APPLICATIONS OF VEGETATIVE PROPAGATION TO FOREST TREE IMPROVEMENT

Hans Nienstaedt

Research Assistant, Connecticut Agricultural Experiment Station
New Haven, Connecticut

Vegetative propagation is one of the most important techniques available to the tree breeder both in the experimental work and in the practical applications of the results of the breeding. Using this method of propagation it is possible to maintain selected elite trees indefinitely without first having to develop true-breeding stock through inbreeding. In this and other ways vegetative propagation enables the tree breeder to shorten a breeding program considerably.

Consider the use of the technique in the estimation of the genotype, a method developed by Dr. Syrach Larsen in Denmark. You heard this morning that we have to make our selections on the basis of the phenotypical characters of the trees as they grow in the woods, we do not know to what extent the superior characteristics of the trees are the result of a superior germplasm, or merely the effects of favorable environmental conditions or past silvicultural treatments. Making up clonal material from different selected trees and planting them in so-called "tree shows" where the clones grow side by side under uniform environmental conditions, you can, by comparing the various clones, get a fair idea of which trees possess a superior germplasm. The environment as a variable has been eliminated and any superiority in vigor or form in a particular clone is therefore likely to be the result solely of a better germplasm in that clone. If such "tree shows" are established under varied ecological conditions the relative plasticity of the different genotypes can be studied and a much more effective selection of parent trees can be made.

A common objection to the undertaking of tree breeding is that it takes so long. As we just heard, Prof. Doran will be 102 years old when certain proved stock will be available. It will therefore be very important if we can

induce early flowering in our forest trees. Various techniques have been tried, involving grafting on dwarf stock or certain types of bark grafts; both methods have shown promising results and may become of importance in the future in the production of improved seed in seed orchards.

The use of vegetative propagation in the establishment of seed orchards is an extremely important part of the breeding work. A number of clones of selected superior trees are planted in mixture in an isolated location in the woods where the chance for pollination by an outside pollen source is small. The trees in the orchard are planted at a wide spacing to favor maximum crown development. They are kept pruned to facilitate seed picking, and fertilizers are applied to insure a regular seed supply every year. In an orchard of this nature seed can be harvested which has resulted from cross pollination between the selected desirable individuals, and you have good assurance that it will be superior to the seed you can collect in the forest itself. The best results will be obtained if the combining ability of the trees is known; to determine that would mean a complete progeny test involving a considerable length of time. It will therefore be more advantageous to start the orchards as soon as the clonal material is available, and then determine the combining ability of the clones while the orchard is growing and reaching a productive age. Trees with poor combining ability can then be removed at a later day.

No factual material is available on the seed production that can be expected from such orchards. In Europe a production of 45 lbs. per acre per year has been estimated for Norway spruce and Scotch pine. If all the area which needs restocking in this country, some 75 million acres, was to be planted with seed from orchards, and we planned to plant only 1/60 of that acreage a year for the next 60 years, the seed production from 74,000 acres(sic.) would be required annually. That shows very clearly that we cannot expect to use orchard seed for our major reforestation program in the future. High quality seed like this should only be used on the very best sites where it would give the highest possible returns.

Finally, let us consider the use of clonal material directly in the forest. This is the fastest possible way in which improved stock can be utilized in forest management. The use of clones, however, involves certain dangers. For example, should the stand be attacked by a new virulent disease to which the clone has no resistance it would almost certainly mean that it would be destroyed completely within a short time. As a safeguard against such hazards the use of a mixture of clones has been suggested. However, even mixtures of clones should not be used indiscriminately. Their use should be for special crops; for example, short rotation pulpwood crops. Should such stands be wiped out the damage would be much less serious than on a 60-year rotation. Clones of sugar maples with a high sugar content, or southern pine with a high gum yield, may be planted, or we may be able to convince the farmers that they can increase the value of their woodlot by planting veneer walnut with desirable figuration. Plantings of such clones should be small, not more than 15 perhaps 100 individuals in other words the planting and maintenance work would not interfere with the farm work, The trees should be planted on the most favorable site and they should be helped along all through life with the best possible silvicultural treatments. I should think it worthwhile to create an interest among small woodland owners for projects of this nature. It would increase the value of their land and may enable us to make this type of land owner interested in a tree improvement program.