FOREST TREE SEED IMPROVEMENT IN NEW YORK STATE

E. J. Eliason[1] and G. R. Stairs[2]

New York State as a leader in reforestation in the Northeastern United States planted its billionth tree in 1958, marking approximately 60 years of active work in this area. The history of seed procurement and its influence upon the performance of planted trees during this period provides an introduction to the forest tree improvement program presently in progress in New York State. It is important to point out at the onset that there has always been concern relative to seed source; however, often problems of procurement were paramount and seed source was by necessity relegated to a secondary position in early plantings. Much of this story centers around individual species, and Scotch pine provides an example of the evolution involved. During the first two decades of reforestation effort a considerable amount of Scotch pine was used, since it was a common tree for reforestation in Europe and inexpensive seed could be purchased. Unfortunately we had not learned much about seed collecting at that time, and as the Scotch pine plantations developed, a great deal of extremely poor stem form was found. In the middle 1920's the reforestation administration found that the Baltic source of Scotch pine maintained good form and we proceeded to make seed purchases from that area of Europe. Nevertheless, during the post World War II period opposition to this seed source came from the Christmas tree growers who objected to the yellow winter coloration of this seed source. We were, therefore, back in the position of looking for a new seed source of Scotch pine.

Concurrent with these happenings provenance studies were being established in New York State, not only with Scotch pine, but also other species such as Norway spruce, and Japanese and European larch. Among the earliest of these were the

[1] New York State Conservation Dept, Ballston Spa, New York.
[2]N. Y, State College of Forestry, Syracuse University, Syracuse, N. Y.

Scotch pine selections made by Dr. H. I, Baldwin and the International series of IUFRO collections., At the same time plantations of exotic species were growing and approaching an age suitable for genetic selection work. Thus we were building a base of materials for species selection in exotic forest trees in addition to our native stands.

Returning to the Scotch pine example we found that we were facing evolving demands for planting stock. Similar situations were found in other species and demand for improved planting stock was receiving impetus from forest genetic and tree improvement programs being established throughout the world. Past experience had indicated that real genetically improved seed could not be purchased, and thus the state adopted a policy of producing its own seed. The present forest tree improvement program was started in 1958, largely through the suggestion of the late Dr. Fred Klaehn of the N. Y. College of Forestry. Since that time a cooperative program has been maintained between the N. Y. Conservation Department and the College of Forestry at Syracuse. The program is presently directed by Mr. Eliason of the New York Conservation Department and Dr. Gerald Stairs from the College of Forestry.

The first seed production area was established in 1959, when ten acres of red pine plantation was converted for seed production. Our first grafted seed orchard was planted in 1961. In 1962, a comprehensive plan for the establishment of a series of seed orchards and seed production areas was published and approved by the administration. This plan called for 189 acres of seed orchards and 316 acres of seed production areas, with all of the major species now being used for reforestation. At the present time (September 196h) we have established 42 acres of seed production areas and 31 acres of grafted seed orchards have been initiated.

In the past we have selected young plantations just beginning flowering for seed production areas; and old growth, mature selections for grafted seed orchards. We plan to continue this policy for seed production areas, but intend to modify the selection scheme for seed orchards. For a time at least we are restricting our selections for grafted seed orchards to established plantations (20 years + age class) that show good growth in New York State, We feel that the problem of defining a selection differential is simplified when one has a plantation of uniformly spaced, even-aged trees. The problem of seed source is often a valid criticism of plantation selection, however, we feel that the ability to define performance offsets, to a degree, inadequate knowledge of original seed source. In addition we are attempting to balance our seed orchard program between grafted and seedling material. Control pollinations for seedling seed orchards were made in 1964 for white spruce, and additional crosses are planned for Scotch pine and Japanese larch in 1965. Basically our crossing schemes will be diallel or modified diallel designs, in an attempt to provide the most breeding information for future generations of trees and tree breeders.. A limited amount of open pollinated, putative half-sib collections will be made on an experimental basis.

We recognize many unsolved questions involved in the use of seedling seed orchards. Aside from the obvious question of flowering times are such problems as: (1) how many genotypes should be included in a given design, (2) can we combine progeny testing with seed orchard designs and maintain a desired level of efficiency in each, (3) are we premature in selecting and conducting controlled breeding prior to determination of the genetically most desirable population within a species and (1k) what crossing scheme will be most useful on either practical or

theoretical grounds? Also important to the entire seed orchard program is the question of a selection index and traits to be selected for, While specifically beyond the scope intended for the present discussion we may risk a generality and define our goals somewhat broadly, Our present selections are made on the basis of phenotypically observed improved growth rate; i.e., the fastest growing tree. Within this framework we are then interested in as many of the usual attributes such as insect or disease resistance, wood quality and chemistry, or tree form that are applicable in a given situation. Thus we are involved in selection for more than one character, but with growth rate the most important single attribute. Since the method of independent culling levels offers the practical advantage of being able to dispose of a proportion of a population at different ages, it is the general method we will use in progeny evaluation.

At this time we may summarize our present progress in genetic improvement of tree seed with the following species breakdown.

White Pine. Both seed production areas (21 acres) and grafted seed orchards (10 acres have been established,, The grafted seed orchards are from northern New York old--growth, natural stands. small orchard of apparent blister rust resistant selections has been established, At the present time we have enough grafts in our transplant beds for two additional orchards; one of these will contain selections from natural stands in southern New York, the other, plantation selections from the northern part of the state

Red Pine, We are presently limiting tree improvement work with this species to seed production areas. The question of relative amounts of genetic variation in red pine requires additional work prior to seed orchard establishment.

Scotch Pine, A large number of Scotch pine plantations with wide genetic variation are available in New York from which to select, One grafted seed orchard (6 acres) has been established with selections made on the basis of desirable winter coloration and overall form. Because of the early flowering in this species seedling seed orchards are planned. A seed production area of 6 acres has been established.

Norway Spruce. No seed production areas have been established for this species and only one small (1 acre) grafted seed orchard. We have had difficulty in grafting this species; present alternative consideration includes seed production areas and seedling seed orchards.

White Spruce. A seed production area has been selected for conversion and one small (1 acre) grafted seed orchard established. In 196L1. a series of control pollinations were made to begin a seedling seed orchard; the very early prolific flowering in this species makes it an ideal one for seedling seed orchard work

European Larch. One grafted seed orchard (6 acres) has been initiated and a search for a suitable seed production area is underway, Both grafted and seedling seed orchards are planned.

Japanese Larch. A grafted seed orchard (6 acres) has been established as well as 5 acres of seed production area. An additional seed production area is being converted during the current (1964) growing season. In addition two small hybrid orchards (Japanese x European larch) have been established from selected clones.