Progress Report

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EVALUATION OF *PYRUS* INTERSPECIFIC HYBRIDS FOR LANDSCAPE USE

Principle Investigator:

Dennis R. Pittenger
U.C. Cooperative Extension Central Coast & South Region
Batchelor Hall Extension
University of California
Riverside, CA 92521
Phone: 951.827.3320 / Fax: 951.827.5717
E-mail: dennis.pittenger@ucr.edu

Introduction

The genus *Pyrus*, a member of the Rosaceae family, contains 22 primary species and at least 6 naturally occurring interspecific hybrids. *Pyrus* is believed to have arisen in the mountainous regions of western China and now is indigenous to Europe, temperate Asia, and the mountainous regions of North Africa (Bell et al., 1996). Today pears are second only to apples as the most important deciduous tree fruit crop in the world, with the major species of commerce being *P. communis* L., the common European pear, and *P. pyrifolia* (Burm.)Nak., the Asian or Oriental pear.

Members of the genus *Pyrus*, notably cultivars of *P. calleryana* Decne. (Dirr 1990) and the species *P. kawakamii* Hayata, have been widely used in California as medium-sized landscape trees, but each has serious defects. The *P. calleryana* cultivar, 'Bradford', was introduced by the U.S. Department of Agriculture in the early 1960's and remains the most widely used of the *P. calleryana* cultivars (Dirr, 1998). 'Bradford' and the other *P. calleryana* cultivars have desirable landscape qualities including attractive spring flowering, outstanding fall color, adaptation to varieties of climate and soil conditions, and variable degrees of fireblight resistance. Unfortunately, 'Bradford' and many of the newer *P. calleryana* cultivars suffer from narrow branch angles that result in severe splitting of the tight, upright branch crotches. *P. kawakamii* exhibits attractive winter flowering, nearly evergreen foliage, adaptation to varieties of climate and soil conditions, and acceptable branch structure, but it is highly susceptible to fireblight. Although the *P. calleryana* cultivars and *P. kawakamii* offer many desirable qualities and their mature sizes are appropriate in scale to most urban residential sites, their defects severely limit their use as landscape trees.

Fortunately, the potential exists for the defects noted above to be overcome through breeding within *Pyrus* because it includes considerable genetic diversity for landscape traits, climatic and edaphic adaptation, and disease and pest resistance. The gene pool available to fruit breeders is well-documented (Bell et al., 1996), but the potential of *Pyrus* for landscape use has been largely unexplored until recently (Hummel, 2000). Evidence indicates that all species of *Pyrus* are diploid ($2n = 34$, $x = 17$) and no major interspecific crossing barriers appear to exist in the genus (Zielinski and Thompson, 1967; Westwood and Bjornstad, 1971; Bell and Hough, 1986; Bell at al., 1996). Self-fertility is rare because *Pyrus* has a gametophytic incompatibility system that insures outcrossing (Crane and Lawrence, 1952), but sterility of the interspecific hybrids is generally not a problem for *Pyrus* breeders (Zielenski and Thompson, 1966, 1967; Bell at al., 1996).

In 1990, the Landscape Plant Development Center, Mound, MN (LPDC), a non-profit organization of cooperating academics and wholesale nurseries devoted to developing improved landscape plants, collected open pollinated (OP) seeds from Melvin Westwood's interspecific *Pyrus* hybrids growing at the National Clonal Germplasm Repository in Corvallis, Oregon. The first controlled crosses of selected *Pyrus* accessions in the Repository's collection were made in 1991 (Hummel et al., 1992; Pellett and Hunt, 1992). Additional crosses were made in 1992. The *Pyrus* species involved in the crosses and their indigenous geographical distribution are as follows: *P. amygdaliformis* Vill. and *P. elaeagrifolia* Pall. have a circum-Mediterranean distribution; *P. regellii* Rehd. and *P. salicifolia* Pall. are mid-Asian species; *P. betulaefolia* Bunge, *P. calleryana* Decne., *P. dimorphophylla* Mak., *P. fauriei* Schneider, *P. pyrifolia* (Burm.) Nakai, and *P. ussuriensis* Maxim. are East Asian species; while *P. nivalis* Jacq. is of European origin (Bell et al., 1996). These species were chosen because they represent a diversity of tree forms, foliage characteristics and climatic adaptations with the potential for recombination through breeding.

Open pollinated seeds and seeds from *Pyrus* crosses made in 1991 and 1992 were sent to the Washington State University Research Center in Puyallup, WA where there is currently a field planting of 503 interspecific *Pyrus* hybrids under evaluation for their potential as landscape trees (Hummel 2000, 2003). Several interspecific hybrids have demonstrated wide-angled branch structure, good flowering, attractive fall color, and fireblight resistance (Hummel 2003), plus their parentage may confer adaptation to warm arid climates like those of Southern California. In addition, previous studies at U. C. Riverside determined ornamental pears are adequately watered at 55% to 60% of reference ET (Pittenger et al., 2002), which indicates *Pyrus* has a moderate water requirement meeting water conservation expectations of landscape plants in this region.

The objectives of this long-term study are to determine the performance and horticultural characteristics of six interspecific hybrid pear selections in cooperation with the LPDC's interspecific *Pyrus* evaluation project under climate and soil conditions typical of inland Southern California. Tree attributes evaluated include:

1. horticultural characteristics including growth rate, mature size, foliage (e.g. fall color, chlorosis, marginal burn, etc.), flowers, and fruit.
2. angle of branch attachment.
3. incidence of fire blight or other serious pests.

Materials and Methods

Bare root whips of six advanced, unnamed *Pyrus* interspecific hybrid selections were received in March 2003 at U.C. Riverside from an Oregon wholesale nursery. The 20 trees were immediately planted in standard plastic 15-gal. (68-l.) containers using U.C. Mix #2 media (Baker, 1957), placed in a nursery yard in the U. C. Riverside Agricultural Operations facility to grow additionally before transplanting in the foeld. For comparison, two trees each of *P. kawakamii* and *P. calleryana* 'Bradford' were obtained from a local nursery in 15-gal. containers prior to planting the interspecific selections in the field. The parentage of the six interspecific accessions in this study are:

P. amygdaliformis X *P. dimorphophylla* (3 trees).
P. (*calleryana* X *fauriei*) X *P. elaeagrifolia* (3 trees).
P. elaeagrifolia X *P. ussuriensis* (3 trees).
P. [*amygdaliformis* X (*ussuriensis* X *calleryana*)] OP (4 trees).
P. amygdaliformis X *P. calleryana* 'Chanticleer' (3 trees).
P. calleryana 'Chanticleer' X *P. eleagrifolia* (4 trees).

All trees were transplanted into a plot at the U. C. Riverside Agricultural Operations facility in November 2004 to begin the long-term evaluation process. Trees were spaced 20 ft. (6.1 m.) within rows by 24 ft. (7.3 m.) between rows. The planting consisted of four rows of six trees in a completely randomized experimental design. Planting holes were prepared in accordance with current U.C. Cooperative Extension recommendations (Hodel and Pittenger, 2002). Soil at the evaluation site is a Hanford sandy loam with suitable soil chemical properties and water holding capacity.

Trees have been well watered with mini-sprinkler irrigation emitters placed near the base of each tree since transplanting. The wetting pattern is approximately 3 ft. (0.9 m) in diameter. Irrigation will be adjusted in November 2005 to 60% ET and emitters will be replaced and/or added as needed to expand the wetted area when tree canopies enlarge. Trees were fertilized as new growth began in February 2005 with urea ammonium nitrate (UN-32) at 2.5 lbs. N/1000 sq. ft. (1.1Kg/90 sq. m.).

Beginning in October 2005, trees will be rated for the following horticultural characteristics four times per year (i.e. seasonally, and some may be rated more frequently in critical periods):

1. Vigor on a 0 to 5 scale with 0 = dead and 5 = extreme vigor, rank growth.
2. Overall quality/attractiveness on a 0 to 5 scale with 0 = undesirable and 5 = outstanding.
3. Canopy density on a 0 to 5 scale with 0 = no foliage and 5 = nearly 100% shade.
4. Flower number/showiness on a 0 to 2 scale with 0 = no flowers, 1 = flowers present but not showy, and 2 = flowers present and showy.
5. Fruit number will rated on a 0 to 5 scale, where 0 = no fruit and 5 = tree densely covered with fruit; fruit size will be rated on a 0 to 5 scale with 0 = no fruit and 5 = large, apple-like fruit.
6. Fall foliage quality will be documented by actual color; color quality will be rated on a 0 = 5 scale with 0 = no fall color (essentially green) and 5 = excellent color display.

7. Incidence of fireblight will be rated on a 0 to 5 scale with 0 = no evidence of disease and 5 = heavy infestation/serious dieback.

The height, caliper 6 in. (15 cm.) above the soil, and crown width of each tree will be measured annually beginning in November 2005 to document growth and tree size.

Early Results and Expected Outcomes

Each of the interspecific hybrids has exhibited wide branching angles (Fig. 1). Two selections also have interesting silver-green foliage color. There has not been sufficient opportunity to effectively evaluate the suceptibility to fire blight, fall color, flowering, and other attributes.

Over the next five to ten year the study will determine the general landscape quality, heat and aridity tolerance, and response to conservation levels of irrigation of six interspecific hybrids from *Pyrus* crosses. It will also be possible to compare their performance to the standard ornamental pear species, *Pyrus calleryana* 'Bradford' and *P. kawakamii*. Ideally, one or more new small- to medium-sized flowering landscape trees with good branch structure, disease tolerance, and other desirable traits will be identified to expand the tree palette for California's growing urban and suburban areas.

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Figure 1. Typical wide branching angles expressed by *Pyrus* interspecific hybrids under long-term evaluation at U.C. Riverside for their potential as landscape trees.