all tree breeders at the time but the authors found it safer to show that even 1/2 percent gain was still worthwhile.

In 1963, at the 7th SFTIC in Gulfport, we had more data and more confidence. I say we, because I myself made these predictions at that time:

--4-6 percent gain in specific gravity
--2-3 percent reduction in compression wood
--10-15 percent gain in volume of wood.

Ray Mailer, at the same conference, expected a 5 percent overall improvement in increased wood yields.

Frank Cech, also at Gulfport, cited Hans Van Buijtenen, who had more confidence than any of us then, with prediction of a 10 percent gain in specific gravity and in stem diameter from one cycle of selection. He believed that an increase of 25 percent in total wood production would not be out of reason.

These were modest predictions when compared to the actual gains that have been demonstrated since. Genetic gains expected today from first generation selection in slash and loblolly pines are roughly as follows:

Characteristic	Relative Gain
Volume	
1st generation seed orchard	10-20 percent
" " " " "(rogued)	15-25 "
1½ generation seed orchard	20-30 "
Specific Gravity	10 "
Straightness	50 "
Fusiform rust resistance	35 "
Oleoresin Yield	100 "

The impact of tree improvement on forestry in the South has been deep and strong. In seed procurement, for instance, drastic changes have taken place. As late as the early fifties, nurserymen would buy cones and seed of the desired species and not question where and what kinds of trees they came from. Today much of the seed comes from seed orchards, most of the rest is of the correct provenance and from trees with acceptable form. According to Zobel, the members of N.C. State Cooperative planted 500,000 acres with genetically improved stock this past season; every acre they planted![1/] A whole new system of seed orchard management has grown up using selected and well-prepared sites, with fertilizer regimes, irrigation if needed, and elaborate systems of protection against insects and disease. The progress from flowering to cone and seed development is carefully monitored.

There is the Eastern Tree Seed Laboratory at `flacon, Georgia, which provides, in addition to the usual seed testing and nursery services, Seed Orchard Seed Evaluation Testing, Cone Analysis Service, and a clearinghouse to expedite the sale of surplus seed, seedlings, and pollen.

Tree seed certification is now available in most Southern States, and is provided by a State agency. Recently the certification agencies in 7 Southern States have added the provision, on request, of international certification under the auspices of the Organization for Economic Cooperation and Development (OECD) with headquarters in Paris, France.

1/ Zobel, Bruce J. Southern Forestry Conference, Forest Farmer Assoc.- Memphis, TN - May 1979 -

Nursery practices had to be developed to maintain the identity of the seed through growing, harvesting, shipping and planting the seedling. Certification programs can be carried through the nursery production and seedling distribution steps if desired. As we move ahead to several levels of improvement and emphasis on special traits, I can visualize a need for seedling certification to assure planters that they have the proper stock. The time may not be far off when seedling certification will be routine.

Tree improvement played an important role in the rapid expansion of tree planting in the South, focusing on site selection and preparation, seedling quality and planting technology.

At the first Southern Forest Tree Improvement Conference in 1951, Dr. I. T. Haig said that over 200 million trees were being planted annually in the South. Last year, nearly 900 million seedlings were planted and about 40 percent of these were genetically improved. A very quick and rough calculation shows that genetic improvement of last year's stock alone will add to the annual total yield in the year 2000 some 200 million cubic feet of wood. And that impact will grow even more spectacularly if present tree improvement efforts are continued.

A Look into the Future

The Southern Forest Tree Improvement Committee, in its 28th year, can look back on a role of inspired leadership, cooperation and coordination. It has not lost an ounce of its vigor or enthusiasm. I am sure that the Committee, as the art and practice of tree improvement develops, is looking to extend its activities in more directions. It is with this in mind that I offer the following remarks.

Until now, it has been taken for granted in the South that the benefits from tree improvement will accrue only through plantations. However, 2 factors may encourage us to think beyond the planting concept. (1) As tree improvement marches on and second generation and special purpose orchards come into production, there will still be an enormous volume of first, rogued, and 1 1/2 generation orchard seed available. (2) The non-industrial private forest owner for various reasons is becoming more and more reluctant to invest in intensive site preparation and planting. Developing methods to establish stands of improved stock other than through complete site preparation and planting would be a welcome addition to Southern silviculture. We will have enough improved seed perhaps to use direct seeding at a modest cost.

Another area that needs attention in the South is seed, and perhaps, seedling certification. Although certification is offered in quite a few States, only if it is demanded by the buyer of seed will certification come into its own. With certification authority vested in the several State agencies that have an agricultural background, and a distant, rather low-key international certification scheme, the situation is made to order for the leadership and coordination of the Southern Forest Tree Improvement Committee. Exported seed should all be certified. We tend to think that we have adequate seed control and seedling distribution to proper sites -- perhaps, but I suggest the final step of certification to assure the public that their interest and environment are protected.

A third opportunity is in the area of gene conservation. Along with the large benefits derived from genetic manipulation, tree improvement workers assume a moral obligation to see that no irreparable harm is done to the gene pool and that genetic diversity is maintained. A rising tide of correspondence from concerned citizens on this subject with reference to National Forest management leads me to believe that it soon will become more than just a moral obligation.

Forest tree gene conservation is a complex subject. It is a matter of technology - far from perfect thus far - and of policy. It concerns the researcher as well as the practitioner of tree improvement. It involves all classes of ownership - from the Federal Government to the small private landowner. And let us not forget the public at large ready to render judement at the drop of a news article or commentary.

This opportunity for positive action is made to order for the unique talents and experience of the Southern Forest Tree Improvement Committee.

Assessing The Present

When I was still an active tree breeder, the SFTIC was a biennial highlight for me to visit other researchers, hear the latest, and get together on new cooperative ventures. I am looking forward to this one with the same enthusiasm.

Tree improvement in the South - A Promise Fulfilled - that is an understatment. We have far exceeded, perhaps not our wildest dreams, but certainly our best conservative calculations; those calculations that convinced the researchers and the managers of Southern Forests that tree improvement was real and a paying proposition. And there are still great payoffs to come, both in breeding progress and in the harvest, just now beginning, of the fruits of our efforts. Today when I walk through orchards, nurseries, and plantations and see the work accomplished during the span of my career, I'm proud of all of us in the South who have set the pace for World Forestry.

On the occasion of this, its 15th Conference I express the wish that the SFTIC may continue to be as vigorous, diverse, adaptable and long-lived as the pool of genes that makes the Southern forest unique in the world.

LITERATURE CITED

Franklin, E. C. 1972. Forest tree improvement-accomplishments and challenges. Proc. Ann. Meeting, Southeast. Section, Soc. Am. For. Birmingham, AL. pp. 14-17.

Kaufman, C. M. 1971 The Southern Forest Tree Improvement Committee, 1951-1971 Eastern Tree Seed Laboratory, Macon Georgia, 31p.

Perry, Thomas 0. and Wang, Chi-Wu. 1958. The value of genetically superior seed. Jour. For. 56(11):843-5.

Wakely, Philip C., 1964. A biassed history of the Southern Forest Experiment Station through fiscal year 1933. Unpublished memo.

Zobel, Bruce. 1977. Increasing Southern pine timber production though tree improvement. South. Jour. Appl. For. 1(1):3-10.