

FOREST GENETICS RESEARCH AT THE UNIVERSITY OF WISCONSIN*

1/

Robert G. Hitt

For a number of years research has been conducted at the University of Wisconsin on various forestry problems. This work is carried on in

1/ Forester-In-Charge, Tree Breeding Research, Department of Genetics, University of Wisconsin.

the Soils Department by Dr. S. A. Wilde, in the Pathology Department by Dr. A. J. Riker, and in the Entomology Department by Dr. R. D. Shenefelt. All of these men are assisted by other well-qualified professional men and graduate students.

Realization of the need for a program of forest genetics research in Wisconsin resulted in the initiation of such a program in 1948. The research is carried on in the Genetics Department of the University of Wisconsin in cooperation with the Wisconsin Conservation Department. The general objective of the program is the improvement of the planting stock used for reforestation. The work has been organized under the following specific objectives:

1. Improvement of the genetic quality of the planting stock now going into reforestation through the utilization of seed harvested from the best existing native stands.
2. Selection of superior trees by progeny tests.
3. Hybridization for the production of improved strains.
4. Specialized studies.

I would like to discuss the first of the objectives later.

SELECTION OF SUPERIOR TREES BY PROGENY TESTS

To date, over 250 individual tree selections have been made in Wisconsin. Included are selections of red pine (Pinus resinosa), jack pine (P. banksiana), white pine (P. strobus), white spruce (Picea glauca), black spruce (P. mariana), and a number of trembling aspen (Populus tremuloides) and large-toothed aspen (P. grandidentata). By the standards which we are using at the present time, many of our original selections cannot be classified as phenotypically plus trees. However, they will be carried along in the testing work.

Open-pollinated seed was collected from many of the trees in the fall of 1948. This spring (1953), nearly 30,000 transplants raised from this seed will be set out in progeny test areas as well as in several breeding collection areas that have been established.

Basic to any breeding program is the building up of a collection of breeding material. The seed and scion collection, to date for the Wisconsin Forest Genetics project includes 28 species of Pinus, 5 species of Larix, 6 species of Picea, and 3 species of Abies. These represent 304 different sources in 14 states, 7 Canadian provinces, and 13 foreign countries, and do not include any of the Wisconsin individual tree collections mentioned earlier. In order to avoid loss of all or a part of the collection by fire, disease, insects, etc., as well as having the material more readily at hand and perhaps have it

flowering about the same time as our native material does, several breeding collection areas have been established throughout the state. One area is to be established on a 20-acre tract which has already been allocated for this purpose in the University of Wisconsin Arboretum in Madison, a second area is at the Griffith State Nursery at Wisconsin Rapids, the third area is near the Trout Lake Forestry Headquarters in Vilas County, and a fourth area will be established somewhere in the northwestern part of the state near the Gordon Nursery.

HYBRIDIZATION FOR PRODUCTION OF IMPROVED STRAINS

Hybridization studies are being conducted relative to the establishment of desirable clones or strains of natural and hybrid coniferous forest tree species. Initially, particular emphasis is being directed toward the improvement of our native red pine. Dr. Heimburger, of the Department of Lands and Forests of Canada, as well as others have expressed the opinion that two or more strains of red pine may exist. Following the ice invasions centuries ago, the red pine moved north again. In so doing, part of the species moved up the eastern side of the Great Lakes and part up the western side. Through the centuries of "isolation" by the water barrier, distinctly different races may have developed. These races or strains, when cross pollinated under controlled conditions, may give rise to progeny showing hybrid vigor. Therefore, crosses are being made between different geographic types of this species.

Controlled pollination work is also being performed using the selected red pine trees growing in Wisconsin. Compatibility tests with this species are in progress. The possibility of producing hybrids between red pine and some of the other hard pines is being explored.

The hybrid resulting from crossing jack pine and lodgepole pine (*P. contorta* var. latifolia) which has been produced by the Institute of Forest Genetics and others shows promise. Efforts are being made to produce this hybrid here by utilizing selected native jack pine and crossing it with lodgepole pine pollen supplied by the Institute of Forest Genetics.

No major work is planned immediately with white pine since the Forest Pathology Research group has already undertaken breeding work with this species relative to white pine blister rust resistance. Cooperative efforts are anticipated on certain phases of the work at a later date, however. Breeding work with various species of spruce (Picea) is planned.

The tree improvement work with hardwoods has thus far been primarily concerned with Populus. Selection of desirable parent trees has been started. The production of hybrid seedlings has been undertaken and attempts are being made to produce polyploid material with our two more important species, trembling and large-toothed aspen. Since disease resistance is such an important factor in the poplar breeding work, cooperative efforts must be maintained with the Forest Pathology Research

group relative to testing any hybrid or polyploid material.

SPECIALIZED STUDIES

Vegetative propagation of selected plant material is an important process which the forest tree breeder must master and use. Trials have been initiated with red pine in an effort to find a technique for inducing root formation on cuttings. Various techniques, media, hormones, etc., have been employed in these experiments. Some greenhouse grafting has been performed, however results to date have been poor. Mr. C. E. Olson has just finished our greenhouse pine grafting and will begin grafting spruce. We plan to do some field or free-land grafting of pine and possibly spruce later this spring.

Methods to induce precocious or early flowering have been sought by tree breeders for some time. We have established 14 test areas in central and northern Wisconsin in order to test a number of different methods for their effectiveness in stimulating flowering on red pine. The treatments include spiral girdling, semi-circular girdling, wire strangulation, and checks or controls. In all cases a definite treatment effect has been noticed, with the spiral girdling being the most pronounced. Death of the terminals and in one case even death of the entire tree resulted from this treatment. As a result, new areas were established in which root pruning was substituted for the spiral girdling treatment. The first of these trials will be read this year.

In order to help our Conservation Department plan its annual cone-buying program, a cone crop prediction survey is made, generally annually. In addition, some cone-picking time studies have been undertaken.

Attention is being given to other specialized problems. These include the establishment and management of seed-tree orchards, improved equipment and methods for controlled pollination work, production of polyploid material, etc. In all phases of our work we are cognizant of the need for close cooperation between the various research groups relative to the production and testing of improved forest trees.

IMPROVEMENT OF THE GENETIC QUALITY OF FOREST PLANTING STOCK

I have reserved this topic for discussion last because we feel that it is one of the most important phases of our work demanding immediate attention. We feel that the most effective step which can be taken now to improve immediately the genetic quality of planting stock is the establishment of a seed procurement plan which involves certification. Measures should be taken to bring under management for seed production existing selected stands of forest trees of the species most important to the reforestation work in the Lake States region. The inferior individuals should be rogued out of these stands and management practices