ADVANTAGES OF SELECTING TREE SEEDS WITH CARE

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The vast virgin forests of North America are gradually being cut away and converted into managed stands. The movement is well under way in the United States and advancing in the same direction in Canada. For the most part, foresters and timberland owners have been content to accept such regeneration as came in naturally regardless of parentage or even of species. For early artificial reforestation, any seed source was acceptable. But the rising costs of timber growing and increasing competition for land use have forced owners to recognize that it is necessary and profitable to secure the best seed for a given site.

Forestry is the last great industry based on a growing organism that has not improved the wild stock under management. The filbert grower does not go out and gather wild hazel nuts to produce his planting stock, instead, he buys the most highly developed strain of filberts he can find, that will thrive in his soil and climate. The same is true of the stockman, the farmer, the orchardist, and the oyster grower. But the forester, for the most part, has not even learned to select the best of the wild strains or to match his seed source with his climate and soil.

The time has come when the. importance of a nurseryman's work will depend upon the forest that is produced from the stock that he raises. His job should extend far beyond the weeding, watering, and fertilizing of seedbeds. He should strive; for the best seed obtainable for the stock that he produces.

Normally the cost of seed is not more than 1 to 2 percent of the total planting cost per acre. Therefore, if the cost of good seed is double that of poor seed, the increase would still be negligible. In the long run, it costs practically as much to plant, protect, and pay carrying charges on a poor tree or stand as it does on a good one. If an average stand will pay its way under management, a better stand is certain to pay a more handsome net return, and a poor stand is just about as certain to leave a forest-growing venture in the "red". One other point, if you plant the wrong tree seed, you may not detect it until it is too late to make a change and you are stuck with it for a lifetime. There are now upwards of 3 million acres of deforested lands in the Douglas-fir region in need of full or partial planting, and each year's cut will leave a little more in the same condition.

Farsighted foresters at the University of Washington visualized this entire situation in 1946, and persuaded me to gather what information there was available on the subject. It was published in a bulletin in 1949, "Better Douglas-Fir Forests From Better Seed. "

What evidence do we have of superior strains of forest trees? What are the climatic limitations of different species? What is the difference in net return from seed from a good source or from a poor one ? How important is all this to the nurseryman, the forester, and the forest industry of the Northwest?
How can we go about getting better tree seed? These are some of the questions we will try to answer.

Strains of Forest Trees

Geneticists feel that it is no longer necessary to prove that there are superior (and inferior) races or strains of forest trees in our native wild stands. Strains may vary in tree form, growth rate, hardiness or other characteristics or a combination of them. Differences become so fixed that they are recognized as hereditary characteristics and will be transmitted to the seedlings produced. Variations in Scotch pine in western Europe are perhaps the best know, but there are many others. To make it more realistic I will cite evidence from our own species right here at home. In our Douglas-fir heredity study, seeds collected above Bridal Veil, Oregon, forty years ago have produced a young stand in the Wind River plantation just across the Columbia River (25 miles)
that is one-fifth larger than the stand grown from seed collected in the immediate vicinity of the plantation. The Oregon seed was collected from a good stand while the Wind River seed was collected from a scrubby stand. In our ponderosa pine test-of-strains plantation, there is one lot of seed from a slow-

growing, brushy strain on the Steilacoom Plains below Tacoma, Washington, and another lot from a fine timber strain in the Willamette Valley above Portland, Oregon. There is not a very great difference in climate between the two areas. At 22 years of age, the Willamette Valley trees, although a year younger than the others, are a third taller and have already lost their lower limbs. The Steilacoom Plains trees have rough boles and still have heavy .limbs all the way to the ground. When our Douglas-fir growth bulletin (No. 201) was published in 1930, 89 percent of the site I Douglas-fir was found below 1, 500 ft. elevation and none was found above 2, 000 ft. Since searching for superior strains during the past 2 years, we have located four areas where site I growth is occurring above the 3, 000 ft elevation. These are superior strains without any doubt.

Climatic Limitations of Forest Trees

From the standpoint of thrift and growth, climatic suitability is as essential as a good strain. When moved far out of their natural climatic range, trees not only make poor growth, but are highly subject to disease and insect attack, and mortality is high from these and other causes. There are countless examples in the literature, but for the sake of better understanding, I will cite cases from close at home. Douglas-fir grows from sea level to timber line, but the strain from the seashore will not grow well on the mountain top. At an elevation of 3, 000 to 4, 500 ft. on the Mt.. Hood National Forest, a plantation was established in 1915 from seed collected at elevations below 1, 000 ft. This plantation has been freezing off regularly just above the snow line and is developing into a scrubby stand. An adjoining plantation put in a few years later from seed collected at a 3,800 ft. elevation withstands the climate and is developing into a good forest.

Douglas-fir from Colorado seed, planted at the Wind River Arboretum, grew well at first, but gradually became affected by rabdocline, adelopus and the common diseases until out of a dozen all but two trees are dead at 35 years. Immediately adjoining, native Douglas-firs of equal age are healthy and twice as large. Lodgepole pine and Western larch in the same arboretum brought from the Blue Mountains in eastern Oregon are practically dead, while the same species native to the vicinity are healthy and growing well.

But trees can be moved great distances with safety if care is given to climatic requirements. The classic example is the introduction of Monterey pine into Australia, New Zealand, South Africa, and South America. It is healthy and making phenomenal growth in these countries. Douglas-fir, when by accident

or design-is properly suited to a planting site, is outdoing all other species in European plantations in both volume and quality. The same is true of some of our other species, but for every successful introduction, there are many failures if extreme care is not taken to match climates.

Climatic Guides For Seed Selection

We recognize that trees have climatic limitations and that there are superior strains and superior individuals to select from, but what can the nurseryman or seed collector do about it; what rules can he follow to get better seed?

Climatic limitations are recognized, but specific ranges for our species have not been worked out. Average annual and minimum temperatures and summer rainfall appear to be the most important factors. Based on European studies and practice and some observations here at home, a tentative scale has been set up for Douglas-fir that may serve as a guide until some more positive data is available. It is explained in detail in my bulletin, "Better Douglas Fir Forests From Better Seeds." In general, it provides that seed should come from a site not more than 2^0 F. higher or lower in average annual temperature than the planting site, and that the seed source should not be more than 500 feet higher or lower in altitude. Where a coast line or topography or other factors interfere, it may be necessary and desirable to use wider limits, but in the meantime, these guides set up safe limits within which to operate.

Maximum temperatures do not appear to be important, but minimum temperatures do. Trees moved to a climate with more than a few degrees colder minimum temperatures are often killed off by frost when winter temperatures are colder than the average.

Comparable rainfall just prior to and during the growing season is far more important than equal annual precipitation.

Selecting Superior Stands And Elite Trees

Identification of superior stands or superior individual trees is a more intangible factor than the determination of climatic limitations. But a group of American foresters who recently visited Europe report that it is this phase of forest culture that is there currently being given most attention where

trees are being raised as a crop from seed. Superior stands are set aside as seed sources. Heavy limbed, poorly formed, or slow growing trees are considered bad pollen parents and are removed. Exceptionally fine specimens are designated as "elite" trees and these are hand pollinated for seed production or propagated by rooting or grafting and planted in isolated patches as seed orchards.

Until the progeny has been tested side by side with others, there is no positive way to identify a superior strain or stand. That test takes years and has been done for only a few stands in the Douglas-fir region. There is another way that superior stands can be identified. It is less positive but can be done immediately and should be used while the longer type field tests are under way. There is a site classification for our forest trees that tells us about what height and diameter growth to expect in a locality with a given rainfall, growing season, and soil. If a stand is found that is better in form and making faster growth than expected in that locality, and if similar trees have grown there for several tree generations, it is reasonably certain that it may be classed as a superior stand. If possible, seed should be collected from such stands. Dr. G. S. Allen and other scientists have determined that Douglas-fir and other conifers seldom, if ever, self-pollinate; therefore, it is apparent that ,just so far as bad pollen parents can be removed from a stand, the offspring should improve. For that reason, scrubby, badly formed and slow growing trees should, if possible, be removed from seed-producing areas.

The identification of the "superior" or so-called "elite" seed tree is a perplexing problem and the "doctors disagree. " In a mature stand, the tree with a clean straight bole, a good crown and faster growth than its neighbors can easily be classed as a superior tree, but from the seedling stage up to commercial size, classification is far more difficult. From the literature and from contacts with foreign foresters, the following characteristics of an "elite" tree have been assembled:

1. It must be faster growing than its neighbors or faster than the average in a stand.

2. It must have a full and vigorous top crown, but must have fewer and smaller limbs on the lower crown than its neighbors or than the average of the stand.

3. It must have a clean straight bole with good form.

4. Needles and crown should be thrifty and full, but should not be overly dense.

5. Large clear spaces between nodes are desirable.

6. Limbs in the upper crown should stand at right angles to the stem or droop slightly rather than to point upward.

Field tests alone will tell us how nearly correct these specifications are and if they are usable; that will take years and in the meantime, all of us should look for more and better ways of identifying our best seed trees. Both superior stands and elite trees should be reported and if they are of suitable size and age for seed collection they should be designated as seed collection areas. If and when a genetics program gets under way in the northwest elite trees will be eagerly sought after for pollen and cuttings.

Selection in the Nursery

Many Europeans are not satisfied with securing the best seed possible; they seek to further improve their planting stock by eliminating weak individuals that show up in the nursery beds. Some parent trees produce rather uniform stock, others do not. With proper uniform spacing in the nursery beds, the weaker individuals will show up. These should be culled out in the nursery, either in the beds or at "lifting" time, but poor trees that escape notice should be thrown out in the planting operation. No positive figures are available, and it will vary with strains,. but it has been estimated that it will be profitable in the long run to cull out 15 to 20 percent of the weaker individuals in the growing of Douglas-fir planting stock. L. I. Barrett, on a recent trip to Europe with other American foresters, found one Swedish nurseryman culling up to 70 percent for the production of some special, stock, but this is, of course, an extreme case. Barrett also reported that Professor Gron of the Danish Forest School had a 500-acre forest of good strain Douglas-fir from which he sold $10,000 worth of seed last year.

An interesting story of seed source recently came out of England. In 1827, David Douglas collected Douglas-fir seed while at the Hudson Bay Post at Vancouver, Washington. He sent half of the lot to San Francisco to be later shipped around the Horn with other seeds, the other half he attempted to carry overland. Two trees were grown in Scotland from the seed sent to San Francisco, and one began producing seed about 1850. This seed was well suited to the locality and hundreds of acres of good plantation have been established from it in the British Isles and Denmark. When Dr. Champion from Oxford and Dr.

Larsen from Denmark were here a few years ago, they asked about the source of this seed. For a hundred years, European foresters have been trying to find that strain of Douglas-fir in the vicinity of San Francisco.

We searched the Hudson Bay Company and Douglas's records and came to the conclusion that the seed was collected on the plains outside Vancouver, Washington.

What is the First Step Toward Getting Better Seed.

Until specific superior strains have been identified for localities and seed collection areas designated and improved, the best formula for getting the best seed for a given site is as follows:

1. Select a better than average (or the best) stand in the vicinity of the planting site where seed collection is possible. Within a 100-mile limitation, a good stand is more essential than closeness to planting site.

2. Seed from an equal or slightly lower elevation is said to give the best growth rate although considerable leeway is permissible.

3. Gather cones, not from the trees with the heaviest crop, but from those with best form and growth rate. Since trees are cross pollinated, all will produce some good, some average and some poor seedlings, but the highest percentage of good trees is likely to come from the best parent.

Foreign foresters are demanding seed from specific strains and climatic zones, Pennsylvania and some other states have set up seed source rules, the U. S. Forest Service is making rapid progress in its seed source program, and tree farms and industrial nurseries have taken special steps to get the right seed for a given site, but we still have a long way to go before we get the best seed into all our nursery beds.

Invitation

All persons who work in reforestation, or who are interested in it or some allied field are invited to send in material for publication in Tree Planters' Notes. If their material is not yet in final form for publication, they are invited to at least send a letter to Tree Planters' Notes and tell what they are doing and what manner of information should be published. The address is: Chief, Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

Call for Papers on Specific Subject

One of the most sought after and widely distributed editions of Tree Planters' Notes yet issued was No. 6. It carried articles on costs, experiences, methods, and machine modification for mechanical field planting. The supply of this issue is exhausted and another issue with new and more articles is planned. We will welcome articles for it on any phase of field planting (hand or machine) -- costs, design, methods, machine modifications or anecdotes about the every day life of a planting job.

The same thing holds for another issue on nursery equipment. We have seen nursery devices indeed worthy of publicizing, although apparently commonplace to the men using them. For example, there are nurseries which determine quantities sold by weighing samples; which have substituted scotch tape for steel strapping or cord; which apply fertilizer in the irrigation water; and which have shipping tags that also serve as order blanks and inventory control. And then there are some with simple devices like a box of crankcase oil soaked sand outside the tool room door for cleaning dirt off shovels and hoes. There are seed aping devices, weed control methods, tillage tools, mulching practices, bird protective equipment, wildling transplant techniques, and others that should be told to the world.

Here is a chance to tell your associates what you or your outfit is doing.

Therefore, in addition to our standing invitation for articles on any pertinent subject, we now issue a special invitation to the profession for articles on field planting and on nursery equipment. No dead-line is set for their receipt although the issues will be published as soon as possible. Beautifully typed articles of flawless grammar are not required, although such would not be rejected. Manuscripts written in lead pencil during noon hour are acceptable if that is what it takes to get an account of what has been done.

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