THE NEW ENGLAND SPRUCE-FIR SEED ORCHARD PROGRAM

Carter B. Gibbs, *Principal Silviculturist*
Northeastern Forest Experiment Station, USDA Forest Service
Orono, Maine

and

James B. Carlaw, *Assistant General Manager*
Northern Division Woodlands Department
International Paper Company
Glens Falls, New York

I once heard it said that if you want to know how something was organized, ask a man who had nothing to do with it. I suspect this may be one of the reasons I was asked to collaborate on this report of the development of the New England Spruce-Fir Seed Orchard Program.

What I would like to do today is give you a brief history of our program and then present a few of the problems we encountered — how we might have avoided them and what we have done to solve them. And then, with the excuse of author's prerogative, I'd like to make observations on the organization of tree improvement programs, based on our rather limited experience.

The spruce-fir program began in 1965 when Arthur Hart, USDA Forest Service Project Leader at Orono, contacted forestry leaders in northern New England and New York and suggested a meeting to discuss the feasibility of initiating a tree improvement program for spruce-fir. Several meetings were held, and a Steering Committee was formed, including one representative each from industry, State forestry, State university, USDA Forest Service State and Private Forestry, and two representatives from USDA Forest Service Research.

The stated objective of the program, covering an initial period of 3 to 5 years, was to begin identification, detailed location, and seed collection of "plus" or superior individual trees of the spruce-fir type. Seed collected from these individuals was to provide, through the development of seedling seed orchards, a better seed source to fulfill future planting requirements. In general, the functions of the program were divided as follows:

1. The USDA Forest Service was to provide technical knowledge and leadership and commensurate manpower to provide direction and to make the necessary computations.

2. The State Forest Services were to cooperate in general field work relating to "plus" trees — seed collections, nursery work, and outplantings.

3. Industry was to cooperate in supplying manpower for the necessary fieldwork relating to "plus" tree selection, seed collections, and outplanting, and to make available the necessary equipment and machine time. It was to provide desirable planting sites within its ownership areas.

Species requirements were rather vague, and they varied from merely spruce and fir to a variety of species. Early preference pointed to the following order: balsam fir, white spruce, Norway spruce, and white pine. Red spruce was considered, but not included because of a general agreement on lack of genetic variability in the species. Later, the number of species was reduced, and we now concentrate on balsam fir and white spruce. Some black spruce have been selected but the species is not well distributed throughout the region.

In choosing "plus" trees, factors were selected to favor growth rate first, then the highest possible combination of growth rate and wood density, and then height to diameter ratio. Favor was not shown towards tree form or angle of branching. The selection criteria reflected the needs of the pulpwood industry in the area and the historic and planned utilization of the species. Even so, the criteria were not biased against the potential use of the superior stock for sawlog production.

Although the major emphasis of the program was on seedling seed orchards, scions were collected from the "plus" tree candidates to preserve their germ plasm against potential losses from cutting, windthrow, insects, and disease. Also, preservation of the selected clones would permit, at some future time, the development of small clonal orchards and a breeding arboretum.

Training sessions were held throughout the spruce-fir region to train foresters in the uniform reporting of "plus" tree candidates. Attendance at these sessions was excellent, and the selection of "plus" trees began in 1966. By June 1970, 80 balsam fir, 55 white spruce, and three black spruce had been selected and subsequently screened for acceptance by the USDA Forest Service State and Private Forestry geneticist assigned to the program.

Most of the selections were made in 1966 and 1967, but the lack of good seed crops and a break in leadership due to the death of Arthur Hart stalled the program. However, pressure from industry and the potential of a good seed year led to a reorganization of the program in June I:970. A new Steering Committee was appointed, and plans for seed collections and nursery plantings were made and finalized.

Nearly all the "plus" trees were revisited. In all, 58 seed lots were collected by the owners and moved to the Maine State Nursery by the Maine Forestry Department. Seed cleaning and nursery sowing were supervised by a forester and a geneticist of the State and Private Forestry Division of the USDA Forest Service. One replication of each seed lot was planted in the Maine Nursery in the fall, and another was planted in the spring. One replicate was planted in the fall at the New Hampshire State Nursery.

Now that we have seedlings in the nursery, we are preparing to meet the problems of outplanting and care of the plantations. We plan to have plantings on forest sites provided by industry, universities, and Federal and State forestry agencies. We are asking all the cooperators to begin site preparation at least 1 year before the stock is ready to be planted. Our Forest Service Research Project at Orono is also starting a research program to develop the intensive cultural practices that are essential to realize the full potential of superior stock.

We are also requesting landowners to make additional "plus" tree selections. We have settled on 150 trees of each species as the minimum number needed. In any good seed year, this should give us a sufficient number of seed lots for comparison purposes.

We feel that we have made progress, but we realize that our program is still in its infancy. We have had many problems and anticipate many more. Because our objective here is to discuss problems and solutions in the organization of a tree improvement program, I will cover some of the pluses and minuses of our experiences during the last 6 years.

On the positive side, from the beginning, industry has shown an active interest in the program. This is undoubtedly related to the fact that economic benefits have been realized from tree improvement programs in other sections of the country, particularly in the South. However, it is also related to the fact that foresters in the executive branch of industry in Maine recognize the need to begin now if we are to have superior trees to produce the greater yields per acre necessary to offset the reduction of our productive forest land base through diversion to other uses such as recreation, highways, and homesites. The rising costs of wood transportation and land taxes indicate a need for concentrating growth as close to the market and on as few acres as possible.

In general, the attitude of industry is typified by a comment made by Jim Carlaw of International Paper at the first meeting of the Spruce-Fir Committee in 1965. I quote: "Current economics do not favor planting or direct seeding on a substantial scale, yet I am convinced that in the future economics will favor artificial regeneration with improved seeds or planting stock. At that indefinite time we will wish we had started sooner on genetic improvement."

Another plus is that the program has been completely cooperative and as such has not required a big labor commitment or large out-of-pocket expenditures by any one group or organization.

But we have had minuses — problems — some of our own making, some the result of the vagaries of nature. Briefly they are:

Too few trees. — Assuming that our program has been active for 5 years, we should have more than our maximum of 80 trees of a single species. Those who have lived with the program feel that we may have given the impression that foresters making the selections should seek the one very best tree on their entire holdings rather than the best tree in a particular area. We are now requesting that any tree that appears "plus" or exceptional when compared to the high average of the stand be reported. Fieldmen thoroughly experienced with the forest type and species can easily make these comparisons.

Not enough communication. — *We* have not always kept the people involved in the program up-to-date on past progress and future needs. A newsletter was planned and started, but was not kept up on a regular basis. Personnel in all organizations changed and because there was no communication with their replacements, continuity and program impetus were lost. We now issue a letter to all members of the program whenever there is any news such as results of seed collection, nursery planting, new trees submitted for screening, or when, as now, we feel the need to stimulate the search for more "plus" trees.

Lack of central record keeping with rapid retrieval. — Closely allied with our communication problem has been our inability to retrieve information quickly on the accepted "plus" trees. People who go to the trouble of selecting and submitting candidates like to know what happens to them, how their company compares with others in the number of candidates submitted, and what the status of the program is in terms of total candidates. We now are developing a computer program to store the information and make simple calculations on characteristics of "plus" tree candidates. We will get printouts from this program for periodic distribution to all the cooperators.

Seed years. — Nature dealt our program an almost mortal blow by denying us a good seed year early in the program. Selection of candidates went very well, but the program was nearly dormant during the off seed years. Obviously there is nothing we could do about this, but we feel that this fact should be recognized in organizing a tree improvement program for a species that does not produce seed crops frequently. Some seed was collected, but in only one case was there a sufficient quantity to warrant seeding in the nursery. Seeds from three trees — one balsam fir, one white spruce, and one black spruce — were collected, planted in 1967, lifted in 1971, and outplanted on the Forest Service Penobscot Experimental Forest and land of St. Croix Paper, the company that collected the seed.

Failure to preserve the germ plasm. — Our scion wood collection has not been actively pursued, and some candidates have been lost because of it. The trees lost either died, were windthrown, or were inadvertently cut during logging operations. We have had very little success with grafting the few scions that were collected. Not only is the grafting of spruce and fir difficult, but many of our "plus" trees are nearly inaccessible during the winter months when scion collections should be made. We have not yet hit upon the solution to this problem.

Leadership. — Leadership is a problem because in a cooperative program involving several public agencies and industry, someone — and I stress the one — must assume the responsibility for pushing the program. This is particularly true when the program represents a small but recurring effort on the part of the participants. Arthur Hart of the USDA Forest Service was dedicated to the program and provided the annual drive necessary to keep it going in the early years. My co-author, Jim Carlaw, has now assumed the role, enabling the program to continue. But had Jim, or someone like him, not been prepared and willing to assume the responsibility for the program, it might have been lost.

From discussions with those who were involved in the organization of the Spruce-Fir Program and a review of the past 6 years' correspondence, we feel that there are several "musts" in the development of a tree improvement program. We realize that these needs are not new, but we feel that they are fundamental and bear repeating in the context of our discussions here.

There must be an individual or group of individuals of significant professional influence, who are sold on the genetic improvement of the species in question. To illustrate, I will again quote from Jim Carlaw's comments at the first meeting in 1965:

"I think we need to start now formalizing a program to identify our needs to locate trees — "plus" trees that meet our needs. We ought to start genetic

improvement programs. I would suggest that it might be difficult to sell this to industrial management on the basis of an immediate need — I think decisions ought to be based on economic appraisals made on the basis of alternatives available today." When the Woodlands Manager of a large corporation talks this way, tree improvement has a real chance for success.

The people who set up and provide the initial impetus to the program must have the authority in their own organizations to commit people and money to the effort. In our case, these people included woodland managers, State foresters, forestry school directors, Forest Service assistant directors in Research and State and Private Forestry, and National Forest supervisors.

Initially the effort must be both modest and cooperative. No public or private agency can be expected to embark alone on a full-scale tree improvement program until some economic or environmental benefits are on the horizon.

The initial leadership must come from some public agency such as the State or Federal Forest Service or a forestry school. These agencies generally have the expertise at hand to provide the necessary technical assistance without adding personnel or committing large sums of money to the project. Also, at least in our area, much of the land that will ultimately be regenerated by genetically improved seed is now owned by the general public; and this is a sound basis for the government — State and Federal — to participate.

Finally, after it is organized, tree improvement is an action program and should be treated as such. Meetings to plan the necessary field actions should not be cluttered with discussions on the various genetic alternatives involved. For example, once you have embarked on a seedling seed orchard program, meetings to organize seed collections are not improved by discussions of the relative merits of seedling versus clonal orchards. Industrial cooperators and others as well are confused and disillusioned by such arguments. To gain and maintain interest in a tree improvement program, those people with expertise in the genetics of the species involved must agree, in public at least, on the immediate needs and the future potential benefits of the planned course of action.