



United States Department of Agriculture

Research, Education, and Economics  
Agricultural Research Service

UNITED STATES DEPARTMENT OF AGRICULTURE  
Agricultural Research Services  
Washington, D.C.

and

ORGANIC SEED ALLIANCE  
Port Townsend, WA

### **NOTICE OF RELEASE OF CARROT CULTIVARS R6220 and R6636**

The Agricultural Research Service of the United States Department of Agriculture and the Organic Seed Alliance announce the joint release of Carrot Cultivars R6220 and R6636.

#### **Trait Background**

These carrots have demonstrated consistent production of uniformly red, smooth, sweet and mild-flavored storage roots.

#### **Breeding and Selection History**

Pre-1995- Development of lycopene red derivatives of (red x non-red) crosses: Intercrosses between carrots from Plant Introductions (PIs) with red roots of 'Kintoki' (PI264543, PI321688, PI321689) and dark orange roots, good-flavored orange roots, and purple-yellow roots of inbreds and breeding populations. F1 hybrids of these crosses were orange or yellow but never red. However red roots were observed to occur in segregating F2, F3, and F4 generations.

Development of (red x red) crosses: Intercrosses between carrots from PIs with red roots of 'Early Scarlet Wonder' (PI319858) from Japan, and 'Sa103' (PI432906) from China. F1 hybrids, F2, and F3 generations were all observed to be true breeding for red color.

1995 to 2001 – In 1995, lycopene red carrots derived from (red x non-red) crosses and from (red x red) crosses described above were grown at the Desert Research and Extension Center (DREC), Holtville, CA, roots were vernalized for 6-8 weeks, and stecklings were planted in a crossing isolation cage at the West Madison Agricultural Research Station (WMARS) in Madison, WI, along with red stecklings of 'Kintoki' (PI264543, PI321688, PI321689) and 'Sa101' (PI432903) from China. Half-sib seed was collected from each seed source in the cage and populations were advanced in 1996, 1997, and 2001. All progeny were true-breeding for red color in all seed stocks over all years. Roots from each population were selected for non-bolting floral initiation, red color, and smooth appearance.

Office of the Administrator  
Jamie L. Whitten Federal Building, Room 302-A  
1400 Independence Avenue, SW.  
Washington, D.C. 20250  
USDA is an Equal Opportunity Provider and Employer

2002 - These 4 generations of recombination from 1995 to 2001 which were undertaken to incorporate alleles for red color into diverse red, orange, and yellow genetic backgrounds. In 2002 plants from the half-sib family originally starting with the 'Early Scarlet Wonder' (PI319858) x 'Sa103' (PI432906) cross were caged at isolation 213-1 in a strain cross in WMARS along with plants at isolation 213-2 from an elite population with orange roots selected for excellent flavor. Half-sib seed was collected from each seed source.

2003 to 2019 - Starting with the F1 generation of this strain cross, roots from each population were selected for non-bolting floral initiation, red color, smooth appearance, and good flavor and were caged for seed production at WMARS. In subsequent generations seed was produced in WMARS, harvested from half-sib families, and grown in DREC.

After three generations of selection, seed originally derived from cage isolation 213-2 was at the F1MSM generation in the 2006 DREC root nursery plot 6220 was identified as having roots with uniform shape, red color, and superior flavor relative to the top fresh market orange carrots grown widely, and this selection was designated R6220. R6220 was advanced for four more generations of sibmating at WMARS with selection exercised for superior flavor, red color, and uniformity and is currently at the F1MSM5 generation.

After two generations of selection, seed derived from cage isolation 213-1 at the F2M generation in the 2006 DREC root nursery plot 6636 was identified as having roots with superior flavor, red color, and uniformity and designated R6636. R6636 was advanced for three additional generations of sib-mating at WMARS with selection exercised for superior flavor, red color, and uniformity and is currently at the F2M4 generation.

#### Root Appearance, Quality, and Crop Performance

Roots of R6220 are 24-29 cm long, slightly conical, and smooth with a red exterior and interior. Flavor is mild and sweeter than average fresh market carrots. Seed productivity is moderate, and no tendency toward early bolting has been observed. R6220 displays a moderate level of resistance to *Alternaria dauci* (*Alternaria* leaf blight) based upon evaluations made under natural field exposure to this disease in Wisconsin and is susceptible to warm-season root-knot nematodes (*Meloidogyne incognita*, *M. javanica*).

Roots of R6636 are 22-27 cm long, cylindrical to slightly conical, and smooth with a red exterior and interior. Flavor is mild and sweeter than average fresh market carrots such as Maverick and Propeel. Seed productivity is moderate, and no tendency toward early bolting has been observed. R6636 displays a moderate level of resistance to *Alternaria dauci* (*Alternaria* leaf blight) based upon evaluations made under natural field exposure to this disease in Wisconsin and is susceptible to warm-season root-knot nematodes (*Meloidogyne incognita*, *M. javanica*). R6636 was observed to be quite salinity tolerant during seed germination in recent studies (Bolton and Simon, *HortScience* 54:38-44, 2019), even though no selection was exercised for this trait during its development.

#### Seed Request Instructions, Field Evaluation Team Credits, and Acknowledgements

Seed of carrot R6220 and R6636 is available for distribution to plant breeders, geneticists,




pathologists and other research personnel upon written request to Philipp W. Simon, USDA, ARS, Vegetable Crops Research Unit, Dept. of Horticulture, 1575 Linden Drive, Madison, WI 53706. Seed samples of this release will be deposited into the National Plant Germplasm System where they will be held for long-term storage. It is requested that appropriate recognition be made if this germplasm contributes to the development of new breeding lines or cultivars.

The efforts of Micaela Colley, Laurie McKenzie, and Katie Miller of the Organic Seed Alliance, Erin Silva of the University of Wisconsin-Madison, Lori Hoagland of Purdue University, Tim Waters and Lindsey Du Toit of Washington State University, and Joe Nunez and Jaspreet Sidhu of the University of California Cooperative Extension, Bakersfield, CA, to grow and assist in evaluation of these inbreds are acknowledged. The efforts of Philip A. Roberts and William Matthews of the University of California - Riverside in nematode resistance evaluation are acknowledged and the efforts of Robert Kane (deceased), Thomas Horejsi, and Emily Martin-Millar of the USDA - ARS are acknowledged in seed production and field trialing. Funding from the National Institute of Food and Agriculture, U.S. Department of Agriculture, under awards number 2011-51300-30903 and 2016-51300-25721 (Carrot Improvement for Organic Agriculture, CIOA), the California Fresh Carrot Advisory Board is gratefully acknowledged.

ARS GIVES NO WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, FOR THE MATERIAL, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Signatures:

  
\_\_\_\_\_  
Program Director, Organic Seed Alliance  
Micaela Colley

Date 3/9/21

\_\_\_\_\_  
Acting Deputy Administrator, Crop Production and Protection  
Agricultural Research Service, U.S. Department of Agriculture

\_\_\_\_\_  
Date