

TITLE: Development of a Raspberry Program for the Southern Region

RESEARCH OR OUTREACH PROJECT: Research

Principal Investigators:

Gina E. Fernandez
Dept. Horticultural Science
North Carolina State University
170 Kilgore Hall, BOX 7609
Raleigh, NC 27695
Email: Gina_Fernandez@ncsu.edu

Dr. Jim Ballington
Department of Horticultural Science
North Carolina State University
Raleigh NC 27695
Jim_Ballington@ncsu.edu

Dr. Zvezdana Pesic-VanEsbroeck
Department of Plant Pathology
North Carolina State University
Raleigh, NC 27695-7616
zvezdana_pesic@ncsu.edu

Objectives of the project: Our overall objective was to reinvigorate the NCSU bramble breeding program. Our emphasis will be on raspberry variety development for the southern United States. This was the first year of a multi-year project.

Specific objectives of this proposal are to: 1) reintroduce ‘Mandarin’ to the Southern Region, 2) propagate selections from the NCSU raspberry breeding program for regional distribution and evaluation 3) continue crossing and selecting using germplasm with desirable characteristics and 4) develop raspberry certification program and nursery industry.

Justification and Description:

Status of Crop in the US

In the U.S., large-scale commercial bramble production is located almost exclusively in states along the Pacific Coast. According to a Census of Agriculture, California, Oregon, and Washington reported 76 percent of the harvested U.S. raspberry acreage. The majority of the acreage in Washington is destined for processing and the California industry is aimed toward the fresh market. However, imports from other countries in the off-season are increasing and enable consumers to get fresh raspberries nearly year round. Production of brambles in the Southern Regions is at the moment restricted to blackberries. However, the demand for locally produced raspberries exceeds the essentially non-existent supply.

Historical Perspective

From the 1930s up through the 1950s North Carolina State (now NCSU) was involved in a unique cooperative raspberry breeding project with USDA to develop cultivars adapted to the warm humid climate of the southeastern USA. In addition to lack of heat tolerance, it was quickly discovered that the extremely variable temperatures that are typical during winter in this region resulted in severe injury to floricanes (fruit producing stems) on almost all red raspberry (*R. idaeus*) cultivars that were available at the time. As a result the program began using raspberry species native to warm humid regions of China in crosses with cultivated red raspberry. It was soon determined that *R. parvifolius* was the most promising species from China for this purpose. It resulted in the highest fertility on average in crosses and backcrosses to cultivated red raspberry, and was a particularly good parent for transmitting genes for heat tolerance. Even though the genotypes of *R. parvifolius* available at that time did not appear particularly resistant to variable winter temperatures, the interspecific hybrids and backcrosses to red raspberry segregated for this trait.

The original NCSU/USDA raspberry breeding program was terminated in the early 1960s, soon after the retirement of professor Carlos Williams, the project leader at N. C. State. At the present time, only two cultivars remain from this program, 'Mandarin', which is $\frac{1}{4}$ *R. parvifolius*, and 'Southland' which is approximately $\frac{1}{8}$ *R. parvifolius*. 'Mandarin' is reliably heat tolerant and resistant to variable winter temperatures, but its fruit is only modest in size (though of good quality) and often somewhat crumbly. 'Southland' is resistant to variable winter temperatures and has "some" heat tolerance. It has attractive fruit of average size, but poor quality. There is still a definite need for new cultivars for states in the Southern Region that will combine superior fruit size and quality with heat tolerance and resistance to variable winter temperatures.

Raspberry breeding was reinstated at NCSU in 1984, and has proceeded rather slowly with regard to breeding for heat tolerance until the "rediscovery" of 'Mandarin' around 1990. Backcrosses of 'Mandarin' to 'Chilliwack' and 'Tulameen', two recent cultivars from the Pacific Northwest with superior fruit size and quality, have now been established in the field. Seedlings from 'Chilliwack' X 'Mandarin' appear to have reasonable heat tolerance in the NC piedmont and fruit quality of seedlings from 'Tulameen' X 'Mandarin' in the NC mountains have been superior to 'Mandarin'. Selections will be made from these seedling populations in 2005.

The progress of the bramble program had to compete with the highly successful blueberry breeding program and the development of strawberry cultivars for the plasticulture system in the Southern region. Recently, G. Fernandez has been able to dedicate a portion of her time to help develop this program. With this added resource and the increasing demand for high value crops such as raspberry, the time is ripe to boost activity in this program. But in order for it to advance to the next level, we need additional support. Funding from the Southern Region Small Fruit Consortium will help us strengthen our program.

Methodologies:

Objective 1. Reintroduce Mandarin. Raspberries are particularly prone to viruses that cause inferior fruit quality (Martin 2002). It is likely that the few plants of 'Mandarin' that had been tested regionally in the recent past had one or more viruses that impacted fruit quality. We believe that virus-indexed 'Mandarin' will have superior fruit quality characteristics to material that has been propagated from old planting stock. 'Mandarin' is currently at the NCSU Micropropagation Unit (MPU) for meristem, virus indexing and propagation. Virus indexed planting stock will be sent to collaborators (University researchers, Extension Specialists or growers) in the Southern Region. Collaborators will be asked to supply feedback on adaptation and fruit quality. (Specific collaborators will be contacted once we know how much we can invest in propagation of material. We anticipate that we will have more potential collaborators than we will have planting stock). We will distribute this material in 2005 and 2006. We are currently talking with one nursery that is interested in propagating and selling Mandarin.

Objective 2. Meristem, virus-index, propagate and distribute advanced NCSU selections. The NCSU MPU agreed to meristem and virus indexing advanced selections from our breeding program. We would like to offer advanced selections to cooperators in the southern Region Consortium for evaluation in their states. We anticipate this material will be available in 2006 or 2007.

Progress: We have established 4-5 selections (NC 534, NC 533, NC 535 and NC 430) and are in the process on establishing 4-5 additional selections in early 2006.

Objective 3. Continue breeding process. Crosses have been made using cultivars from existing programs, such as 'Tulameen', 'Qualicum' 'Chilliwack' and 'Algonquin' with Mandarin. These seedlings were planted in 2003. After 2 years of exposure to summer heat and winter fluctuating temperatures, selections will be made summer of 2005. In 2004 we planted a 6 parent diallel using 3 heat adapted cultivars and 3 cultivars with superior fruit quality. Statistical analysis of traits will help us to identify which parents contribute traits of interest.

Progress: In 2005, we germinated 12 seed lots. The crosses involved advanced NC selections with cultivars from other breeding programs. They will be planted in the spring of 2006. We also planted a large diallel cross involving 6 cultivars. Three cultivars were not adapted to NC but have superior fruit qualities (Tulameen, Chilliwack, Algonquin) and 3 adapted cultivars (Mandarin, Cherokee and Latham). Half of each population was planted in two locations. We attempted to make 16 additional crosses in the spring of 2005, but had some problems with greenhouse conditions, so our seed lots were fairly low. We will repeat those same crosses and do an additional 12-20 in 2006.

Objective 4. Certification Program. Our experience with the blackberry industry in the last few years has taught us the importance of using Certified planting stocks. An integral component of our raspberry breeding program is the development of a certification program for the dissemination of clean stock to nurseries. This certification program will enable us to establish a nursery industry in the Southern Region. Thus providing growers the opportunity to produce plants as well as fruit. We will be working with the NCSU MPU, North Carolina Crop Improvement Association, Inc. and NC Seed Producers Inc. to develop this program.

Progress: We have agreed with NC Crop Improvement to proceed with this step and have

identified at least one potential nursery that is interested. We will use the established protocol for blackberry with some modifications and anticipate this objective will be complete in 2006.

Conclusions and Impact: Our overall objective was to reinvigorate the NCSU bramble breeding program, with an emphasis on raspberry variety development. In the past year we have made crosses, germinated and planted over 600 seedlings, developed protocol for tissue culture and introduced several NC selections *in vitro*, made over 30 selections from seedling fields at the Sandhills and the Mountain Horticultural Crops Research Stations. We have also started a molecular marking project looking for heat tolerance and adaption to fluctuating winter temperatures. We intend to continue to step up the activity of this program each year with the goal to release cultivars adapted to the southeastern U.S.

Citations: N/A