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Shrub Rose Breeding and Evaluation at the Minnesota Landscape Arboretum

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INTRODUCTION

At the Minnesota Landscape Arboretum (MLA), where minimum winter temperatures of -25 to -30F are typical, the number of repeat-flowering shrub roses hardy enough to survive a winter without protection is limited. Those that show slight to moderate levels of cane injury after a Minnesota winter are typically from one of three groups: hybrid rugosas, and Explorer and Parkland roses from Agriculture Canada. The number of disease-tolerant, hardy repeat-flowering roses is smaller yet.

The Woody Ornamental Research Program at the MLA has taken a two-pronged approach to increasing the number of hardy, disease-tolerant shrub roses for gardeners in the northern tier of the U.S. Existing cultivars that have not yet been trialed in Minnesota are being planted and evaluated to identify those that will perform well. A hybridization program to develop new cultivars is also under way.

EVALUATION

Floral traits, rebloom, plant size and habit, disease incidence, insect incidence, and winter hardiness are monitored during evaluation studies. Roses are evaluated every 10 to 14 days over several growing seasons.

Floral Traits. Floral traits monitored are the color, form, diameter, and fragrance of mature, fully open blooms. Inflorescence size, or the number of blooms in a single cluster, is also measured.

To evaluate rebloom, the growing season is divided into three periods: June, July, and August/September periods. Bloom during each of these periods is recorded as slight, moderate, or heavy.

Plant Size and Habit. At the end of the growing season, each plant's height and width are measured and a plant form (dense, open, suckering, spreading, arching, rugosa, climbing, and groundcover) is assigned.

Disease Incidence. Roses being evaluated are not protected with fungicides, which allows differences in disease incidence among cultivars to be observed. The incidence of blackspot, powdery mildew, leaf spots, and rust are recorded as none, slight, moderate, or heavy for each cultivar. An estimate of defoliation is also recorded.

Insect Incidence. The occurrence of aphids, mites, rose stem borer (*Agrilus aurichalceus*), and the mossy rose gall (caused by *Diplolepis spinosa*) are monitored.

Winter Hardiness. Winter hardiness evaluations are done by observing cane injury in early spring as vegetative buds are swelling. There are a range of cane injury patterns seen. The descriptors we use are:

None: No injury is seen. Canes are hardy to the tip.

Tip: Cane tips are injured, resulting in less than 10% of the crown being injured.

Snow: Canes die back to the snowline.

<1/2: Injury results in dieback of 50% or less of the plant crown. Dieback among individual canes within any one plant varies from none to complete kill to the ground.

>1/2: Injury results in dieback of more than 50% of the crown. Dieback among individual canes within any one plant varies from none to complete kill to the ground.

Base: Every cane is killed to the ground. In spring, new canes grow from the plant's crown.

An ultralow freezer has been used during lab studies to quantify mid-winter hardiness levels of some cultivars and species. This is done by removing cane segments from the freezer at every 3 to 5F drop in temperature, incubating the material, and visually inspecting it for brown discoloration in the xylem or cambium. The lowest temperature at which half of the stem sections of a cultivar are uninjured is interpreted as the mid-winter hardiness level.

Shrub rose hardiness was also the focus of Laura Minsk's research while she was working on her master's degree at the University of Minnesota several years ago. The ultralow freezer technique was used to periodically measure the hardiness of seven shrub cultivars from September through April. This gave a profile of hardiness for each cultivar that could be compared to the typical minimum winter temperatures over the same time period. This work along with the correlations that we see between temperature patterns and winter injury patterns indicate that most cane injury in shrub roses occurs during late fall and early winter during the acclimation phase.

The rose cultivars evaluated initially were those in the shrub rose garden at the MLA. The 196 plants evaluated were a combination of old garden roses, shrub roses, and species roses. Evaluation data was taken between 1988 and 1992. This information is being published by the Minnesota Agricultural Experiment Station and will be titled *Roses for the North*. The publication can be ordered as MR-6594 from the Minnesota Extension Service Distribution Office, 20 Coffey Hall, St. Paul, MN, 55108. The publication's cost is $11.95.

The majority of roses in the second evaluation study are the shrub roses developed at Iowa State University by Dr. Griffith Buck. His best known rose is *Rosa* 'Bucbi' Carefree Beauty™. Dr. Buck's goal was to develop repeat-flowering shrub roses with enough cane hardiness to survive winters with minimum temperatures of -20F.

Seventy-two of his 87 cultivars have been located, and most of these have been reidentified, propagated, and planted. One year of evaluation has been completed. Dr. Buck's roses are very floriferous and after one mild winter, most appear to be crown hardy in Minnesota. Disease tolerance is variable but there are some with very high levels of blackspot resistance.

HYBRIDIZATION

The first shrub rose evaluation study provided a wealth of information to base a hybridization program on. Parental material spans many of the rose classes. Species roses, cultivars not too far removed from their species ancestors, and a few repeat-flowering cultivars are being used to incorporate hardiness. There are several roses native to eastern North America, such as *R. virginiana, R. carolina, and R. palustris*, that are hardy tetraploids but have not been used in breeding programs prior to this. Hardy, non-native species such as *R. pimpinellifolia* and *R. amblyotis* are being used. Rugosa roses are extremely hardy but sterility barriers occur very quickly when they are crossed with roses from other classes. A better way to take advantage of the hardiness of *R. rugosa* is through *R. kordesii,* as was done in the development of many of the Explorer roses from Agriculture Canada.

Disease resistance is a difficult trait to work on in a rose breeding program. There is little known about the genetic control of disease resistance in roses, and information on disease tolerance or resistance is typically based on how a plant performs in the field. Factors such as microclimate, culture, cultivar/pathogen race relationships, and inoculum level create variation in the disease levels seen in the field. When these variables aren't controlled, the level of disease incidence for any one cultivar varies over time and location. Ideally, there should be controlled screening techniques in place to eliminate this variation. But, until controlled screening techniques are developed, field tolerance is what will be used.

A range of diseases infect roses. The most common and serious, from an aesthetic standpoint, are foliar diseases. Blackspot, with its ability to defoliate, is of primary concern in the MLA's breeding program. Many species roses show high levels of field tolerance to blackspot. A number of old garden roses, especially among the albas, damask, and gallicas, are blackspot tolerant. There are also cultivars among the Explorer series and among Dr. Buck's roses that are blackspot tolerant.

Incorporating cold hardiness and disease resistance into repeat-blooming roses takes time. The breeding program at the MLA is the traditional one of emasculation, hybridization, growing and planting seedlings, evaluation, roguing of the bad plants, and selection, propagation, and reintroduction into the breeding program of the good seedlings. This process takes several years. Remontancy is a recessive trait, which means that a hybrid of a repeat-flowering rose and a one-time bloomer will most likely be a one-time bloomer and will not begin blooming until 3 years of age. Repeat-flowering plants will appear in the second generation. Disease resistance and cold hardiness appear to be quantitative traits, which makes breeding and selecting for these traits more complex and time consuming. Trying to combine all of these traits into an attractive plant takes multiple generations. At 5 years of age, the MLA breeding program is still in its infancy. Cultivar/species hybrids that are hardy, disease resistant, and carry a repeat-flowering gene have been produced and have been used in crosses with repeat-flowering cultivars over the past 2 years. Seedlings resulting from these crosses are being grown on for planting and evaluation.