Tree Improvement Activities in the Pacific Northwest

By:

John W. Duffield 1/

I am taking the liberty of attempting to combine an account of tree improvement activities in the Pacific Northwest with a summary of the present conference. This is possible, I believe for two reasons. First because the basic tree improvement problems are similar in all regions, and second because the program of this conference has covered the tree improvement field so well.

I. Historical Background.

Tree improvement work in the Pacific Northwest dates from the Douglas fir seed source study set up at the Wind River Experimental Forest in southern Washington in 1912 by Dr. J. V. Hoffman, who is here today, and some other notable collaborators. Although this pioneer American seed source study did not have the wide geographic basis, nor the systematic hypothetical structure of the southwide study reported in the papers by Wakeley and Henry, it did sample Douglas fir in the Pacific Northwest rather extensively. Seed was collected in 13 localities in Washington and Oregon, from marked and recorded trees, and individual lots were kept distinct in propagation. Five outplantings were made in Washington and Oregon, two of them covering an altitudinal range from 2800 to 4600 feet on the slopes of Mt. Hood. Four of the original five plantations survive today, and the data from their most recent remeasurement are being analyzed at present by Roy Silen of the U.S. Forest Service. Perhaps the most interesting outcome of this study is that it indicates that certain collections - the Darrington and Granite Falls - were uniformly good in all outplantings, and in some cases were better than local collections. This study has given great impetus to tree improvement work in our region.

In 1927 a second study, this one involving ponderosa pine, was established by T. T. Munger. This has been especially interesting because it included localities which were represented also in similar studies established at about the same time in north Idaho and New Zealand, The Pacific Northwest study was based on collection localities, outplanted in six localities in Washington and Oregon. Four of these plantations survive, and the most recent remeasurements have just been jointly analyzed by Roy Silen and Tony Squillace. In this study also, certain collection localities have proven outstanding, for example, the El Dorado County, California source, which has also been a leader in the New Zealand tests.

1/ Technical Director, Industrial Forestry Assoc, Col. W. B. Greeley Forest Nursery, Nisqually, Washington.

II. Current Activities.

The Forest Genetics Research Foundation has recently published a summary of tree improvement activities in the western United States. Therefore I shall not attempt a systematic survey, but rather comment on some of our problems and activities in comparison with those which have been discussed at this Conference.

First, I believe I should give a bit of the seed supply, planting, and direct seeding picture in the Northwest as background to our tree improvement activities. Douglas fir dominates our artificial regeneration programs; perhaps 95% of artificial regeneration is with Douglas fir in western Washington and Oregon. Very few cones are collected from the tops on logging operations; small cones and rough terrain make this uneconomic. The Douglas squirrel collects and hoards cones, and his caches furnish a large proportion of the cones harvested. In addition, because fairly small trees produce good crops on occasion, a large crop is collected by climbing. This does not, usually, require the skill and involve the hazard connected with climbing southern pines, so that we do not need to hire the tree experts mentioned by Don Cole in his paper. Often a light extension ladder can be leaned into the crown of cone-bearing trees; in other cases, sound limbs are within easy reach from the ground. Relatively few cones are picked by the ultimate user; the bulk of our cones are bought from local collectors. This often leaves a substantial margin of uncertainty as to exact origin, especially in years of localized and spotty cone production.

Logging in the Douglas fir region is moving up into the mountains; much of the land cutover at lower elevations has been regenerated for fifty years or longer and, in some cases is starting to produce its second harvest. Thus the bulk of our current regeneration job is at higher elevations. Inasmuch as we have little knowledge of elevational races of Douglas fir, we are being conservative and attempting to use seed no more than 500 feet above or below its source. We find that seed production is less frequent at the higher elevations - above 2000 feet - than at lower elevations. Moreover, there is little young growth at high elevations from which seed can be readily collected. Therefore, high elevation seed is usually a rather scarce commodity.

Cone and seed insects further complicate our seed supply problems. 1958 started out with the promise of fair to good seed crops in many parts of the region. We ended the season with an unusually poor crop, largely as a result of insect attacks. Douglas fir has an impressive list of cone and seed destroying insects, the four principal ones being Dioryctria and Barbara, cone feeding lepidoptera, Megastigmus, a seed chalcid, and finally a gall midge, family Itonididae, which has only recently been recognized as a major threat. We have not yet developed sufficient life history information to go very far into aerial spray programs as described by Merkel in his paper.

However, we have learned enough to know that sprays to control the gall midge may have to be applied at about the time of pollination, and are therefore confronted with the pollen and conelet toxicity problems discussed by Matthews.

In years when seed supply is adequate, we use a much larger proportion of our seed supply for direct sowing than you do in the southeast. This is because of our rough terrain on the one hand and the fact that neither our nursery capacity or planting labor supply can keep pace with demands. Moreover, development of seed protectants and brush control chemicals have made direct sowing at least a satisfactory interim measure of regeneration.

Nursery capacity in our region totals at present approximately 100 million a year, but is being increased about 10 percent per year. Most of this stock is 2+0 Douglas fir. However, there are two noticeable trends in stock production. One is toward 2+1 transplants; the other toward an increasing percentage of true firs, especially noble fir and grand fir. These trends are largely the result of the very heavy damage inflicted on young Douglas fir seedlings by rabbits, field mice, mountain beaver, and deer. Most of our nurseries are quite complex in terms of number of species grown and in terms of numbers of seed lots within a given species. We grow appreciable amounts of noble fir, grand fir, western hemlock, sitka spruce, and Port Orford Cedar in addition to Douglas fir.

Seed certification in our region is in the active discussion stage. The Georgia Seed Certification Program, as outlined by John Barber, has been the focus of much interest in our region. A sub-committee on forest tree seed certification ultimately responsible to the Western Forestry and Conservation Association has started work. Its approach, so far, has been to work for an international program including British Columbia, Washington, Oregon and California, emphasizing the problems of "wild" seed certification for origin, and stressing industry self-regulation. As "cultured" seed becomes more important in our region, something resembling the Georgia program may be adopted.

Specific tree improvement activities in our region resemble those in the Southeast in general, but are as yet much more limited in extent. We are making a start with seed production areas, although the scarcity of young growth stands at the higher elevations for which we want seed limits this program. We are choosing stands in the 10 to 25 year age class, as these give us more scope for selection and tree-shaping than older stands. Moreover, we find that Douglas fir in this age class can be brought into fair cone production by heavy applications of nitrogen and phosphate fertilizers. Our first fertilizer study on a seed production area was established in 1955 cooperatively by the Industrial Forestry Association and the Weyerhaeuser Timber Co. Five-fold increases in cone production over controls encouraged us to go ahead with more extensive studies. At present, about 12 seed production areas up to 10 acres in size are being developed throughout the region.

We are thinking in terms of 40 to 80 trees per acre in these stands. On the basis of results so far, and under optimum conditions, we are expecting about 2 bushels of cones per 20-year old tree. This converts to about 60, 000 seed per tree per year.

We are learning, from the individual tree performance on our first seed production area, that there are wide variations in flower and cone production from tree to tree, and that these remain relatively constant year after year. This will have an important bearing not only on the development of these areas, but ultimately on the selection of clones for our seed orchards. We are learning also that fertilizer applications tend to iron out the year-to-year fluctuations in flower crops.

Seed orchard programs in the Northwest resemble yours in general. However, it is probably fair to say that our grading of selected trees is, so far, less rigorous. To date we have had a relatively small number of people actively hunting for select trees. In several instances, a quota of 15 or 25 has been set for a given seed orchard, and this number of good-looking trees has been selected in a relatively short period in the appropriate area. We adhere to the usual criteria of form, branch habit, and growth attributes. However, the major emphasis has been placed on selecting generally good-looking trees from high elevation stands for development of seed orchards at lower elevations. Thus, our seed orchards are, to date, primarily intended to produce seed from good phenotypes for high elevation sites.

The industrial basis for tree improvement in our two regions differs somewhat. Much of our pulp is produced from by-product chips. The primary products are still lumber and plywood, and we believe that this will continue to be the case. This means that although we are very much interested in wood quality objectives as they affect the pulping uses of wood, we cannot be influenced by them to the exclusion of wood properties affecting quality of lumber and plywood. Indeed, it would seem that our quality objectives should be so selected as to ease as much as possible the shift from old growth to young growth timber supplies on the part of the lumber and plywood industries. We are, accordingly, in British Columbia, Washington, and Oregon, studying variations in specific gravity, which influences lumber and plywood utilization as well as pulping. We may not be quite as interested in cellulose content as you are in this region, but, at any rate, we are going slow in committing ourselves to very specific wood quality standards at present.

Approximately 15 seed orchards have been established so far in British Columbia, Washington, and Oregon. All but one are composed of Douglas fir; the exception is a small noble fir seed orchard. The largest of the orchards covers 20 acres, and was established in 1958 by the Olympic National Forest. Most of the seed orchards are 5 acres or less in extent. Several establishment

procedures have been used. Natural regeneration stands have been top-worked as in the Olympic National Forest, planted seedlings have been field grafted, and bare-rooted seedlings have been bench grafted, lined out, and outplanted after a year in the nursery. Field grafting without covering is generally successful with Douglas fir, and can be done from April to July.

Individual clones of Douglas fir show wide variations in graftability, and we are accumulating evidence of stock-scion incompatibilities. Developing flowers on Douglas fir scions strongly inhibit growth of vegetative buds, and are usually removed from new grafts. Many types of grafts work on Douglas fir, the choice of type often being a matter of personal preference.

Isolation of Douglas fir seed orchards is not likely to be readily accomplished; the Douglas fir region is full of Douglas fir, and west coast Douglas fir is not hardy east of the Cascades. Fortunately, Douglas fir pollen grains are heavier than pine. It seems likely that artificial pollination may be practiced to some extent in Douglas fir seed orchards, as it has been for sometime in the apple orchards of eastern Washington.

In addition to these activities in applied tree improvement, there are basic and exploratory studies being conducted in the major forestry schools of our region and by several public and industrial organizations. Lines of work which have not yet reached the seed orchard stage include studies of blister rust resistance in white pines, of weevil resistance in Sitka spruce and other spruce species and hybrids. Individual variation in wood properties are being studied in a number of institutions.

In summary, I believe a conference such as yours, held in the Northwest, would cover much the same subjects, but, at present, would have fewer active workers to call on. We like to think that our tree improvement activities may be like our Douglas fir - slow to start compared to your southern pines, but with lots of staying power.

Publications and Reports Prepared in Cooperation With the Committee on Southern Forest Tree Improvement:

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Proposal for a cooperative study of geographic sources of southern pine seed. Subcommittee on Geographic Source of Seed, Philip C. Wakeley, Chairman. Southern Forest Expt. Sta. 1951. (Mimeo.) *

Standardized working plan for local tests of seed source. Subcommittee on Geographic Source of Seed, Philip C. Wakeley, Chairman. Southern Forest Expt. Sta. 1951. (Mimeo.)

Hereditary variation as the basis for selecting superior forest trees. Subcommittee on Tree Selection and Breeding, Keith W. Dorman, Chairman. Southeastern Forest Expt. Sta. Paper 15. 1952.

Directory of forest genetic activities in the South. Subcommittee on Tree Selection and Breeding, Keith W. Dorman, Chairman. Southeastern Forest Expt. Sta. Paper 17, 1952.

Working plan for cooperative study of geographic sources of southern pine seed. Subcommittee on Geographic Sources of Seed, Philip C. Wakeley, Chairman, Southern Forest Expt. Sta. 1952.

Suggested projects in genetic improvement of southern forest trees. Committee on Southern Forest Tree Improvement. Southeastern Forest Expt. Sta. Paper 20, 1952.

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Progress in study of pine races. Philip C. Wakeley. Southern Lumberman 187 (2345): 137-140. December 15, 1953.

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Supplement No. 1 to the original working plan of September 12, 1952, for the southwide pine seed source study. Subcommittee on Geographic Source of Seed, Philip C. Wakeley, Chairman.

Time of flowering and seed ripening in southern pines. Subcommittee on Tree Selection and Breeding, Keith W. Dorman, Chairman, and John C. Barber, Southeastern Forest Expt. Sta. Paper 72. 1956.

Proceedings of the Fourth Southern Conference on Forest Tree Improvement, University of Georgia, 1957.

Pest occurances in 35 of the southwide pine seed source study plantations during the first three years. Southern Forest Expt. Sta. 1957.

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* These reports are out of print.