

## PROVENANCE TESTING AT MICHIGAN TECHNOLOGICAL UNIVERSITY

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The location of M.T.U. in the Keweenaw Peninsula of Upper Michigan provides some unique advantages and disadvantages in provenance testing and tree improvement research. Extremes in summer and winter temperatures are uncommon because of the moderating effect of Lake Superior. Near the Lake we have about 140 frost-free days while inland the frost-free season is only 80 days or less. Many exotic species of plants will grow in the Houghton locality but are prevented from naturally migrating here because of the cold belt to the immediate south.

Heavy snowfall does occur, averaging about 200 inches per year, and is a serious problem in provenance testing. Heavy snow accumulations affect even small pole-sized trees. The lower 4 feet of branches are repeatedly pulled down and out, weakening the stem at the node. Most trees in plantations have some type of basal crook.

### Scotch Pine

Scattered plantings of Scotch pine are found throughout our area. The seed source is unknown but in most of these plantings, some of which are 30 or more years old, growth and reproduction is excellent. Where Scotch pine has been planted in mixtures with other conifers, the reproduction is almost all Scotch pine.

Our first effort in provenance testing was the NC-51 Scotch Pine Project initiated by Dr. Wright of Michigan State University. This was planted in 1961. Eight replicates of eighty sources were planted on the Keweenaw Peninsula and two replicates were planted at the Ford Forestry Center, 50 miles south. This report considers only the Keweenaw planting, the Ford Center planting having suffered excessive mortality. Analysis through the 1968 growing season indicates that:

(1) The varieties from western and central Europe: var. *haguenensis*, var. *hercynica*, var. *borussica*, var. *polonica*, and var. *pannonica*, are best suited for our area on the basis of height growth. The best of these are the Belgian sources, var. *haguenensis*, which have averaged two feet of height growth per year. Our results compare closely with Khalil's recommendations for central Minnesota, although his recommendations for northern Minnesota include some sources which are just average in our plantings.

(2) Among the sources tested, the Belgian group had the highest mortality, poorest form, and have produced the greatest number of lammas shoots.

(3) South European varieties had the most insect infestation but the incidence was not serious.

(4) Belgian sources had the most cones, with south European sources a close second. Only 6 percent of all trees had cones in 1969, however.

(5) Spanish sources have survived well, have slightly better than average height growth and appear to be one of the best for Christmas trees.

### Tamarack

Our tamarack planting is part of the NC-51 Project initiated by Dr. S. S. Pauley of the University of Minnesota. The planting is part of the 1962 Accession and consists of 27 sources from Minnesota, Wisconsin, Michigan, Illinois, Ohio, Maine, Ontario, and Manitoba. The trees were planted in 1967 in sod and mulched with 3-foot squares of black polyethylene. Survival was over 90 percent through the fall of 1968. All of the trees were bent and about 25 percent of the trees were partially broken due to heavy snows of the past winter. We have tried to repair this damage and the results look good but height growth will likely be affected for several years.

The best source so far on a basis of height growth is from Clare, Michigan. These trees grew about 3 feet in 1968. The trend to date indicates the sources from central Minnesota, central Wisconsin, and central Michigan are best suited for our area with respect to height growth. Some of the more southern sources are comparable to these but adjacent southern sources grow poorly. Elgin, Illinois, and West Bend, Wisconsin, rank with the best, but Waukesha, Wisconsin, has performed relatively poorly. Poorest height growth is from the Canadian sources from Manitoba and Ontario.

The 1964 Accession was planted in 1968 and consists of 21 sources with a greater geographic range than the 1962 Accession. Thus far survival has been over 95 percent.

### **Yellow Birch**

The yellow birch planting consists of 30 sources, range-wide, and was initiated by Dr. K. E. Clausen of the North Central Forest Experiment Station's Institute of Forest Genetics, Rhinelander, Wisconsin. The trees were outplanted in the spring of 1968 and are clean cultivated. Survival has been over 80 percent but nearly every tree has been damaged by snow.

### **Sugar Maple**

The sugar maple planting consists of 26 range-wide sources and is in cooperation with Dr. W. J.

Gabriel, Northeastern Forest Experiment Station, Burlington, Vermont. Sugar maple has also been severely damaged by snow the past year. The stems have been broken and in many cases 1969 growth is entirely from sprouts. These trees are only slightly taller now than they were in the nursery two years ago.

Our other provenance plantings include Douglas-fir, ponderosa pine, white spruce, red pine, Austrian pine, white pine, red oak, and cottonwood. Analysis of these plantations is incomplete but information will be provided to anyone who may be interested in a particular planting.

Our other tree improvement work has been a study of phenotypic variation in specific gravity of sugar maple and in fertilization of northern hardwoods. Limited samples for the specific gravity study have been collected range-wide, and a more intensive sampling has been obtained from Upper Michigan. Preliminary results indicate as much variation within the merchantable part of the stem as among trees within a stand.

The study of fertilization of northern hardwoods is in cooperation with the Connor Lumber Company and is under the direction of Dr. Stephen G. Shetron and graduate student Ronald Heninger. These are first-year results in small and medium-sized sawlog stands for 600 trees stratified as to site. Sugar maple, red maple and basswood responded with about a 10 percent increase in diameter growth. There was no response with yellow birch.