UP-TO-DATE SEED SOURCE INFORMATION

FOR LAKE STATES SPECIES

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INTRODUCTION

The importance of selecting the proper seed source for forest planting programs has been proclaimed for many years . One can hardly open a single proceedings of a tree improvement meeting without seeing some reference to the importance of seed source. Numerically, this importance can be expressed either as the difference between the growth of the "right seed source" and the "wrong seed source" , or as the difference between the "average seed source" and the "best adapted seed source" , The values can be found by examining the results of the provenance tests that have been established during the past 20 years.

NOTE: To facilitate reading, references are not shown in the text. A list of selected references is given at the end of the paper.

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Moving seed over great distances between widely different climates is probably not done today. Nevertheless, I suspect that there still could be much movement of seed within a region such as the Lake States Such movement can have marked adverse as well as beneficial effects as demonstrated by the results of a Lake States Jack Pine Seed Source Study established in 1954. In these tests, the difference between the best and the poorest provenance ranged from 15% to 40% and averaged in the neighborhood of 25% for 11 test sites

In this study, nursery stock - the stock generally distributed by the major Lake States nurseries - was included as control, Comparing the growth of these plants with that of trees from the best seed sources in the study, gives us an indication of the gains or benefits that can be derived from the use of a selected, superior, introduced seed. Depending on where the jack pine test plantings were located, the differences ranged from 14% to as much as 28% in height growth - one test on the Superior showed only a slight difference between the local nursery stock and the best seed source: Look at it this way: In 1954, roughly **2.4** million jack pine were sold by State nurseries in Wisconsin. If in 1954 we had known what we know today about jack pine seed source, we probably could have obtained 15% to 20% more growth on the approximately 2,400 acres planted to these trees. If we assume an average yield of 20 cords at 40 years, we may be talking of 7,500 to 10,000 additional cords

Enough said about the importance of seed source. During the rest of my presentation, I will summarize briefly what the findings have been and what we now recommend for seed collection for our important tree species. I shall confine myself to the species that are generally planted or could be important in future plantations in the Lake States,

Four Cardinal Steps in Selecting the Proper Seed Source

First, some logical seed zones must be developed for the geographic region, The zones must be based on climate and known reaction of the important tree species to the environments

Seed zones for the Lake States were developed by Paul Rudolf (1956). His detailed zoning has been modified and simplified for administrative reasons by the agencies using them, The Forest Service considers 9 seed collection zones in the Lake States, and Wisconsin DNR 3 zones in that State

Furthermore, as the knowledge of the species reaction becomes available, further modification may be in order. The Forest Service, for example, reduces the 9 seed collection zones to 4 for seed orchard purposes.

Second, some provenance testing must be completed before seed source recommendations are made. I shall not tire you with the details - suffice it to say that it is a major undertaking.

Third, arrangements must be made for the reliable collection of source-identified seed on a commercial scale. This is an equally obvious point, but is one that is constantly overlooked. Cones are still being purchased on the open market by some agencies. Furthermore, if high yielding seed sources are identified in provenance tests, it is rarely possible to re-collect the seed for production purposes .

In the future, whenever possible, it might be advantageous to preserve the stand from which seed is collected for the seed source test until early results of the test have indicated the worth of the seed source. Then, promising stands could be permanently reserved for seed production.

Fourth, it is essential that the germ plasm of the seed stands be preserved uncontaminated for future years . This point, with few exceptions, has been overlooked completely in the past, and so it may already be too late in some areas to prevent contamination of the seed source by foreign germ plasm. Supporting this contention is the fact that the sources of seed used for most plantations in the past were not controlled. Many forests today are a hodge-podge of plantings of non-native sources of seed and native stands that are freely intercrossing The problem is serious and should be considered when seed sources are established for continued commercial collections.

Select Better than Average Stands for the Production of Seed

In the future, as I have said before, we should preserve stands used for provenance tests until the tests yield reliable results and then develop the best stands as seed production areas .

However, it is rarely possible now to go back to the original stands on which the seed source data are based, The best alternative then is to collect seed within the general location of the original provenance: In this situation, a stand should be chosen that represents the type of site where the provenance in the test originated. Also, a better-than-average stand for the region should be selected. Finally, the stand should be rogued and developed into a seed production area using recommended techniques

Seed Source Recommendations

PINE

jack Pine

I have already mentioned the magnitude of losses or gains that can be expected by the wrong or the right choice of jack pine seed sources. Based on the study of trees planted in 1954 from 30 seed sources, we now recommend as follows:

Lower Michigan - Local seed source 1/

Upper Michigan - Lower Michigan seed sources mixed with local seedlings

Minnesota - Local seed sources

Wisconsin - Lower Michigan mixed with local seedlings

Selection of better-than-average stands is a definite advantage in jack pine,

Red Pine

Red pine is perhaps the least variable of our northern conifers. Nevertheless, the choice of seed source can affect survival as well as rate of growth. The recommendation is to use local seed sources.

White Pine

The range of variation in white pine is similar to variation in jack pine, in one study of 17 seed sources, trees from 7 seed sources from the Lake States varied up to 30% in height growth around the plantation mean in 4 plantings in the Lake States. In other words, serious losses or important gains can result depending on the choice of seed. We recommend the following:

Lower Michigan - White pine seed from Tennessee or southern Ontario

Upper Michigan - Lower Michigan provenances

1/ By "local" seed source we mean seed collected from natural stands within 50 miles of the planting site,

Minnesota - Local provenances

Wisconsin - Local provenances or provenances collected up to 100 miles south of the planting site

Scotch Pine

Christmas tree recommendations only:

Lower Peninsula of Michigan (exception for the colder interior)	- Spanish provenances
Upper Michigan	- Turkey, Greece, and southern France provenances
Minnesota	- Poland, Czechoslovakia, and Germany
Wisconsin	- Turkey, Greece, and southern France provenances

SPRUCE

White Spruce

White spruce is a highly variable species; selection of the proper provenance can increase yields up to 15 percent or more, and yields can be further increased through the use of seed from trees selected for the fastest annual height growth. Several tests, both in the Lake States and adjacent Canada, indicate that seed from southeastern Ontario is suitable for all three Lake States (as well as adjacent Canada and northeastern United States). We recommend the southeastern Ontario (50-mile radius of Beachburg) provenances for Michigan and Wisconsin, but suggest that in the drier and more severe climate of Minnesota this provenance be mixed with local seedlings.

For the past several years, the three states have attempted to purchase seed of this provenance in Canada, This effort has failed because thearea has been and continues to be heavily damaged by spruce budworm. Both the State and industry in Minnesota, as well as the State of Wisconsin, have now begun to develop a provenance seed orchard using grafted material from existing trees of this seed source in the three States.

Black Spruce

Black spruce provenance research is new :n the Lake States. A large study covering the entire range of the species was established in 1971 in the nursery at Rhinelander. It is one of several nursery tests conducted in co-operation with the Canadian Forestry Service and other agencies r After two seasons' growth, there is a three-fold difference between the smallest Alaskan source and the largest sources from Michigan, Wisconsin, and Ontario

Among the 10 best provenances at year 2 are Ontario sources from as far north as 48 N latitude. This somewhat unusual result might indicate that rather great random differences can be expected from -seed sources representing a large spread of latitude, and it could indicate a substantial opportunity to select provenances not of local origin. However, until the study is older, we must recommend that local seed sources be used for the planting programs.

Norway Spruce

The growth potential of Norway spruce probably surpasses white spruce in the southern parts of the Lake States, and in the North the best provenances have been equal to, and in some cases slightly better than, the best white spruce provenances. The species is sometimes heavily damaged by the white pine weevil and, as yet, there are no known resistant provenances.

Generally : for Michigan, Minnesota, and Wisconsin we recommend provenances from Eastern Poland, White Russia, or other East-Central European countries.

MISCELLANEOUS CONIFERS AND HARDWOODS

Balsam Fir

A balsam fir study was initiated by the University of Wisconsin in the early 1960's but it is still too early to use the results for reliable seed source recommendations. Six years after seeding in the nursery at Rhinelander, growth of the 10 best sources were areas as far apart as Oconto Co, Wisconsin, Roscommon Co., Michigan; and Sunbury, New Brunswick,

There are also obvious differences in the time of flushing among provenances and among individual progenies within a provenance, Time of flushing is correlated with spring frost injury and is under strong genetic control_ The data, therefore, suggest that collecting seed from late flushing individuals may be advantageous. Until the study is old enough to yield reliable results, we suggest collecting seed from late flushing individuals in the stands of local seed sources.

Tamarack

Studies of this species were originated by the University of Minnesota. Nine-year (from seed) measurements are available (1 year younger trees were used for some sources) , but have failed to identify any clearly outstanding seed sources for northern Wisconsin. The results from tests in Minnesota are not yet published,

Until additional information is available, the following sources are recommended for planting on upland sites in the northern half of Wisconsin:

Forest Co., Oneida Co. , and Eau Claire Co „ Wisconsin
Itasca Co., Minnesota
Somerset Co., Maine

European and Japanese larch have been tested on a small scale in the Lake States and show promise of becoming the most productive conifers in parts of the region. For Japanese larch, seed source probably is not of great importance. The Institute of Forest Genetics has begun a breeding program with the genus Larix. An early study includes tests of some of the best species and hybrid material from European tests .

OTHER CONIFERS

Douglas fir, white fir, southwestern white pine, ponderosa pine, and Austrian pine have been tested in southern Michigan but not to any extent in the rest of the region. Results are probably not applicable outside the general area of the test. For southern Michigan, Jonathan Wright recommends the following:

Southwestern White Pine	- Central parts of Arizona and New Mexico
Ponderosa Pine	- Eastern Washington and Oregon
Austrian Pine	- Parts of Greece
Douglas-Fir	- Northern Idaho or central parts of Arizona and New Mexico
White Fir	- Central parts of Arizona and New Mexico

Yellow Birch

Yellow birch tests are still young. Based on a northern Wisconsin nursery test of 3-year old trees and subsequent 5-year field tests (8 years from seed) in Wisconsin, Upper Peninsula, and southern Michigan, we generally recommend that seed be collected from better-than-average stands without searching for outstanding trees . Tree appearance (phenotype) has not been a good indicator of progeny performance,

Yellow Birch (con't)

Recommendations for individual states are:

1. Northern Minnesota - collect seed from local stands (Itasca State Park and Virginia sources have done well; Grand Marais has not) and mix with seedlings from central Wisconsin.

2. Wisconsin - collect seed from central and southeastern Wisconsin (Waukesha Co.) stands an.d mix with seed from Lower Michigan or Poconos Mountains of Pennsylvania,

3 Upper Michigan - collect seed from a selected stand near Moran but add seed from central and southeastern Wisconsin or the Allegheny Plateau in Pennsylvania. or Frontenac Co., Ontario.

4. Southern Lower Michigan - local seed is scarce, so it is probably safe to use seed from the Catskills of New York; Frontenac Co„ Ontario; or Pennsylvania.

4b. Northern Lower Michigan - use local seed or seed from Moran in U.P. in mixture with seed from southeastern Wisconsin, the Catskills, or the Allegheny Plateau,

Walnut

The natural distribution of walnut is limited to 3 tiers of counties in southern Minnesota, southern Wisconsin, and the southern half of Lower Michigan; extensive planting should probably not be done outside this natural. distribution without testing. Data. from newly established tests in Minnesota, southern Michigan, an.d southern Illinois suggest that walnut seed be collected from local, or south-of-local areas. Movement north by as much as 150 miles has been advantageous and safe in both the two Lake States tests.

2/ Details regarding the location can be obtained from:

North Central Forest Experiment Station.
Institute of Forest Genetics
Star Route #2
Rhinelander, Wisconsin 54501

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