# Tree Improvement Work in Progress at the Quetico-Superior Wilderness Research Center

by Clifford E. Ahlgren 1/

During the past 9 years, this Center has been engaged in tree improvement work which has emphasized the working out of field techniques for putting the results of geneticists into practical application in this region. The work was first begun because the area provided an ideal place for testing the resistance of white pine to blister rust. Later, it developed that the climatic conditions and the humidity afforded by the large body of water are also advantageous for field grafting. Because of the unique ness of these conditions, we have been advised to continue and expand the work. As previously reported, 5-year results show that our field grafting of white pine selections being tested for blister rust resistance has been successful in over 60 percent of some 700 grafts, so we have accepted the technique as practical wherever needed in future work in our area. Consequently, our emphasis has shifted to other aspects of the pine breeding problem.

Controlled pollinations have been continued, as the amount of flower producing wood increases on the grafts. To date, approximately 54 cones have been pollinated with pollen from resistant selections. Seed from the crosses is extracted and grown. for us at the Griffith State Nursery at Wisconsin Rapids by Dr. Patton of the University of Wisconsin.

In 1955 a. new area was established for testing the resistance of hybrids and root grafts. It is located on a very good white pine site, bordered on three sides by a swamp which provides abundant Ribes for inoculum as well as supplying proper microclimatic conditions for the development of the disease. Incidence of rust is very high on natural reproduction, and the Ribes bushes under observation show a consistently high infection rate. The hybrids under test include some developed by Drs. Riker and

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Patton of the University of Wisconsin and some from our own parent selections on the test site. In this same area we also have a lest plot for root grafts, also developed by Drs. Riker and Patton, The area now supports 1,100 seedlings and 150 grafts. Our test area, for root grafts established 9 years ago continues to show a very low infection rate on the root grafts, while the controls have shown 100 percent infection and have been replaced.

To investigate the possibilities of flower induction by combining different species in grafting, over 200 interspecific grafts involving eastern white, Norway, Balkan, Swiss stone, and Korean pine in various combinations have been made. Average survival has been 80 percent, and there have been very striking differences in the vegetative growth patterns among the different combinations of species. Some of the combinations produce reduced primary growth and yet. flower more abundantly than those which grow vigorously. For example, of the 30 Swiss store pine scions on Norway pine rootstocks (a slow-growing combination), 20 have flowered while of the Swiss stone pine scions on white pine (a very vigorous vegetative combination, one out of 50 have flowered. Differences among the other combinations are equally significant, and the work is being continued. Some of this work is in cooperation with the Minnesota Iron Range Resources and Rehabilitation Commission, with whom we are also engaged in intraspecific Norway pine grafting for the establishment of seed orchards. This latter problem has continued along the same lines as previously reported.

She attempts to induce flowering by bark inversion as reported at the last meeting have been continued. To date, there has been a reduction in primary growth on the trees with inversions. However, there is as yet no indication of flowering. Since superficial examination of the call us tissue revealed cell orientations difficult to interpret in terms of normal cambial development, an anatomical study of the disturbed tissues is being conducted by Dr. John Carlson of the biology department of the University of Minnesota, Duluth Branch. In connection with this, annual samples of bark inversions have been made, in addition to bark grafts and inversions in which the xylem and phloem have been separated by a plastic strip to determine the effect of each tissue on the differentiation of young cells.

In an effort to speed up the process of testing for resistance to blister rust, attempts have been made to supplement natural inoculation by artificial methods. In our first attempts last year, 30 diamond-shaped pieces of infected bark have been grafted onto healthy trees. These patch grafts, however, did not survive, for they were drowned out by pitch. This past spring, entire rings of diseased bark were grafted onto healthy trees, in the same manner as done in our bark inversion trials. Some of these inoculations appear to be transmitting the disease, although results are still preliminary.

These preliminary attempts at flower induction, pollination, seed orchard establishment, and artificial inoculation offer enough promise, we feel, so that we plan to continue our work along these lines for the immediate future.