

Title: Raspberry Breeding for the Southern Region
Grant Code: 2008-01A

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Additional Cooperators:

Drs. David Lockwood and Dennis Deyton, University of Tennessee
Dr. Jeremy A. Pattison, Virginia Polytech Institute and State University
Dr. Kim Lewers (NC 349, NC 344)
Mr. Andy Rollins, Clemson University (NC 344, NC 452, Nantahala)

Grower Cooperators:

1. Eli Hernan, Biltmore Estates (NC 344, Nantahala)
 2. Jane Murry (Nantahala)
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 3. Jeremy Delisle/Michale Meath (Nantahala)
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 3. Harold Lineberger (NC 344)
 4. Rick Donley/Al Shirley
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 5. SunnyRidge Farms (NC 344 and NC 430)
 6. James Cooley (see above with Andy Rollins)
- Germplasm Exchange:
USDA Germplasm Repository
Mandarin Red Raspberry

Objectives:

Our overall objective is support the NCSU bramble breeding program. Our primary emphasis is raspberry variety development for the region, and a smaller emphasis on the development of primocane fruiting blackberries.

Specific objectives of this proposal for 2008 are to:

- 1) Promote release of 'Nantahala' tested as NC451;
- 2) Continue crossing, planting and evaluating seedlings and selecting germplasm with desirable characteristics;
- 3) Establish advanced selection (unreplicated) and replicated trials of selections in NC and other locations and;
- 4) Continue molecular mapping project to identify heat tolerant and high chilling genotypes.

Methodologies and Results:

Objective 1. Promote the introduction of the new raspberry cultivar, 'Nantahala'.

- In late 2007, we were granted permission by NCSU to release 'Nantahala'.
- Plant material for 'Nantahala' NC 451, was propagated at Sakuma Brothers and Nourse nursery in 2008, and limited material is available to growers. *
- Production and Marketing Agreements have been signed Sakuma Brothers (Norcal Nursery), Nourse Farms and North American Plants with the NCSU Office of Technology Transfer.
- Plant Patent was submitted in late 2007. (Application no. 11/998,754)

* In light of the increasing number of viruses being identified in blackberry (approximately 15 at this time), we are waiting for additional virus testing of 'Nantahala' for these viruses, before we promote widespread planting of 'Nantahala'.

Objective 2. Continue crossing and selection process. 2008 activities

- No. crosses made in 2008: 49 (raspberry and blackberry)
- No seeds generated from 2007 crosses: 49,000
- No. seedlings planted in spring/summer/fall 2008 (from 2007 crosses): +/- 1300 (1100 in Salisbury and 200 in Sandhills). High seed mortality of 2007 seed lots, due to mice invasion (traps are set and we are watching closely, so this does not happen again, it was devastating).
- 8 selections made in 2008 at Sandhills Research Station.

Objective 3. Selections that show promise will be placed in replicated research station trials and unreplicated on-farm trials. Several promising PF and FF raspberry selections are emerging. In addition, we have put advanced selections in the tunnel to determine performance under tunnel conditions. Some highlights are below.

Raspberry

NC 344 (Floricanne fruiting red raspberry)

- This selection did well in Salisbury (Figure 1) and did OK in Oxford (Figure 1).
- NC 344 is at several on-farm trials. With one more year of data, we should know if it is worthy of release. We held back the release because of lack of data.
- This selection is at 4 on-farm locations (see list above). Linebergers was the only farm with fruit in 2008. Although they don't have any yield data, they liked it and have asked for more plants.

- No data from the other cooperators in 2008.

NC 548, NC 612 and possibly NC 621 (Floricanne fruiting red raspberry)

- Will go into replicated FF trials in 2009.
- All have been identified as heat tolerant via screening at the hottest NC location in the Sandhills.

NC 452 (Primocane fruiting red raspberry)

- Will go into a replicated trial in 2009.
- Overall, PF raspberries are doing very well in mountains and there are several growers that have put in or will be putting in small to large size acreage of raspberries in 2008-10.

Nantahala (tested as NC 451, primocane fruiting red raspberry)

- All cooperators like the flavor and firmness of 'Nantahala'. Demand is great for this cultivar.

Blackberries

- NC 533, NC 535, NC 537 and NC 538 look like the most promising PF blackberry selections (Figure 3). NC 535 has the largest fruit of the NC material (Figure 4).
- Yield trials with spring applied row covers showed that PF blackberries did well in the NC mountains at the Upper Mt. Research Station in Laurel Springs.
- NC 537 and NC 536 very productive at trials in Corvallis Oregon (with USDA breeder Dr. Chad Finn) Data not shown but available upon request.
- All PF blackberry fruit severely damaged at 28 F in Laurel Springs.

Objective 4. Molecular mapping of *Rubus* for heat tolerance, high/low chilling and other traits.

- The objective of his project is to link heat tolerance in a segregating raspberry population (NC 497 X Qualicum) to molecular markers using SSR and AFLP technology.
 - We have evaluated 69 different SSR markers in the NQ population.
 - In addition, we have screened 7 different AFLP primer pairs for the NQ population that we know are highly informative.
 - We anticipate the PhD student will graduate in the summer or fall 2008. A significant amount of data/results will generated in the next six or so months.
- A heat screening protocol was developed during the summer of 2008 using chlorophyll fluorescence. Chlorophyll fluorescence is routinely used as a physiological parameter that correlates well with heat tolerance (Srinivasan et al. 1996). Our preliminary data indicates of the genotypes we screened, the cultivar 'Mandarin' is the most consistently heat tolerant genotype in our collection. The data also shows that of the parents of our mapping population, NC 497 (has Chinese germplasm in its heritage) is more heat tolerant than the other parent 'Qualicum', and seedlings are segregating for this trait (data not shown).

Conclusions

Impact Statements

Quote from an article "Southern Region Small Fruit Consortium combines Strengths" published in the Fall edition of the NCSU publication "Perspectives"
(http://www.cals.ncsu.edu/agcomm/magazine/fall08/n_consortium.html)

“Dr. Gina Fernandez, CALS associate professor and small fruit specialist, has used grant funds from the consortium to breed new varieties of raspberries and blackberries. She and Dr. Jim Ballington, CALS professor of horticultural science, recently released a new raspberry cultivar, and they have several others in the pipeline.

“The funds from the Southern Region Small Fruit Consortium, is not just seed money for me,” Fernandez said. “It has been the backbone for the project.””

Funding from the SRSFC has been the backbone of the NCSU raspberry and blackberry breeding program. This funding has facilitated the release of a new raspberry variety ‘Nantahala’. At a recent NCCC-22 meeting held in NC, small fruit breeders from around the world were able to taste ‘Nantahala’. They were all impressed with its unique flavor and large size and wanted to get some plants.

Funding from SRSFC also enabled us to evaluate our selections and seedlings at additional at Research Stations in NC and at on-farm throughout the southern United States. Further, in conjunction with other funding (GoldenLEAF) we are testing our advanced lines both in the field and under tunnels. And finally, we are making slow but significant progress on our molecular component. The breeding program would not have been able to sustain itself or grow if not for the SRSFC funding. Thank-you.

PUBLICATIONS RELATED TO PROJECT

1. Ballington, J.R. and G.E. Fernandez. 2008. Rubus breeding for the Southeastern United States. *Acta Hort.* 777:87-90.
2. Fernandez, Gina E., James R. Ballington and Susan J. Bryson. 2009?. ‘Nantahala’ Red Raspberry. *HortScience*. Accepted.
3. Shore, D. 2008. Southern Region Small Fruit Consortium combines strengths. http://www.cals.ncsu.edu/agcomm/magazine/fall08/n_consortium.html

PATENTS

Ballington, J.R., G.E. Fernandez and S.J. Bryson. ‘Nantahala’ red raspberry. PPAF in 2007. (Application no. 11/998,754)

Figure 1. Marketable yield (g/plant) of floricanе fruiting raspberries in Salisbury, NC, 2008.

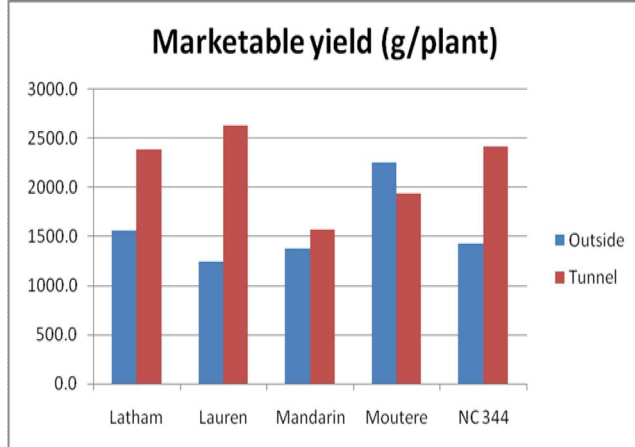


Figure 2. Marketable yield (g/plant) of primocane fruiting raspberries in Salisbury, NC 2008.

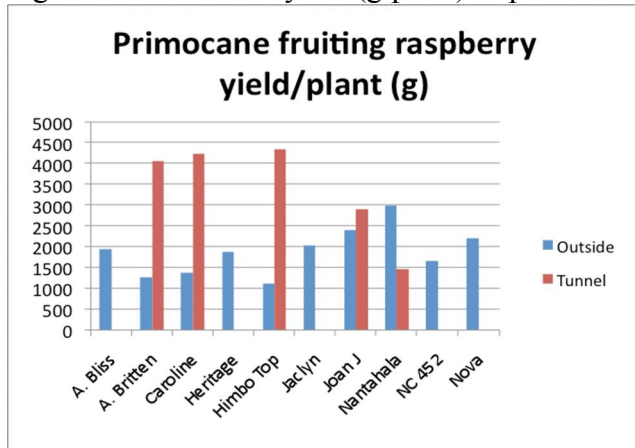


Figure 3. Marketable yield (g/plant) of primocane fruiting blackberries in Laurel Springs, NC 2008. Half of each plot was covered with a 1.25 oz/yd² row cover in the spring, prior to primocane emergence.

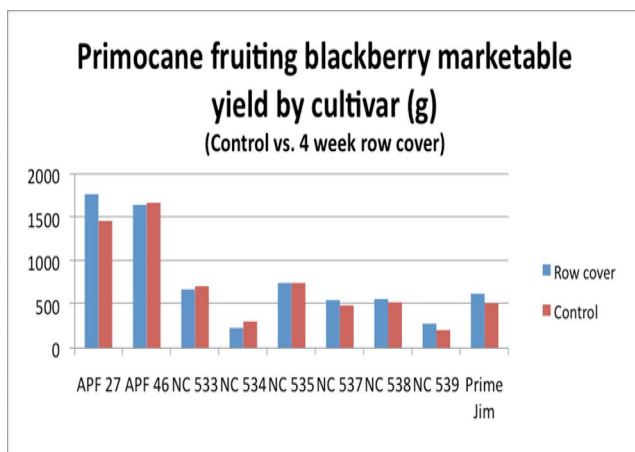


Figure 4. Fruit weight (g/plant) of primocane fruiting blackberries in Laurel Springs, NC 2008.

