Bred for success
Breeding the next generation of ornamental plants for Oregon and beyond

By Ryan Contreras
The Nursery Crop Breeding Program at Oregon State University has both teaching and research components. The research component focuses on developing superior woody landscape plants that have reduced invasive potential, increased disease resistance, and increased abiotic stress tolerance (drought, soil pH, salinity).

Developing sterile cultivars
Several economically important nursery crops have been identified as potentially invasive. They have become the target of legislation that prevents them from being grown in areas where they have traditionally been marketed. Examples include Norway maple (*Acer platanoides*), burning bush (*Euonymus alatus*), and Japanese barberry (*Berberis thunbergii*) in New England states.

Because Oregon exports nearly 75 percent of its nursery stock to other states, it is important to be cognizant of regulations elsewhere.

The program is working to develop sterile alternatives to economically important crops using a variety of techniques including manipulation of chromosome numbers (ploidy manipulation), inducing mutations using radiation and/or chemicals, and crossing distantly related species to produce sterile offspring (which results in the plant version of a mule).
**Norway maples.** Improved Norway maple cultivars ‘Crimson King’, ‘Royal Red’, ‘Emerald Queen’, and ‘Dissectum’ were treated with chemicals (mitotic inhibitors) to develop plants with four sets of chromosomes (tetraploids). These plants with higher than normal sets of chromosomes (polyploids) will be used to cross with “normal” plants that have two sets and the resulting progeny are expected to be sterile triploids (plants with three sets of chromosomes).

The reason for sterility of triploid plants is that during the formation of pollen and egg cells (meiosis), the three sets of chromosomes cannot be divided equally and the unbalanced number of chromosomes renders both pollen and eggs sterile.

Tetraploids of the four cultivars above have been developed; however, only ‘Royal Red’ was propagated in 2010 due to reduced growth after treatment. In 2011, all cultivars will be propagated and grown to flowering for backcrossing to “normal,” diploid maples.

**Cherry laurels.** In addition to being invasive in unmanaged areas, the recent ban on *Prunus* spp. plants with attached fruit into California due to western cherry fruit fly has restricted sale of cherry laurels. Both common cherry laurel (*Prunus laurocerasus*) and portuguese cherry laurel (*P. lusitanica*) are being utilized to develop sterile forms.

To date, the program has developed polyploids of common cherry laurel that will be handled similarly to the Norway maples described above. Also, gamma radiation is being used to induce variation in seed with the goal
The program is partnering with pathologists to identify effective screening methods for taxa of interest.

of recovering new forms that are sterile. The resulting seedlings will be evaluated for fertility, landscape performance, and aesthetic quality.

Finally, crosses were made between these two species. A desired characteristic of the resulting progeny is sterility; however, these crosses also have the potential to produce plants with increased shothole disease resistance and cold hardiness. From 800 crosses made in 2010, eight seeds were recovered and at the time of writing, a single seedling has emerged.

Disease resistance

Breeding for disease resistance is a long and involved process, which the program is just beginning. There are as many diseases as there are plants and at times it seems that new diseases are “released” more quickly than new cultivars. The program is partnering with pathologists to identify effective screening methods for taxa of interest. New projects will be added as funding and other resources become available.

Cotoneaster spp. Being a genus of over 400 species, there is a great deal of diversity, which has yet to be utilized in the nursery and landscape industries. Many species not currently grown offer multi-season interest and...
fill a landscape niche due to their ability to grow in difficult sites.

However, many of the commonly cultivated cotoneasters are susceptible to fireblight in varying degrees and can exhibit extensive injury, which leads to losses during production and in landscapes. Fireblight is widespread in the U.S. and while it is not especially a problem in the Willamette Valley, it is a major issue in other areas.

Preliminary screening studies have identified differential resistance to fireblight in Cotoneaster, indicating that sources of resistance are available, which may be exploited in a breeding program. The germplasm collection compiled by the program currently consists of approximately 50 species.

The current plan is to screen the entire collection, while continuing to expand the number of available species. Goals of the project include fireblight resistant forms that exhibit superior performance under difficult growing conditions as well as identifying current selections and new releases from other programs that could benefit Oregon growers.

**Non-winter browning in Thuja spp.** Unsightly winter browning occurs in *Thuja plicata* (western red cedar), *Thuja occidentalis* (American arborvitae), and *Thuja orientalis* (oriental arborvitae; syn=*Platycladus orientalis*) as a result of conditions during winter that slow down photosynthesis. It has been shown in related species that doubling the chromosome number to develop polyploids is an effective mechanism to prevent winter browning; therefore, we are developing polyploids of these three species.

To date, the following numbers of polyploids have been developed: 67 western red cedar, seven oriental arborvitae, and 189 American arborvitae. The largest treatment has yet to be screened from which is expected to yield an additional 150 to 200 polyploids for these three species combined. Container and field evaluation will be conducted in coming years to identify non-winter browning selections that have superior form and vigor.

**Landscape performance and abiotic stress tolerance**

Nursery and landscape plants are exposed to myriad environmental stresses during production and after planting including drought, excess water, poor soils, and freezing temperatures to name a few. The program seeks to develop new cultivars that exhibit superior performance under difficult growing conditions as well as identifying current selections and new releases from other programs that could benefit Oregon growers.

**Breeding for increased economy of water.** Water is becoming increasingly scarce with each passing year and events such as the ban on watering in Atlanta during 2009, and perennial water shortages in California will become increasingly common. As such, it is necessary to identify plants that may be produced and used in landscapes with reduced water.

Collaboration is planned with Jim Owen, Jr. to determine if it is possible to breed for increased economy of water in woody nursery crops. The ultimate goal is to identify and/or develop plants that grow equally well using less water and are tolerant to drought.

**Project team and funding**

The program began in December 2009, with the hire of Ryan Contreras who has teaching and research responsibilities in the Department of Horticulture. His teaching responsibilities include landscape plant materials, and plant growth and development.

Contreras has a 75 percent appointment at OSU and has recently entered into a partnership with the Landscape Plant Development Center to oversee breeding activities for their organization, which funds the remaining 25 percent of his salary.

Ryan recently finished his doctoral work at the University of Georgia where he received a Ph.D. in horticulture and before that received M.Sc. and B.S. degrees from North Carolina State University in horticultural science.

Also on the team is Mara Friddle, faculty research assistant, who provides general support of the research program, which includes diverse activities such as spraying weeds and determining the DNA content of treated seedlings, sometimes within minutes of each other!

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