DEVELOPING DISEASE-RESISTANT TREES AT THE UNIVERSITY OF WISCONSIN*

A. J. Riker[1/]

In Wisconsin, the State Conservation Department and the U. S. Forest Service already have shown distinguished leadership in reforestation and improved silviculture. They have made important and extensive efforts to restore the natural resources provided by trees. Thus, they have attached a destiny to much otherwise useless land.

To assist with certain phases of this work, the College of Agriculture has been breeding forest trees for disease resistance since 1935.

Three erroneous criticisms sometimes have been made against tree breeding, namely: it rivals silviculture, it takes too long, and it costs too much. Let us consider each one briefly.

Actually, tree breeding is an adjunct to and supplements silviculture. The process of cutting the best trees and leaving the scrubs for seed trees leads to eventual degeneration. A sound tree improvement program should employ sound silvicultural practices which would eliminate such decline.

Things that take a long time must be started at once. However, the time required to synthesize and to use improved varieties is not nearly so long as often thought. Vegetative propagation and better breeding techniques permit results in a relatively short time.

1/ Professor, Department of Plant Pathology, University of Wisconsin.

(This paper was illustrated by kodachrome slides.)

Tree breeding is expensive, of course, like most long—time research. However, one should consider the overall cost in terms of possible return in the form of industrial development, employment, and maximum land use. Then tree breeding becomes a "must" item with a high priority.

The basic procedures for breeding trees are relatively simple. They have been developed and proved with many agricultural crops. They include: (1) selection of outstanding individuals already present, followed by thorough testing and screening for desirable characteristics of superior native trees; (2) similar critical selection and examination of related trees grown elsewhere that have shown unusually desirable characteristics; (3) additional improvement by cross—pollinating trees with the best characteristics and by giving thorough tests to the seedling progeny.

In pathology, we have been particularly concerned with developing trees for disease resistance. The reason we have done this work is because the genetics involved is simple, while the pathology is relatively complex.

Work at the College of Agriculture has been in cooperation with many different agencies, including particularly the Wisconsin Conservation Department, the United States and State Departments of Agriculture, and various forest industries, especially the Nekoosa—Edwards Paper Company. In our work to develop white pine resistant to blister rust, Messrs. W. H. Brener, T. F. Kouba, and R. F. Patton have had active participation. In our work with poplars resistant to canker, rust, and so on, Messrs. J. E. Kuntz and K. R. Shea have been particularly active.

Frequently, difficult and complex questions arise in connection with any work of this kind. Success through tree breeding depends on coordinated cooperation of many different agencies over a long period of time. We feel that our progress would have been practically impossible without an opportunity frequently to consult our colleagues in the Departments of Biochemistry, Engineering, Entomology, Genetics, Soils, Wild Life Management, and so on. Likewise, we have secured much helpful advice from professional men in the Forest Products Laboratory and in the State Conservation Department.

To make very short a 15—year story of developing rust—resistant white pine, we originally selected 163 trees and since then have accumulated over 60 additional selections. If I could take you to the Blister Rust Nursery at Wisconsin Rapids, I would show you a number of trees which have survived extremely severe epidemics of blister rust infection. The early work is described in the Journal of Forestry 41: 753-760, 1943. Further work has confirmed and extended these studies. Among the first 163 trees, we have approximately 3 dozen which possess a high degree of resistance to the blister rust fungus and which give promise of surviving in many areas where the eradication of Ribes bushes is not feasible.

Obviously, breeding these resistant trees is not in competition with the Ribes eradication program. Rather, our work supplements Ribes control in this way: On approximately half of the white pine sites in Wisconsin,

Ribes eradication is not feasible for one reason or another. Rust-resistant pines appear to be the only answer.

Our work on poplars was begun in 1935 under a stimulus from Dr. Raphael Zon. He pointed out that more raw cellulose could be secured from the right kind of poplars in a suitable location than from any other species.

Recently, poplars have received increasing attention because of improvements in various technical processes that permit greater utilization of wood from this common and widely distributed species. Production, however, is seriously limited by disease, particularly by Hypoxylon canker. This disease has infected large numbers of trees and has made certain investments go bad that originally appeared foolproof.

Some widely touted hybrid poplars developed elsewhere have been unsatisfactory in Wisconsin because of their susceptibility to cankers, especially those caused by Septoria and Cytospora. However, these poplars have shown **a** relatively high degree of resistance to Hypoxylon canker.

Our work in Wisconsin has been directed primarily toward selecting the best poplar trees of the native species. Also we have secured elite trees from elsewhere. For several years we have been making crosses between the most promising selections so as to combine the better and to eliminate the poorer characteristics, including disease susceptibility.

So far, we have collected from one source or another over **400** selections which are being tested in various places. We have greatest hope from trees that have already grown well in Wisconsin and have demonstrated their ability to withstand Wisconsin weather, insects, and disease. Doubtless considerably improved trees can be secured by crossing such desirable parents.

The techniques for making cross-pollinations are easy. However, in handling pollen, seed, and seedlings, we have encountered numerous obstacles. Recent experiments have overcome important difficulties. We now feel confident that we have overcome the important ones and that we are ready to move forward as rapidly as our facilities and personnel will permit.