

THE OKLAHOMA LOBLOLLY AND SHORTLEAF PINE  
TREE IMPROVEMENT PROGRAM<sup>1/</sup>

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ABSTRACT. The history and objectives of the Oklahoma forest tree improvement program are discussed from inception in 1965 to present.

Additional Keywords: Pinus taeda, Pinus echinata.

Dr. Clayton E. Posey, while at Oklahoma State University, initiated a program in late 1965 to improve the commercial forest trees in Oklahoma. His objectives were to improve the two native species of pine, shortleaf (Pinus echinata Mill.) and loblolly (P. taeda L.), for use in Oklahoma, and to provide trees of known parentage and geographic source for further research in genetics, physiology, pathology, and soils.

The program was based on the selection of superior trees from natural populations. Selections were made from twenty to sixty year old stands on the basis of phenotypic and physiologic characteristics. Forestry personnel from several agencies were trained in the identification of superior candidates from natural populations. The select candidate trees were evaluated by the comparison tree method. The best five neighboring trees growing in similar environmental conditions were compared with the candidate, which had to be a certain percent better than their average. Where possible, trees were selected from only even-aged stands that had not been high-graded.

The selected candidate trees were evaluated using a standardized rating system. The following characteristics were considered:

A. Total Height - The ratio of the height of the select tree to the height of the average of the five best check trees was expressed as a percentage. Select trees with less than a ten percent advantage received no points for height.

B. Volume - The select tree was given one point for each 10% excess in volume over the average of the check trees.

C. Crown - Crown was judged subjectively from the stand-point of the individual select tree as compared to the five check trees.

D. Form Class - Form class was determined by the Girard Form Class Method. The select tree was given one point for each form class greater than the average of the five check trees, less one point.

E. Straightness - Straightness was judged subjectively for the individual select tree and not compared to the check trees.

F. Pruning ability - The ability of the select tree to shed its lower limbs was scored by comparison to the five check trees.

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G. Branch Diameter - Branch diameter was judged subjectively from the stand-point of branch diameter of the select tree to the five check trees. A small branch diameter was preferred.

H. Branch Angle - Branch angle was judged subjectively for the select tree compared to the five checks. A flat branch angle was more desirable.

If the select tree was poorer than the check trees in any of these categories, except straightness, points were deducted by the same scale as they were added when the select tree was superior to the check trees. A tree with a minus score in more than one characteristic was not accepted.

I. Age - A tree which was apparently more than three years older than the check trees was not accepted. Select trees which were apparently younger than the check trees were given bonus points.

J. Specific Gravity - Points were not awarded a select tree for specific gravity. The value of a tree for specific gravity was judged by two criteria:

1. The select tree's specific gravity was compared with that of its five check trees. This gives an indication of the tree's specific gravity relative to trees growing under the same environmental conditions.
2. The select tree's specific gravity was compared to the regional average. The specific gravity of the select tree had to be at or above the regional average.

Breeding orchards were established by grafting scions from the selected trees. In the spring of 1966, vigorous 1-0 seedling rootstock was planted to facilitate grafting of the select scion material. Later, in the spring, scion material from the previously selected trees was collected and grafted to this rootstock. Both field grafting and bed grafting was used. One breeding orchard for coastal plain loblolly pine and two shortleaf pine breeding orchards were established. Select shortleaf trees below one thousand feet elevation were established as one breeding orchard and were designated lower elevation shortleaf. The trees above this elevation were designated mountain shortleaf and were established in a separate breeding orchard.

A shifting clone orchard design was used. The objective was to position the ramets to insure that each clone had an equal chance of crossing with all other clones an equal number of times with a minimum chance of selfing. A twenty clone loblolly, a thirty clone lower elevation shortleaf and a twenty-four clone mountain shortleaf orchard were established in this manner.

In the spring of 1967 a cooperative working agreement between the Forestry Division, Oklahoma Department of Agriculture, and the Department of Forestry, Oklahoma State University, was consummated to provide for the

development of improved varieties of pine trees for Oklahoma and to establish and maintain seed orchards in order to provide a reliable source of large quantities of improved seeds. This agreement dictated specific responsibilities of each cooperator as follows:

A. Oklahoma State University, Forestry Department, Agreed to:

1. Provide general technical advice and assistance for the entire program.
2. Give technical instruction, initially and at other times, to Department of Agriculture personnel on the performance of tasks connected with the program.
3. Devise suitable grading rules for all species and grade all trees selected for the seed orchards.
4. Provide laboratory and greenhouse facilities for the entire program. This will include facilities for the measurement of wood characteristics and the analysis of soils.
5. Maintain records for the entire program.
6. Initiate and perform studies to solve practical problems encountered.

B. Department of Agriculture, Forestry Division, Agreed to:

1. Locate and make selections of candidates to be considered for inclusion in seed orchards.
2. Collect scion or cutting materials and vegetatively propagate or assist in the propagation of acceptable candidate trees.
3. Cooperatively establish and maintain the seed orchards.
4. Develop and utilize interim methods to collect tree and shrub seed including material for vegetative propagation, from the best adapted sources.
5. Assist in the construction and modification of equipment and buildings.

C. It is Further Agreed by Both Parties:

1. All equipment, materials, and property of any kind purchased by either cooperator and not consumed in the program shall remain the property of the purchaser.
2. That nothing herein shall be construed as obligating either cooperator to make expenditures of money

present or future, in excess of appropriations authorized by law, and administratively made available.

3. Industrial organizations and individuals may cooperate in this program to the full extent of their interest but this will in no way change the responsibilities of the cooperators.
4. This Agreement shall become effective when completely executed and shall continue indefinitely but may be modified by mutual agreement between the parties in writing, and may be discontinued at the request of either party. Request for termination or any major change shall be submitted to the other party not less than 60 days in advance of the effective date desired.

The first improved seed produced as a result of this cooperative was collected from the pine seed orchards during October, 1972. The following listing depicts the annual yield from the 1972 through the 1981 seed harvests. The demand for loblolly seed in Oklahoma has increased due to regeneration of loblolly pine on what was once thought to be shortleaf sites. Consequently, demand for shortleaf seed has declined greatly and management of the shortleaf seed orchards was terminated indefinitely in 1981.

	Loblolly		Lower Shortleaf		Mountain Shortleaf	
	bushel cones	pounds seed	bushel cones	pounds seed	bushel cones	pounds seed
1972	--	5.5	--	5.8	--	1.7
1973	28.0	28.4	14.0	15.1	7.5	10.5
1974	19.5	23.8	14.0	5.5	3.0	3.7
1975	66.0	85.8	33.0	26.6	11.5	9.3
1976	95.0	123.2	34.5	13.6	14.5	3.7
1977	--	100.6	--	32.7	--	6.6
1978	--	53.6	--	64.8	--	22.7
1979	237.0	375.0	100.0	100.0	60.0	60.0
1980	425.0	500.0	22.7	22.0	85.0	80.0
			Management terminated			
1981	620.0	601.0	52.0	44.0	152.0	132.0

By 1973 sufficient open pollinated seed was generated in the orchards to allow the initiation of open pollinated progeny tests. The first test

was field planted in February, 1975. The planting consisted of four replicates, each contained twelve 10-tree row plots of loblolly pine seedlings. Subsequent tests were established and have contributed information to the thinning/roguing of the loblolly orchard in 1982.

As a result of control pollination efforts, the first controlled cross progeny tests were outplanted in the spring of 1979. A randomized complete block design consisting of 4-tree plots with eight replications, representing sixty families, were planted in two locations. First year survival at both locations was sufficient to warrant retention of these tests. The tests will be measured in 1984 to evaluate five year performance. Progeny from the three different orchards are now in test at many sites representative of the area where the improved stock will be grown commercially. These full-sib progeny will also be used for second generation selection work.

In 1980, the Oklahoma Division of Forestry became a member in the Western Gulf Forest Tree Improvement Program (WGFTIP). Membership was deemed prudent due to the program's need for a broader genetic base as second generation work began. The broader genetic base will allow for continuation into second and third generation material without inbreeding in the orchards. Other benefits enjoyed by the membership are sharing of information and genetic material among the cooperators. Since becoming a member, seventy-two additional select loblolly trees have been located, graded and established in a scion bank to be used by the membership to support the overall plan of the cooperative improvement program.

In 1982, a six and one-half acre advanced generation loblolly seed orchard was established to provide more seed and higher quality seed for the tree farmers in Oklahoma. Scion material for this orchard was furnished through WGFTIP, and has been tested in first generation progeny tests.

First generation controlled-cross pollinations and progeny testing will continue for the next several years. Outplanting and measurement of these tests will follow the WGFTIP guidelines to insure future comparability of the Oklahoma program's data with related data generated by other WGFTIP cooperators. Continuation of advanced generation breeding work and orchards is planned.