Forest Tree Improvement at the University of Minnesota

by Scott S. Pauley 1/

Principal initial effort in the establishment of the tree improvement project at the University of Minnesota continues to be directed to the accumulation and propagation of experimental materials at the University's North Central School and Experiment Station (NCSES) and in a new nursery established on the St. Paul campus. Additional test and demonstration outplantings were also established and new studies initiated by several graduate students in 1956-57. A summarized description and report of progress on these activities follows.

Nursery Propagation

Through cooperation of the Knife River Nursery (Kimberly-Clark. of Minnesota, Inc.) and the Willow River and Badoura nurseries (Minnesota Conservation Department), several thousand seedlings and transplants of white spruce, black spruce, red pine, jack pine, and white pine have been lined-out for use as rootstocks in the NCSES nursery and in the St. Paul nursery. Additional rootstocks of the following species have been propagated from seed: Yellow-poplar, black willow, quaking aspen, cottonwood, silver poplar, grey birch, river birch, paper birch, American elm, Siberian elm, slippery elm, rock elm, red maple, silver maple, and black locust.

In addition to the new nursery site made available to the Tree Improvement Project on the St. Paul campus in the spring of 1957, three new rodent-proof seedbeds and a heeling-in bed adjacent to the Green Hall (School of Forestry) greenhouse have been constructed. These facilities will materially improve our ability to handle seedling progenies.

Outplantings

Tree Improvement Arboretum. --Through cooperation of the Blandin Foundation, initial outplanting in a Tree Improvement Arboretum at the D. M. Gunn Memorial Park, Prairie Lake, was made in the spring of 1956. The planting consisted of various cottonwood, balsam poplar, and aspen ecotypes and hybrids.

In May 1957, 100 4-tree plots of paper birch seed sources were established in the arboretum area, The seed sources represented cover most of the range of this species in North America. Seed of this material was assembled by Dr. Chi-Wu Wang in 1953 while on the staff of the Harvard Forest. (Dr. Wang is now on the staff of the School of Forestry, University of Florida.)

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In addition, 28 4-tree plots of various paper and yellow birch seed sources, and putative natural hybrids of these species with bog birch, were planted. Seed of this material was assembled by A. G. Johnson while on the staff of the Arnold Arboretum, Harvard University, in 1953 and 1954. (Mr. Johnson is now on the staff of the Horticulture Department, University of Minnesota.)

Cook outplanting. --The Cook outplanting area, established through cooperation of the Diamond Match Company on the Pete Trygg farm near Cook, Minn., in the spring of 1956, was increased in the spring of 1957 by the addition of a portion of the birch sources described above. Twenty-one of the Wang seed source collection and 12 of the Johnson collections, in various plot sizes, were outplanted in the spring of 1957

Five F2 and backcross progenies of quaking aspen were also outplanted in the Cook test area.

Highway 33 outplanting .--Through cooperation of the Diamond Match Company another teat site for birch was made available to the Tree Improvement Project in the spring of 1957. This area comprises a piece of newly cleared land on the west side of Highway 33, about 10 miles north of Cloquet. Forth-five of the Wang birch sources were outplanted here in the spring of 1957.

Waseca, Austin, and St. Paul outplantings.--One hundred cottonwood and balsam poplar clonal lines were established in hardiness tests in north, central, and southern Minnesota in the spring of 1956. Marked variation in frost damage of certain clones between plantings was recorded in 1956-57. The plots will be maintained with cooperating agencies for several years.

Studies in Progress

Mode of inheritance in aspen. --Several F2 and backcross progenies derived from crosses of F1 hybrid aspen populations were produced in the greenhouse during late winter 1956 and 1957. The F_1 populations utilized were derived from controlled crosses of selected quaking aspen and European aspen parents made by the Cabot Foundation in 1950.

Hermaphroditism in quaking aspen. --An analysis of female, male, and hermaphroditic (bisexual) trees in a 206-tree sample of sexually mature quaking aspens, all of seedling origin, was made in 1956. Results of this study are summarized in Minnesota Forestry Notes No. 55.

Certain aspects of this initial study (e.g. actual ratio of male or female flowers to bisexual flowers in a single tree, self fertility studies of bisexual plants, genetic sex mechanisms involved, etc.) will, be continued by Mr. Soon Chul Hong, a Korean graduate student now in residence.

Birch studies. --In addition to the Wang and Johnson birch collections described above, further studies of ecotypic diversity and natural hybridization in the native birched have been initiated:

(1) In cooperation with Raymond J. Wood, Manager of the Diamond Match Company's Land and Timber Department, open pollinated seed collections from 11 selected birch stands were made in late August 1957.

(2) Studies of natural hybridization involving paper birch and bog birch were initiated during the past year by Knud E. Clausen, a graduate student; in the School of Forestry. Initial effort has been directed to the location and mapping of hybrid swarms throughout the State and collection of herbarium material and seed for morphological and cytological studies.

Forest genetics survey.--A report on the Minnesota forest genetics survey conducted by Thomas O. Rudolph and William J. Libby during the summer of 1956 has been completed. This report was not intended for publication, but as a reference for more detailed investigations. Three copies have been prepared and are available on loan. A portion of the data collected, concerned with jack pine variation and distribution in Minnesota, has been published as Minnesota Forestry Notes No. 58.

Jack pine variation.--As an outgrowth of the above report, a detailed investigation of jack pine diversity has been undertaken by Thomas O. Rudolph and Roland E. Schoenike, both graduate students in the School of Forestry. These students are presently engaged in a study of the jack pine seed source plantations established by Dr. Schantz-Hansen at the Cloquet Experimental Forest in the early 1940's, and the more recently established seed source plantings made cooperatively by the Lake States Forest Experiment Station and the Universitv of Minnesota. If feasible, fieldwork will be undertaken outside the State throughout the range of jack pine, and especially in western Canada where the natural range of jack pine and, its western, counterpart, lodgepole pine, overlaps.

Toxin tests for Dutch elm disease.--Tests of a toxin screening method for the isolation of American elm seedlings resistant to the Dutch elm disease were undertaken by Frank S. Santamour, a graduate student in the School of Forestry, during the past winter, Results of these tests did not support the feasibility of such a screening method nor support the hypothesis that a toxin, produced by the causal fungus, is the prime dis ease-causing factor in infected trees.

Grafting and hybridization of elm.--The grafting and hybridization studies undertaken by Paul F. Coillins while a graduate student in residence at the School of Forestry in the spring of 1956 are being continued at South Dakota State College.

Yellow-poplar ecotypes.--Adaptability tests of four open-pollinated seed sources (New York, Tennessee, North Carolina, Michigan) of Liriodendron tulipifera were initiated in 1956. Other such tests of southern species, designed to isolate possibly adapted individuals, are planned.

Jack pine and lodgepole F_2 population.--Through cooperation of the Institute of Forest Genetics, Placerville, Calif., we have been supplied samples of seed from F1 hybrids of the cross lodgepole x jack pine--a controlled cross that was made at the Institute a number of years ago. Several samples of lodgepole pine seed from the same locality of origin as the female parent of the original cross have also been supplied. These samples, together with samples of Minnesota jack pine, are currently being propagated.

Progeny test analysis.--Mr. John C. Barber, on leave from the Southeastern Forest Experiment Station, U. S. Forest Service, was in residence as a graduate student in the School of Forestry during the 1956-57 academic year. Mr. Barber's research problem is concerned with the 6-year evaluation of several slash pine progeny tests growing in the State of Georgia.

Basswood propagation .--Studies of basswood propagation from stem and root cuttings have recently been undertaken by William J. Peters, a graduate student in the School of Forestry. Basswood is given high ranking by Minnesota farmers as a desirable farm woodlot tree. Other hardwoods of high preferential rating by the State's farmers are: rock elm, red (slippery) elm, red oak, white oak, butternut, walnut, and green ash.

Growing northern planting stock in the South .--Richard Watt, a member of the Lake States Forest Experiment Station, will be in residence as a graduate student in the School of Forestry during the current academic year. Mr. Watt plans to initiate a research problem which will be designed to assess the feasibility of growing certain native northern conifers in nurseries of the deep South. In the long growing seasons of such areas, and under an artificially lengthened photoperiod designed to increase the period of active growth, high-quality planting stock may be produced in a shorter time.