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Developing New Plants For Your Future Plant Inventory©

Harold Pellett
Landscape Plant Development Center, PO Box 39, Chanhassen, Minnesota 55317

INTRODUCTION

The Landscape Plant Development Center is a relatively young organization. It was established in 1990 with a mission of developing superior landscape plants with emphasis on plants that are more tolerant of biological and environmental stresses. The Center was started because there is a need for greater diversity of landscape plants that are tolerant of environmental and biological stresses. Unfortunately, many landscape plants presently available are not well adapted to withstand the harsh conditions of the man-modified environments found on many landscape sites. I have seen figures and surveys indicating that the life span of the average tree planted in city conditions may only be 7 to 10 years.

The Center is a nonprofit corporation with a Board of Directors from all over the United States. The Center relies completely on grants and donations for the support of its research efforts. It operates as a cooperative effort of researchers located at many different institutions across North America, Europe and Asia. Headquarters for the Center is at the Minnesota Landscape Arboretum.

We utilize the following general approach for our breeding projects. The cooperative nature of the Center, allows us to use the plant collections of participating institutions to do hybridization. This gives us access to a very broad range of genetic diversity. First generation hybrids (F1s) are grown at a location with a very favorable climate. When a plant with good tolerance to a given environmental stress is crossed to another plant that may not be very tolerant but that possesses other desirable qualities, the first generation hybrids are intermediate in tolerance to the stress between that of the two parents. Thus, if these hybrids were grown in a severe climate the F1 population may not survive. However when the next generation of plants is produced by intercrossing the F1 siblings, some of the progeny will be as stress tolerant as the most tolerant of the original parents and a few plants may even have greater tolerance than the tolerant original parent. We can therefore select those individuals that combine the desired qualities from the less-tolerant parent with the tolerance of the more hardy parent. Second generation hybrids are planted in many different geographic regions by our cooperators. Superior plants will be selected from these populations that are well adapted to the climatic conditions of the region in which they are selected. Thanks to a generous donation of land by the J. Frank Schmidt Family Charitable Trust, we now have a research station in Oregon to grow our first generation hybrid populations and produce the second

generation plants. We constructed a machine shed-office building, installed an automated drip irrigation system, acquired field maintenance equipment, and started research activities at the station in 1999.

PROJECTS IN PROGRESS

The first breeding activity that we started was to develop small landscape trees of pears. Many people have asked, why pears? Aren't there already too many cultivars of pears and aren't they overplanted? It's true that there are many cultivars of Callery pear and they are perhaps used too much in areas where they are adapted. However, none of the cultivars are reliably winter hardy in northern areas and there are many *Pyrus* species that are little known that have some very valuable traits. Many of them also have some severe faults that limit their landscape potential in their present form. Collectively the many species of *Pyrus* possess tolerances to most of the environmental stresses of concern and also have many different plant forms and foliage qualities. Great potential exists for recombining the desirable characteristics through a controlled breeding program to provide a great diversity of plant types, forms, foliage characteristics, and climatic adaptation. We decided to start with pears for several reasons. First, there is a need for more small trees. Plants in the genus *Pyrus* are quite tolerant to heavy soils which is a common problem in landscape situations all over the world. Next, there are many different species with various qualities that could be very valuable in landscape plants. Finally, there is a good collection of pear species at the USDA Clonal Repository in Corvallis, Oregon that we were able to utilize in starting this breeding effort. That collection was developed primarily as a repository for germplasm for use in fruit breeding activities but the species available serve our purpose equally as well. Along with the species pears, the Corvallis collection also includes some interspecific F1 hybrids between some of the species that we used. Dr. Mel Westwood made those crosses many years ago. He was interested in them for their potential use for understocks for fruiting pears. In 1991 and 1992, we made interspecific crosses using 10 different species of *Pyrus* in many of the possible combinations. The goal is to develop small-statured trees with small fruits for landscape use.

The Callery pear was one of the species that we used. Within the Callery group, there are several different cultivars available such as 'Chanticleer', a more upright narrow form. The cultivar 'Autumn Blaze' has a wider form and good fall color. It has been the hardiest of the Callery pears at the University of Minnesota Landscape Arboretum. We grew some for several years before they perished following a winter when temperatures dropped to -33°F in midwinter. In our laboratory cold hardiness testing it tested hardy to -31 or -32°F.

Another species that has a lot of potential to offer in the breeding program is *P. betulifolia*. This species has not been used widely in landscaping but there is at least one cultivar, 'Dancer', that is now available in the nursery trade and has good potential for use where it is winter hardy. As I look at this plant, it reminds me of the quaking aspen. The upper part of the leaf is green with silver underneath. When the leaves flutter in the wind, it gives the same effect. Another desirable quality of this plant for landscape use is the small fruit.

Most plants of the species *P. elaeagnifolia* show little promise from a landscape standpoint. They have a coarse, somewhat spiny habit of growth and not a very nice plant form. The nice features include its silver foliage and tolerance to different

adverse conditions. It is native in the Mideast and, therefore, has some heat tolerance and possibly drought tolerance.

There is much confusion in the trade between the subspecies *P. fauriei* and the syn. *P. calleryana* subsp. *fauriei*) (sometimes listed as cultivar 'Fauriei'). The species *P. fauriei* is more of a large shrub growing 8 to 10 ft high and 12 to 15 ft wide in Minnesota. Seedlings have shown excellent fall color ranging from golden-yellow to orange and reddish-purple. It has been reliably hardy in the Minneapolis/St. Paul area, although severe winters in the past have caused slight amounts of tip kill. There is a lot of potential for it in large areas for use as a background screen. It could possibly be grafted on a standard to produce a better tree form. Other desirable features that it possesses are small stature and small fruit.

The snow pear, *P. nivalis*, probably does not have a lot of potential for direct use in landscaping. Its fruit is larger than desired, more than an inch in diameter. The plant has a slightly irregular growth form. Yet it has very thick, glossy foliage and probable tolerances to heat and drought based on its native areas.

Pyrus salicifolia has a weeping form with silver foliage similar to that of Russian olive. The fruit is 1 inch in diameter, again, larger than desired. We had one plant of *P. salicifolia* 'Silver Frost' at the Minnesota Landscape Center that did quite well for several years. It tolerated more cold than I ever expected it to withstand. It survived the -33°F we had two winters ago. Unfortunately, last year it contracted fireblight and was completely killed in one season.

Pyrus ussuriensis, Ussurian pear, is definitely the hardiest of the pears. It has a slightly larger flower than the Callery pear and is even showier. It grows a little larger than the Callery pear, around 40 ft tall or higher under ideal growing conditions. The fruit size is undesirable. It is used in our breeding program for its hardiness and big, showy flowers.

The possibility of recombining the good qualities of these plants is our goal. Dr. Rita Hummel has been growing the plants from successful crosses at the Washington State University Research and Extension Center-Puyallup. Second generation seedlings from these plants were grown at our Oregon station. This past spring plants of the second generation segregating population were planted by the Centers' research participants in Georgia, New York, Pennsylvania, North Carolina, Kentucky, Iowa, Michigan, Minnesota, Texas, and Arizona. Many were also replanted in wider spacing at our Oregon station. Superior plants can now be selected from those populations that are well adapted to the climatic conditions of the region in which they are selected.

The second project underway is development of small trees in the genus *Acer*. This project was started by the Center using the plant collections of the Morris Arboretum, The Arnold Arboretum, The Holden Arboretum, The Morton Arboretum, and the Minnesota Landscape Arboretum. Dr. Susan Wiegrefe started this work while working as a postdoctoral fellow for the Center. She has since taken a tree breeding position with the Morton Arboretum and a cooperative agreement was developed between the Center and the Morton Arboretum so that Susan could continue this work as a cooperative project. A similar cooperative project is underway with interspecific hybridization of *Carpinus*. Many interesting interspecific hybrids have been produced in those efforts. Some of the *Acer* hybrids in the palmata section are now starting to flower so we will soon be able to produce second generation hybrids.

Another project underway is development of sterile cultivars of species that

naturalize too freely or that have messy fruit. We are utilizing two approaches to accomplish this goal. The first is to induce tetraploidy by use of chemicals. The tetraploids will then be crossed with their normal diploid counterpart to produce triploids, which are normally sterile. The second approach is development of female sterility genes and transformation of these genes into plants of species where sterility is desired. We are cooperating with Dr. Alan Smith at the University of Minnesota in this effort.

Our first breeding effort with herbaceous perennials is now underway in an effort to develop free standing bush forms of *Clematis*. We are utilizing *C. integrifolia*, *C. forsteri* (syn. *hexapetala*), *C. recta*, *C. heracleifolia*, and *C. fruticosa* in this effort. Crosses made in 2000 have produced hybrids between *C. integrifolia* and *C. forsteri* and between *C. integrifolia* and *C. recta* that look very promising. Flowers on these plants are blue in color and are up-facing. Flowers on some plants open with an intense blue purple color and fade to almost white as the flowers age. Additional crosses have been made in 2001 between these species and also between these species and several of the large-flowered vine cultivars.

We have made a little start in an attempt to develop thornless varieties of barberry. We acquired plants of thornless green-leafed Japanese barberry and several cultivars of red-leafed Japanese barberry and established them at the station in Oregon in 2000. We had hoped these would flower extensively this spring but, unfortunately, they bloomed rather sparingly. Hopefully, next year we can make more progress in hybridization of these plants.

FUTURE PROJECTS

I started some breeding efforts with other shrub groups this past spring. These include efforts to develop yellow-flowered cultivars of *Weigela*, golden foliage and compact plant forms of red-twigged dogwood, and compact forms of *Physocarpus* with bronze leaf color. We hope to expand efforts with shrubs in the future with emphasis on developing dwarf, more compact varieties and also emphasis on developing and selecting superior cultivars of native plant species. Another research area that we are interested in starting is selection of clonal rootstocks for their potential to impart better tolerance to soil-related stresses or to influence growth characteristics of the top. There is a lot of potential in this area. Dwarfing rootstocks are used in the fruit industry for size control. Selected rootstocks that result in better tolerance to certain soil-related stresses such as drought, high soil pH, poorly drained and compacted soils, and low soil fertility would be very beneficial.

POTENTIAL FOR SUCCESS

There is tremendous potential for developing superior landscape plants of many different plant genera. The Center's cooperative nature provides an efficient and effective approach for developing superior new cultivars that are well adapted to the stresses encountered in many different geographic regions. However, breeding of new plants is a time consuming and costly process. The success of the Center is very dependent on the level of support that it receives. Broad support from the nursery industry is a must if the Center is to reach its full potential. I strongly believe in the potential of the Center and will continue to donate my time and expertise to see the Center succeed as long as my current good health permits. As support increases, the Center is able to expand the projects underway and initiate breeding efforts with more plant groups.