

A. Title of Project: Development of improved landscape plants

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C. Name of Institution: Landscape Plant Development Center

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Summary of progress

The Center's research effort to develop durable landscape plants is an ongoing effort. We work with many different plant species and our goal is to develop superior new cultivars for all geographic regions. Plants of 2 of our introductions, Center Glow Ninebark and Silver Ball Pear are now being sold by licensed nurseries. One year old seedlings of second generation hybrids between *Acer palmatum*, *A. pseudosieboldianum* and *A. japonicum* are growing in seedbeds in Minnesota. These are being overwintered with out protection for selection of cold hardy individual plants. We have identified several selections of *Carpinus* hybrids for propagation for broader evaluation. We continue to expand our activities with additional plant species as funding allows. Since the interim report, we have propagated many additional selections of *Buddleia* and *Weigela* for further evaluation. We have also collected seed from crosses made in spring of 2006 of many different plant species.

Ornamental Pears

The Center continues to focus its breeding research on pear trees because of their small size and their potential for different forms and tolerance to different environmental extremes. The pear also has beautiful foliage, excellent fall color and delivers showy flowers early in the season.

Currently, nine (9) research cooperators at universities and arboreta across the country are evaluating the Center's second-generation pear hybrids. In addition, in 2003, the Center planted certain selections that were propagated asexually in Georgia, Pennsylvania, North Carolina, New York, Michigan, Minnesota, Iowa, Texas, Kansas, Oklahoma, Idaho, California, and Washington. One of the significant features the Center is looking for in these pear selections is resistance to fireblight.

Notable developments in 2006 include:

- A cool, wet Oregon spring in 2005 produced ideal conditions for rust disease resulting in heavy infestation of most of the pear plants. As a result, the Center has identified plants that have excellent resistance to rust disease.
- The Center is receiving excellent feed back from cooperators on performance of selections sent out previously for evaluation. A couple of selections have been made in Arizona of plants that are resistant to high soil pH. These were budded in late summer 2005 for further evaluation and grown out in 2006.
- Some of the dwarf selections may have potential for use as dwarfing rootstocks for fruiting pear varieties. The Center has initiated efforts to explore the potential of some of its dwarf selections to be used as dwarfing rootstocks for fruiting pear varieties by budding dwarf selections onto clonal rootstocks. These were grown out in 2005 and buds of DeAnjou pear were budded onto these leaving a 12" interstem of the dwarf selection. The resulting plants were grown in 2006.
- In the 2006 spring, J. Frank Schmidt & Son Company sold a limited number of Silver Ball™ Pear, the Center's first tree introduction.

Acer & Carpinus

The Center's *Acer* and *Carpinus* breeding programs are carried out in cooperation with the Morton Arboretum. Dr. Susan Wiegrefe made the initial crosses and utilized plants growing at the Morton, Morris, Arnold and Holden Arboreta. Currently F1 populations of these genera are growing at the Morton Arboretum and at the Center's research station in Oregon. Some maple hybrids are also growing at the Washington State University's Puyallup Experiment Station.

Notable developments in 2006 include:

- Crosses made in 2004 between selected F1 hybrids are currently being grown at the Morton Arboretum.
- Open pollinated seed of hybrids between *Acer palmatum* and *A. pseudosieboldianum* and *Acer japonicum* and *A. pseudosieboldianum* was collected in fall of 2005 and sown in a seedbed at Bailey Nurseries, Inc. in Minnesota. Seedlings will be left this winter (2006-2007) to provide an early selection for winter hardiness. The Center will transplant any surviving plants to its Minnesota Research Station in the spring.
- The Center also planted approximately 75 seedlings at the Minnesota Research Station this past spring.

Some of the F1 hybrids of *Carpinus* have very nice plant form and excellent foliage qualities. The Center is selecting from these hybrids and will propagate the selections for further evaluation. Many of the F1 hybrids are now flowering and seed will be collected in fall of 2006 for growing the F2 population.

Clematis

The Center has made excellent progress in developing non-vining cultivars of *Clematis*. The Center's hybrids between *Clematis integrifolia* and *C. hexapetala* appear very promising. Flowers are blue in color and upright facing. We also have many hybrids between *C. integrifolia* and *C. recta* that have smaller, upfacing flowers. In addition, the Center has hybrids between *C. integrifolia* and several of the large, flowered vine cultivars.

Notable developments in 2006 include:

- Plants resulting from crosses made in 2003 between *C. integrifolia* and large flowered, vine cultivars and between *C. integrifolia rosea* and *C. hexapetala* are now being grown at the Oregon Research Station.
- Plants from 2002 crosses that are now growing in a field planting at the Oregon Research Station flowered in this past year. Many of these appear to be vining in form but are likely to be shorter than many of the current vine cultivars. One

early selection is quite short and could be used effectively in a perennial garden supported by a tomato cage.

- Donahue's Greenhouse, which specializes in *Clematis* production, has been licensed to grow 'Center Star,' the Center's patented selection of *C. integrifolia* x *C. hexapetala*. 'Center Star' combines the blue flower color from the female parent and the upfacing flowers of the male parent. Flowers are 1½ to 2" in diameter and the foliage is a dark, glossy green.
- The Center's hybrids of *C. integrifolia rosea* with *C. hexapetala* are large flowered vining cultivars are now growing at our Oregon Station. Our goal with these hybrids is to extend the flowering color range.

Improving Native Plants

In 2003, 2004 and 2005, the Center collected native woody plants in Iowa, Michigan and Minnesota in cooperation with Dr. Robert Schutzki of Michigan State University and Dr. Mark Widrlechner of North Central Regional Plant Introduction Station. The Center is growing these plants to select superior individual plants to be used in breeding. The Center is also using Ethyl Methane Sulfonate, a chemical mutagen, to develop dwarf varieties of selected plants.

Notable developments in 2006 include:

- The Center has developed a cross between *Cornus sericea* 'Cardinal' and *C. s.* 'Isanti' to develop a compact variety with brighter winter twig color. The Center also selected compact plants from open pollinated seedlings of *C. sericea* 'Cardinal' treated with Ethyl Methane Sulfonate (EMS), a chemical mutagen. These exciting selections are now being propagated for further evaluation.
- The Center's first patented shrub introduction, 'Center Glow', is a hybrid between *Physocarpus opulifolius* Diabolo™ and *P. o.* 'Dart's Gold' and has significantly brighter leaf color than Diabolo™. 'Center Glow' was commercially available in limited quantities in 2006 and will be available in greater quantities in 2007.
- The Center continues to work with seedlings from crosses between 'Center Glow' and its siblings. The seedlings exhibit a broad range of leaf color (from green-yellow to bronze) and a number of plants have rosy red leaf color at maturity. We are also propagating and evaluating a dwarf selection from seedlings treated with EMS.

Developing Sterile Cultivars by Ploidy Manipulation

We are working, in cooperation with Dr. Tom Ranney at North Carolina State University, Mountain Horticultural Research Center, to develop sterile cultivars by modifying ploidy levels. We are treating plants with oryzalin to produce tetraploids. These will then be crossed with diploid plants to produce triploids, which are most frequently sterile.

Notable developments in 2006 include:

- Tetraploids of crabapple, *Acer platanoides* and *Acer ginnala* have been verified by flow cytometry from plants treated with oryzalin.
- The Center continues to observe hybrids resulting from wide crosses to identify sterile plants. Several of the Center's selected pear hybrids appear to be sterile. In addition, some of the Center's *Buddleia* cultivars appear to be sterile or of low fertility and the Center anticipates several sterile selections with excellent ornamental traits.
- Pollen of selected hybrids was sent to Dr. Ranney to use in crosses with tetraploid *Pyrus calleryana* that he has induced.
- In our cooperative breeding program with North Dakota State University, Dr. David Dai has successfully established plants in tissue culture. He has developed a satisfactory protocol for gene transformation with *Buddleia*, and the Center is positioned to introduce genes that result in sterility and dwarfness. Dr. Dai continues to work on protocol for transformation with other species.

Cooperative Breeding Program with Cornell University

In 2003, the Center began a cooperative breeding program with Cornell to expand and enhance the breeding of landscape plants. Peter Podaras, the Center's plant breeder at Cornell, is making crosses in many different genera.

Notable developments in 2006:

- The Center made numerous cross in many different plant species in 2006. The Center focused on crossing *Buddleia* and *Weigela* on advanced generations growing in the greenhouse and on *Quercus* in the field. There was excellent nut production of many interspecific crosses from the 1700+ cross combinations made in spring of 2005. Plants from these crosses are now growing. Many additional crosses were made in 2006 using *Quercus bicolor*, *Q. macrocarpa*, *Q. muhlenbergii* and F1 hybrids primarily as the female parents and many different species as male parents.
- Plants resulting from interspecific crosses of the following species made in 2003 and 2004 are now growing in the field and progeny from 2005 crosses are growing in containers: *Asclepias*, *Baptisia*, *Betula*, *Buddleia*, *Calycanthus*, *Cornus*, *Diervilla*, *Hypericum*, *Quercus*, *Platanus*, *Sambucus*, and *Weigela*.
- The Center continues to work to develop *Buddleia* cultivars that are cold hardy, dwarf and sterile. The Center's recent crosses will produce plants of the 6th and 7th generation. Many of our selections include plants with different plant forms, flower color, foliage color, degrees of sterility and potential cold hardiness. The Center is considering the potential of some selections to be used as annuals in northern climates where *Buddleia* is not reliably hardy.
- We continue to explore potential for intergeneric hybridization between closely related genera. Based on the previous apparent success of hybridization of *Aronia* with *Chaenomeles*, Peter attempted crosses between *Sorbus*, *Amelanchier*, and *Pyrus* with *Chaenomeles* in spring of 2006. A few seeds were obtained and hopefully, these will germinate and prove to be true hybrids. We are now in our

4th and 5th generation of *Buddleia* intergeneric hybrids and have some very promising dwarf selections. Some of these have low fertility or are sterile. Crosses between *Diervilla* and *Weigela* resulted in a couple of true hybrids with pink flowers. More crosses were made in 2006 to produce more hybrid plants.

- Hybridization efforts with other genera in 2006 include: *Sambucus*, *Syringa*, and *Rhododendron*, interspecific crosses of *Acer* primarily in the *trifoliata* and *palmata* sections. Intergeneric crosses between *Stewartia* and *Camellia*, and intergeneric crosses between *Aronia* and *Chaenomeles*.

Cooperative Breeding Research with North Dakota State University

Overall status of project:

The Center began a cooperative effort with Dr. David Dai at North Dakota State University (NDSU) in 2005 to utilize biotechnological approaches for landscape plant improvement. NDSU has excellent facilities for tissue culture and related research activities, and the Center provides funding for a research technician to work on the project. The goal of this breeding program is to develop new landscape plants by use of various biotechnology approaches including *in vitro* mutation breeding, ploidy manipulation, and genetic transformation.

Notable developments in 2006:

- Since the Center and NDSU began the breeding program, tissue cultures of 15 landscape plant species have been established.
- Three (3) species, dogwood, ninebark, and forsythia, have been selected for *in vitro* chromosome doubling and chemical mutation. Colchicine and Ethyl Methane Sulfonate are used for chromosome doubling and *in vitro* mutation, respectively. We are optimizing treatment conditions (chemical concentration and treatment time) for each species. Approximately 100 treated dogwood plants are growing in the greenhouse.

Cooperative plant testing program with Blake Schools

In 2005, the Center established a cooperative effort with The Blake School, a private school in Hopkins, Minnesota, to evaluate the performance of certain pear and mountain ash selections. The project was part of a family community service activity, and over 40 trees were planted on campus by students, staff and parents. In addition, many families planted trees in their home landscapes. Students are evaluating trees planted on school grounds as part of the 6th grade science curriculum and families that planted trees at their homes provide yearly evaluation information.