

**Deployment of Nutrient-Rich Nematode Resistant Carrots to Benefit Growers,
Consumers, and the Environment
2010 Progress**

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Outputs

Inbred lines, single cross hybrids, and diverse populations from several sources of resistance have been developed and evaluated on a small scale in field test sites heavily infested with nematodes. Plants with superior levels of resistance have been selected and seed supplies of selected individual plants with elite high resistance were increased in collaboration with industry cooperators to provide adequate seed for larger scale testing in the upcoming year. Advanced Brazilian and Syrian resistance sources are in seed production trials to increase seed quantities to a level adequate to allow medium-scale field testing of resistance on grower fields within a year. Seed companies and both large- and small-scale growers are involved in testing these improved carrot populations and hybrids. A web site is being developed to target large and small-scale carrot growers, and regular interactions with crop production and seed production industry personnel provide stakeholder input as a part of this project. Collaborative trials in organic production sites are in place this year with harvest expected soon. Regular communications have been established with carrot grower and seed company representatives on our industry stakeholder team, as well as with other carrot growers and seed companies.

Outcomes/Impacts

Carrots are an important source of nutrients for the U.S. diet and have \$550 million farm gate value to U.S. growers, but root-knot nematodes (*Meloidogyne* spp.) threaten approximately 3/4 of U.S. carrot crop. Nematode infection causes forking and galling disfigurement to carrot taproots resulting in cosmetic injury and economic loss. New sources of genetic resistance to the two most important root-knot species affecting carrot production, *M. javanica* and *M. incognita*, have been identified in several unrelated germplasm sources from local carrot populations of diverse geographic origins including Brazil, Europe, Syria, China, and Australia. These sources of nematode resistance vary widely in nutritional value attributable to both carotenoid and anthocyanin pigments, and also vary in flavor. This project is moving nematode resistant carrots into mainstream production and also improving nutritional value of typical orange, nematode resistant carrots. The inheritance and genetic map location of resistance genes is being determined, and molecular markers are being developed to facilitate incorporation of resistance genes by indirect selection. Carrot types with unusual purple and yellow colored taproots that occur in resistant germplasm will also be available for large-scale and niche market growers. Progress has been made in achieving the goals of this project according to our proposed plan of work. Extensive evaluation of the strength of the nematode resistance

has been made at two infested field screening sites, and in greenhouse screening, with extreme nematode pressure. The resistance from original Brazilian sources as well as a new source of resistance derived from a Syrian carrot was found to hold up very well. Other sources of resistance identified several years ago are still being evaluated and hold some promise. A new source of resistance from a wild carrot is also being evaluated to determine gene action. Nutritional quality evaluations have been made based upon carotenoid and anthocyanin pigment levels and types, and promising nutritional value is evident. Flavor evaluations indicated promising organoleptic quality as well.

Publications:

Simon, P.W., and Roberts, P.A. 2010. Deployment of Nutrient-Rich Nematode Resistant Carrots to Benefit Growers, Consumers, and the Environment (SCRI). HortScience Meeting Abstracts: 51-52.

Participants and Training

Included co-PIs P.W. Simon and P. A. Roberts, J. Nunez, University of California Cooperative Extension, scientists and students with the USDA, ARS at the University of Wisconsin – Madison, and with the University of California-Riverside, carrot seed industry and producers. The California Fresh Carrot Advisory Board was also involved in undertaking this work. Professional development and training included presenting information to carrot growers groups at meetings and at field days in carrot nematode resistance evaluation trial and carrot hybrid germplasm evaluation trial.

Target Audience

Includes carrot seed producers, crop production industry, small-scale and organic specialty crop growers and support industry, vegetable researchers, plant geneticists, and consumers. A web site was developed to inform industry, researchers, and consumers about project progress, and oral and poster presentations were made at crop production meetings, national horticulture, plant breeding, and genomics meetings.