HYBRIDIZATION IN IMPROVING SOUTHERN PINE

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We have seen in the previous papers in this series the possibilities for aching improvement in tree species by selec ting better strains, better individuals, more disase-resistant types, and producing seed of these on a commercial scale. By so doing, we can produce in quantity the superior individuals now existing. If we make a further step and combine selection with still another operat ion--namely, the hybridization or crossing of superior trees--the chances are good that we can produce even better pines than now exist in nature. These will b e made-to-order pines, which we can't describe as yet because we've never seen them.

A good start in hybridizing has a1ready been made. Sensational results have been obtained in other regions and countries. Some hybrids grow two to three times as fast as the parents, and there is one of these hybrids suitable for planting in the West, the Lake States Region, and the Northeast. The important job now in tree selection combined with breeding is to produce a highly vigorous, disease-resistant, high-quality tree for planting in the South. The possibilites are exellent because we have nine species with a wide variety of traits in this general region. Crosses should be made between these species as well as with species from other regions and countries.

Methods and Purposes of Controlled Breeding

In forestry, controlled breeding has many possibilities for use in both intensiveand extensive methods. Intensive methods performed by hand are usuallyon a rather small scale and involve crosses between flowers on

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the same tree, between trees of the same species, or between different species. Extensive methods are conducted on a much larger scale, as in seed orchards where isolated groups are planted in such a manner that cross pollination is under natural conditions. Control is obtained by composing the groups with selected material.

The intensive methods are suitable for experimental work and for producing matrial for establishing seed orchards. Both methods are at present included in forest tree-improvement progams in Australia, South Africa, Sweden, Denmark, Great Britin, Canada, and the Northern and Western United States.

We have seen that there are a number of ways of making controlled pollinations, and likewise there are a number of results to be gained. The methods to be used are governed by the objective desired, just as in other silvicultural or forest management practices. Some Of the advantages of controlled breeding are as follows:

1. It gives a very high control of quality in the offspring because both parents are known.

2. It proves a method, when combined with selection, for producing a much wider variety of genic combinations than is obtainable in natural populations, especially when species or races are crossed.

3. It may produce stock with hybrid vigor.

These items have immediate and practical value in the improvement of local tree species. We could start tomorrow and might have valuable leads within three or four years. There are two more advantages of controlled breeding that are of interest to long-range programs or basic studies of forest genetics. These are:

1. It gives, over a period of time, pure lines of very uniform material in self-pollinted plants.

2. It provides a method for studying inherent traits.

All of these points will be discussed in detail later on when we cover the southern pines in more detail.

History of Tree Breeding

It will help us understand some of the methods of controlled breeding and organize a program of work if we review briefly the history of fine and hardwood tree breeding. The oldest known attempt at deliberate crossing of forest trees is reportd by Klotzsch, who in 1845 amongst other species produced Pinus sylvestris x nigricans, Alnus glutinose x incana, and Ulmus campestris x effusa. Thus pine, alder, and elm figured in this first successful effort to breed forest trees. This work did not attract much attention, and neither did Luther Burbank's hybrids of walnuts produced in 1877 to 1887, although they too displayed very luxuriant growth. In 1909, N. Sylven began experiments with self-pollination and the progeny of wind pollination of Norway spruce as a basis for investigations into the inheritance of various branch types in that species. Ihe hybrid between Japanese and European larches, described by Henry and Flood, in 1919, attracted considerable attention among foresters. Crosses between two species of fir were made in Denmark in 1924. In 1932, A. Deng1er published results of his work with Scots pine.

Since 1925, when the Institute of Forest Genetics was established in California, many crosses have been made with pine in the West. The Northeastern Forest Experiment Station has been working with hardwoods in the Northeast. A program involving more than a dozen agencies, some of which

are in Canada, for breeding white pine for resistance to blister rust has been originated in recent years. The program of the Tennessee Valley Authority has attracted wide interest. The breeding program for poplars and disease- resistant chestnuts is quite well known.

The first crosses with southern pines were made in 1929 by Mr. Wakeley at the Southern Forest Experiement Station. The Institute of Genetics has a 17-year-old tree of a short leaf-slash pine cross. In more recent years crosses have been made between the four major species of southern pines, but none between selected trees of each species except on the new Callaway project in Georgia last spring. Very few crosses have been made with the minor species, such as sand, pond, Virginia, pitch, and spruce pines.

of a longleaf--slash pine cross and one

At Lake City, Florida, in 1943, slash pine trees selected for gum yielding ability were crossed. Progeny are now five years old. They were planted with seedlings from controlled pollinations between high-yielding and average trees and seedlings from wind-pollinated average-yielding and high-yielding trees. A very few crosses were made between slash and longleaf pine, but these were generally unsuccessful.

In 1942, Australian foresters inbred selected slash and loblolly pine. These were plus trees that, on the basis of test results, have proven to be "elite" trees. Results of this work are very significant, and will be discussed in more detail later on.

In 1950, a project in tree improvement was started at Hamilton, Ga., near Columbus, under the Ida Cason Callaway Foundation in cooperation with the Southeastern Forest Experiment Station. The program includes testing of superior indivduals, strains, and work in hybridization.