

Department of Agriculture, Trade and Consumer Protection
Division of Agricultural Development
Agricultural Development & Diversification Program (ADD)
Grant Project Final Report

Contract Number:17035

Grant Project Title: Plum Breeding – The Development of New Adapted Commercial Cultivars for the Wisconsin Grower

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Project End Date: 8/01/03

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Please use the following questions as a guide for writing your grant project final report. In your final report, please answer each question as it relates to your grant project.

- 1) What did you want to accomplish with the grant? Increase the scope of plum breeding at UW-River Falls, further test advanced selections , bring these selections close to cultivar status and begin release to Wisconsin commercial growers. In essence, plant the seeds(so to speak) of a new commercial plum industry in the state. Educate growers on commercial potential of plums. Develop a greater interest in a core group that could help us continue our cultivar development and release efforts.
- 2) What steps did you take to reach your goal?
 - What worked? All of the above objectives were met. We expanded the plum seedling acreage on site and established replicated trials of our advanced selections to test against industry standard cultivars. Traveled to multiple meetings and gave presentations regarding our plum breeding efforts and commercial potential of new plum cultivars. We also established closer ties to researchers at UW-Madison which broadens our ability to test, propagate and release our new selections. We currently have the first of our selections in “patent pending” status awaiting release to the public.

- What did not work? We were unable to evaluate many of our newest seedlings for the first two years of the project due to severe winter conditions and hard, late spring freezes. We also had continuing problems with plum seedling survival in our greenhouse.
 - What would you do differently? Search for funding to conduct an in-depth study on the improvement of seedling survival in the greenhouse.
- 3) What were you able to accomplish? Our outreach efforts this past year included 3 major conferences- 2 regional and one national. The first presentation “Plum Breeding and Cultivar Development at UW-River Falls” was at the National NAFEX (North American Fruit Explorers) Convention held at the University of Minnesota Arboretum on 9/12/02. The second presentation was an update on our plum hybridization and cultivar development efforts and was at the annual WI Fresh Fruit and Vegetable Growers Conference held in Oconomowoc on Jan. 5, 2003. The third presentation(2/7/03) was at the Upper Midwest Regional Fruit & Vegetable Growers Conference held in St. Cloud, MN and was the same title as at the NAFEX convention. A good number of growers and nurseryman after these meetings inquired about our new cultivars and about the possibility for commercial production. Nurseryman were very interested also about propagating more trees of our selections and offering them for sale.

Hybridizations went very well this past spring with over 1,500 interspecific seed produced, representing over 34 different progenies.

We established a new replicated plum performance trial this past summer that included newly propagated trees of 9 of our most elite advanced selections along with 4 industry-standard cultivars for comparison.

Another aspect of progress was the evaluation of new plum selections just coming into fruiting for the first time. The following are some of the plums selected this summer but does not include any later selections than a 9/15 maturity date:

1. 03-96-25-1 Asian-American x European hybrid- 36mm round, dark reddish-purple fruits. Skin peels easily. Flesh is yellow with a meaty texture and sweet, mild flavor. Semi-freestone. Tree is rank, vigorous with upright growth habit- 14’Tx 8’ wide. Ripens 8/14.
2. 03-99-40-18 Purple-red 37 mm fruits with prominent tan-pink dots have very rich sweet flavor from its plumcot parent. Clingstone. Moderately productive trees 10’ x 10’. Ripens 8/21.

3. 03-99-47-4 42 mm fruit are grey-green base w/ 75-90% dusty rose blush and prominent dots. Marbled yellow and purple flesh has very sweet, mild flavor. Tree is very productive and 11'T x 15'W. Ripens 9/08.
4. 03-99-55-4 Deep red 41 mm fruit have yellow flesh with mild, sweet flavor-no astringency. Some premature fruit drop. Extremely productive tree with large cherry plum-like growth habit and *P. americana*-like foliage. 9'T x 12'W. Ripens 9/10.
5. 03-99-46-1 Deep dusty reddish- purple 34mm fruit have numerous small dots. Skin is somewhat tough but no astringency and very rich, sweet, red & yellow marbled flesh from plumcot heritage. Extremely productive. 12'T x 7'W. Ripens 9/15.

We have also propagated a number of trees of older elite advanced selections for further replicated testing and have narrowed down the numbers to the “most likely” to become cultivars first. These include 98-95-21-1, 98-95-21-3, 98-95-17-7, 98-95-17-11, 98-95-17-14 and 98-95-47-1 .

- 4) What challenges did you face? Late spring frosts that ruined a majority of our crop unusually severe winter(for plums), insufficient funding to carry out the project as far as I would have liked, even though we met our original expectations.
- 5) What do you plan to do in the future as a result of this project? Continue the plum breeding program, continue to release more cultivars for commercial growers and actively educate these growers regarding cultural strategies that will improve plum production reliability and productivity.
- 6) How should the agricultural industry or the State of Wisconsin use the results from your grant project? Continue to promote and assist in the education of potential plum growers and help new growers get started. Support continuing efforts at UW-River Falls to conduct research and outreach programs on this potentially economically important crop.

**Plum Hybridization and Cultivar Development at the
University of Wisconsin - River Falls
Brian R. Smith, State Extension Fruit Specialist
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The Wisconsin/Minnesota fresh retail market fruit industry consists primarily of apples and strawberries. Diversification into other crops would provide the growers involved with a cushion against financial problems in these uncertain times. Diversification into a crop new to our region would provide a particularly promising market niche that would have great potential for increasing farm profitability. The market outlets developed for apples and strawberries – roadside stands, farmer’s markets, pick-your-own and pre-picked on-farm sales – could easily accommodate a new crop such as fresh market plums. Additionally, much of the equipment required for apple production (and to a slightly lesser extent, strawberries) will work quite well for plum production. Unfortunately, even with this basic infrastructure in place, growers cannot initiate commercial plum production due to the lack of quality cultivars adapted to our severe climate.

In order to adequately address the problem at hand, let’s look at what our current situation is for plum production. The diversity of native and introduced plums and prunes available have allowed plum breeders to develop a broad array of cultivars that can be grown in home orchards just about anywhere in the U.S. However, there is a much more narrow array of adapted cultivars that can be grown with any success commercially. Even with this small group of superior cultivars, climate still plays a major role, with consistent, efficient, production seemingly limited to orchard sites on the West Coast and U.S. – Canadian Great Lakes region. An overwhelming 95% of all plums and prunes produced in the U.S. come from California with the remainder supplied by Idaho, Michigan, Oregon, Washington, Ontario and New York.

Since most fresh dessert plum production has been centered in the ideal California climate, 80% of the production must be shipped out-state in order to find sufficient numbers of buyers. This wholesale market is typified by poor quality fruit (usually harvested too early) and narrow profit margins. The further the crop is grown from the ideal climate, the greater the decreases in efficiency due to higher growing costs/ risks(such as late spring frosts and more severe winters). These poor growers are in a vicious cycle!

The goal then, if we are to grow plums commercially here, is to significantly decrease typical plum-growing risks and increase profit potential to a point where it all starts looking attractive. This can be accomplished by a multi-faceted plan. Returning plum sales to a direct-marketed approach via such methods as on-farm, farmer’s markets or roadside stands could have a dramatic effect on profits. This is one of the primary reasons why many Minnesota and Wisconsin apple orchards survive in the face of the massive Pacific Northwest wholesale production; they compete based on product quality(adapted, flavorful cultivars) and higher profit margins(direct marketing). Initially, the lack of consumer awareness could be a major roadblock to success but with proper promotion... The other primary factors that currently limit commercial plum production here include late spring frosts, a short growing season with low seasonal heat unit accumulation, cultivars with questionable fruit quality, severe winters and a series of pests (borers, curculio, bacterial spot, brown rot and scald). Climatic risks can be addressed somewhat by just proper site selection/development and good rootstock selection. Pest problems can be reduced by increasing grower awareness/education and by adoption of multiple control measures to include such methods as resistant cultivars. There is a considerable amount of compatible, diverse, germplasm from across the world that can be used in hybridization in order to create much more

adapted, lower- risk cultivars for our climate. Winter-hardy, late-blooming and high quality cultivars ripening over a span from late July to late September are definitely possible!

Yes, there are a number of factors that must be overcome, but on the bright side, Minnesota and Wisconsin are otherwise a good production area typified by relatively dry summers (less disease incidence), high light intensity, fertile soils and plentiful water supplies for irrigation.

The next hurdle to overcome was to decide where the new plum cultivars could be developed. An informal survey was conducted in 1990 and revealed that there were only nine major plum breeding programs in North America and none were targeted for cultivar development in USDA Hardiness Zones 5 or below. Four programs were located in California and one each in Texas, Georgia, West Virginia, Ontario and New York(now being phased out). Due to the inherent potential of breeding adapted plums and the scarcity of programs, a plum breeding program was initiated at the University of Wisconsin-River Falls (UWRF) in 1991.

The objectives of the UWRF program are as follows:

1. Employ interspecific (crosses among different species) hybridization techniques in order to transfer desirable characteristics from wild to cultivated forms.
2. Continue to screen and identify wild species and specific cultivars with unique qualities such as specific and general combining abilities, winter hardiness or high fruit quality.
3. Test new hybrid seedlings from the UWRF breeding program for performance under field conditions.
4. Identify superior Wisconsin-adapted seedling genotypes and thoroughly test for possible commercial release as new cultivars and/or for use in further breeding.

Hybridization and evaluation of seedlings has been and continues to be accomplished via discipline-accepted conventional techniques without the aid of biotechnology. UWRF has an extensive germplasm collection of 342 potted breeding trees representing 240 cultivars and 14 species. The other sources of germplasm are the Canadian and U.S. National Germplasm Repositories.

Most of the species used in breeding have a specific environmental adaptation or fruit quality aspect to contribute but others are used primarily to form “genetic bridges”, allowing a free exchange of traits among species otherwise considered incompatible. A substantial amount of pollen is kept on reserve from previous years in the freezer so that the first crosses of the year can be as diverse as the last. This pollen storage also allows us to use rare pollen shipped in from various sources for “exploratory” crosses over a period of 3-4 years; thus at least some seedlings will be generated and the pollen will not have been all wasted on incompatible crosses.

All hybridizations are made on potted trees overwintered in walk-in coolers and then “forced” in the greenhouse in late winter and early spring. Controlled hybridizations are made and fruit containing the resultant hybrid seed are harvested between April 15th and July 1st. Seeds are extracted from the pits and then stratified. These seeds begin to germinate by August 15th and continue (depending on the progeny) through the winter months. Seedlings are grown in the greenhouse under 18hr. days and then transplanted to the field in July at 4x16 ft. spacings. Seedlings are typically clean-cultivated between rows (helps on frost control during bloom) with herbicides applied within rows. Irrigation is used for establishment and thereafter only during critical droughts.

Seedlings differ greatly in precocity but as they come into bearing, nearly commercial numbers of pesticide applications are made in order to obtain fruit for evaluation. The primary pests that must be controlled include plum curculio, borers and brown rot. New plum seedling hybrids can ripen any time from July 10 to October 1, so a weekly walk through the seedling orchards is imperative so as not to miss a new “selection”.

New selections are propagated as soon as possible via chip- or T-budding onto standard *P. americana* or Myrobalan rootstocks. These selections may be utilized just as “breeders” and/or eventually become new cultivars with commercial potential. Most of our selections are composed of at least two to three species (plumcots and chumcots), while a few are made up of a union of six species in one individual. Interspecific fruits can display rather striking characteristics such as vivid yellow and red or green and red marbled flesh. Fruit exteriors can be somewhat pubescent or smooth and can be anywhere from black to ruby red to light gray. Flavors can also be very pleasant, such as rich blends of apricot and plum.

As we identify superior clones for future commercial production, it also becomes necessary to conduct research regarding the proper selection of rootstock(s) and propagation methods for such genetically complex individuals. A joint project was initiated this past summer with Dr. Brent McCown (UW-Madison) in order to investigate the potential of tissue culture(micropropagation) and cuttings as suitable increase methods for our selections. Also included in this project are performance trials with our selections propagated on industry-standard rootstocks.

A recent highlight in our efforts at UWRF involved the identification of a very late-blooming series of selections. This past spring was typified by a series of devastating late frosts that ruined 80-95% of the plum and cherry crops in the Great Lakes region (including much of the UWRF crop). Fifteen UWRF seedlings, however, bloomed 10-15 days later than most of the other *Prunus* which resulted in 100% cropping . As an added bonus, the crop maturity dates ranged from August 10 to September 20- all from the same parentage.