PROBLEMS NEEDING STUDY IN DEVELOPING DISEASE-RESISTANT TREES*

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By hardiness we mean the ability to withstand the difficult features of the environment. They are easy enough to name -- too much or too little of temperature, of moisture, of light, and of the various essential mineral salts; as well as too much toxic material either in the air or in the soil.

All of these factors influence the growth of trees and may cause physiological or nonparasitic diseases. Further, these factors also influence the pathogenic bacteria or fungi as well as the interaction between the trees and such microorganisms which we call disease.

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Too little time is available for discussing more than a few representative examples of disease situations that may influence hardiness.

Earlier on this program, I spoke about tree breeding for disease resistance with white pine and with poplars. In this connection, let me emphasize that the breeding work is aimed at improved quality. Emphasis has rightly been placed on disease resistance where disease is the most important factor limiting growth. However, we know that disease resistance is only one item in quality. Rate of growth, tree form, quality of the wood, ability to withstand Wisconsin's winter (especially unseasonably early and late freezes) as well as other items involved in environment or site -- such items are considered in selecting and developing elite trees.

Trees that are hardy in one location may not do well in another. This may be critical in the planting program and may explain failures in natural reproduction. Needle droop is an excellent example. Dr. R. F. Patton has demonstrated that needle droop is not a parasitic disease, as we had feared at one time. Needle droop develops when the evaporation of water from the needles exceeds the uptake from the roots. The growing tissue at the base of the needles is injured or killed and the needles droop down. This is particularly bad in certain sandy soils, where grass competition is severe and where a rapid decrease in the moisture content may occur easily.

Crowding of natural or planted seedlings may provide a number of difficulties. If the growth in the trees slows down, they may develop susceptibility to a variety of insects and fungi. At the time the crowns begin to close, there is particular danger from root and butt rot. Certain insect and disease problems have appeared seriously in plantations in some of the eastern states (e.g., the Rochester watersheds). forest management practices, such as suitable thinnings and improvement cuttings, which keep the trees growing vigorously, may do much to overcome such hazards.

Related problems have appeared when large areas of even-aged stands of similar or identical species were growing. For example, near Goodman, Phelps, and Mountain in northeastern Wisconsin, the insect, and fungi combined to produce the burn blight complex and to destroy or to discourage the jack and red pine trees over considerable acreage. Once the epidemic started, no barriers were present to slow it down or possibly to stop it.

Since we are planting so many trees every year, the question of weed competition is an extremely serious one that affects not only survival but also the rate of growth. Not far from here (northwest of Rhinelander at the entrance to the McNaughton Prison Camp) one can see large trees that were clean-cultivated for several years after planting. Nearby are similar trees that grew with weed and grass competition. They are less than half as tall with a volume of wood correspondingly much decreased.

Obviously, clean cultivation is expensive even under favorable circumstances and impossible in much rough or stony ground. However, the recent development of selective herbicides suggests the possibility of using them for increasing the growth of seedlings during the first few years.

Another interesting situation perhaps bearing on hardiness is the frequency with which certain species of trees form root grafts underground between individuals. This has been surprisingly common among northern pin oaks and certain other species, as shown by J. E. Kuntz, C. H. Beckman, and their associates. When a tree is cut, the root system left in the ground frequently is adopted by neighboring trees to which it is grafted. This helps account for some of the rapid growth shown by neighboring released trees. Not only do the remaining trees have more light from above as well as more moisture and nutrients from below, but also they have an expanded root system. Furthermore, the stumps remain alive for a time and sprouts are encouraged.