STRATEGIES FOR URBAN TREE IMPROVEMENT RESEARCH WITH SELDOM-USED SPECIES

by Frank S. Santamour, Jr., research geneticist,
USDA, Agricultural Research Service,
U.S. National Arboretum, Washington, D.C. 20002

ABSTRACT. — Seed collections that will adequately sample the gene pool of exotic species, especially those from Asia, are difficult to obtain. Rather than rely on normal "plant explorations" or correspondence, special efforts must be made, and are most successful when concentrated on a single species or small number of species. After collection and testing of germplasm, some provision should be made to insure a continuing "domestic" supply of exotic seed from seed orchards.

ONE OF THE MAJOR PROBLEMS in starting work with a species that is currently rare in cultivation is the general lack of fruit or seed that will form the basis of the populations to be tested.

SEED COLLECTION

For the purposes of this paper, I will only consider species not native to the United States. With the network of foresters and horticulturists throughout this country, it is a relatively simple matter to arrange for the collection of seed, the growing of seedlings, and the establishment of long-term test plots of most tree species with potential use in landscape planting.

American foresters have also been quite successful in enlisting significant cooperation from their European counterparts in assembling comprehensive seed collections from throughout the ranges of the major European forest tree species, usually by correspondence. It is also possible that similar cooperation would be engendered in dealing with European species of marginal forestry interest, but few efforts have been made along these lines.

An excellent example of a recent success in obtaining a wide range of germplasm of a European species that is little-used in the United States is the provenance testing of black alder (Alnus glutinosa (L). Gaertn.) now being conducted under the auspices of Pennsylvania State University and Iowa State University. The seed was obtained entirely by correspondence and involved no on-the-ground exploration by American scientists.

Problems of seed supply, especially from known geographic origins, become more acute with species native to the temperate Orient (Japan, Korea, China) and the Soviet Union. In the past, the interest of American foresters and horticulturists has been aroused by the few specimens of particular species seen in botanic gardens and arboreta — and judgements as to the relative worth of some species has been, and is presently, based on casual observation of these meager introductions. In recent years (post World War II), as more complete "Floras" of these areas have been compiled and become more available to Americans, we have learned of a vast store of landscape tree germplasm that exists "out there". Rehder's "Manual" gives only a glimpse of the possibilities.

Distance, language, and politics provide some barriers to the development of efficient plant introduction schemes. Furthermore, many species exist in scattered groups, in difficult terrain, and are sometimes even rare in their native countries. The scarcity of trained botanists and foresters in many areas makes "collection by correspondence" impossible and even personal, on-the-ground, collection extremely difficult.

Lest you think that these difficulties are peculiar to American horticulturists trying to obtain certain Korean plants, try to imagine the ordeal a Korean horticulturist would have in obtaining representative seed collections of our native American species Halesia monticola (Rehd.) Sarg. or Ostrya virginiana (Mill.) K. Koch.

Botanical "expeditions", as they have been and are presently constituted, are not the complete answer. The geographic areas covered are too small, and the collecting "apetites" of the botanists too extensive, for the collection of the kind of intraspecific genetic diversity that will enable us to adequately evaluate the full potential of exotic species. What we need to do is to concentrate our efforts on a single genus or group of species and pursue the desired germplasm by letter, on foot, through diplomatic channels, and international agencies.

Flowering Cherries

One recent outstanding example of this approach has been the work of Mr. Roland M. Jefferson of the U. S. National Arboretum with Japanese flowering cherries. Granted that the flowering cherries are better known than Gleditsia japonica Miq., the success of Jefferson's efforts was the result of careful planning and persistence, as well as the involvement of many Japanese and American organizations. And even though the flowering cherries could not be considered as seldom-used or rare in cultivation, they are very poorly understood. Indeed, some of the species are only represented in the United States by a single collection of unknown geographic origin or doubtful as to purity of species.

From the ca. 370,000 seed collected, we are currently growing plants of 8 species and 5 hybrids from 73 different collection sites. Furthermore, we are attempting vegetative propagation of more than 140 cultivars that had been selected by Japanese horticulturists. We have also shared the seed with 10 other horticultural institutions in the United States. All in all, we have assembled the finest collection of flowering cherry germplasm in the world, and have the raw

material from which to select and breed truly superior flowering cherries for most of the United States.

Not all germplasm collection schemes could be, nor need they be, so intensive. Two seed sources are always better than one, and a single seed source of known origin is better than an unknown origin. Certain species' ranges need not be exhaustively sampled and a few provenances from carefully selected localities may provide a considerable portion of the genetic variability within a species. What is needed is the decision to begin, the dedication to follow through, and the commitment to preserve, use, and make the germplasm available for future generations.

SEED ORCHARDS

After the seed collection comes testing, after the testing comes selection, and after the selection comes the naming and introduction of new superior cultivars. Does that mean that of the 1000 or 10,000 genotypes tested we discard all but a few plants? I hope not. The time and expense of collection and testing demand that we conserve this germplasm for the future. The testing and selection phases may take 20 years or more, and during this time period climatic, biological, or political changes may make the duplication of the initial seed collection virtually impossible. We should consider all major provenance or seed source collections of exotic species as our "last chance" and act accordingly.

I would advocate the development of "seed orchards" to preserve a considerable portion of the "best" genes available in any species. Of course, it is often difficult to determine precisely what the "best" will be over a period of 50 years or so, since some plants of less than desirable growth habit may contain genes for resistance to pests that they were not subjected to during the testing phase. Still, continual observations in the test plantings should select out those trees that are most adaptable, that resist certain pests, and that have other horticultural attributes desired in landscape trees.

A seed orchard could consist of 2 trees or 20 trees, from a single provenance or several provenances, but it must be planted in an area isolated from other trees of the species or from species with which it is capable of hybridizing. The major objective in creating a seed orchard is a continual supply of seed that is representative of the species and/or the seed source. Thus, if black alder from a certain area in Europe exhibits superior qualities in the test plots, selected individuals of those progenies should be placed in an isolated seed orchard for future seed production. If, in the future, it is deemed desirable to make further selections of black alder, other than the 1 or 2 superior cultivars that may have been introduced into the nursery trade, there is no necessity to try to arrange for new seed collections in Europe. The "domestic" source of the foreign seed will be at hand.

Seed orchards should be established as soon as the researcher is satisfied that there has been significant natural or artificial selection to choose the superior trees.

Let me cite an example of premature selection for seed orchard use. I became rather impressed with the distinct growth and bark-color superiority of certain individuals of 5 provenances of the Japanese white birch (Betula platyphylla var. japonica (Miq.) Hara. These trees, at the age of 4 years from seed, were far better than trees of other American and European birches in the same test plots, and the “literature" stated that Japanese white birch had a reasonable degree of resistance to the bronze birch borer. Twenty trees were selected, dug with a tree spade, and removed to an isolated seed orchard site. Within the next 2 years all the transplanted trees had been attacked by the borer. At the age of 10 years, not one of the 127 remaining trees in the original planting had survived borer attack.

Should we continue to attempt to maintain a domestic seed source of Japanese white birch? Under our test conditions in Maryland, it may not be worth the effort.

This little story illustrates that the selection of trees for a seed orchard may not be possible while the trees are still small enough to be physically moved with a tree spade. Thus, it may be necessary to vegetatively propagate selected individuals for seed orchard use.

The creation of gene "banks" in seed orchards will involve considerable time and effort, but the investment should pay dividends far into the future.