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USDA 'Cascade': A Multiple Pest–Resistant, Rose-skinned, Creamy Yellow-fleshed Sweetpotato

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The sweetpotato [*Ipomoea batatas* (L.) Lam.] cultivar USDA Cascade was jointly developed by the US Department of Agriculture (USDA), Agricultural Research Service (ARS), US Vegetable Laboratory (Charleston, SC, USA), and the Washington State University, Northwestern Washington Research and Extension Center (Mount Vernon, WA, USA) to provide a wireworm-resistant sweetpotato for growers in the Pacific Northwest region (Wadl et al. 2025). 'Cascade' is a "dry-fleshed" type with light rose-colored skin and creamy yellow-colored flesh. The leaves of 'Cascade' are green, entire, and reniform to cordate, and vines exhibit vigorous growth with dense leaf canopies. 'Cascade' is highly resistant to root-knot nematodes and soil insect pests. The storage roots of 'Cascade' are long elliptic and uniformly shaped with good baking quality and are of similar dry matter content and flesh color to 'Liberty' (Jackson et al. 2011). 'Cascade' is less sweet than 'Covington', with an average Brix of 5.60 °Bx before curing and 7.70 °Bx after curing. Yields of 'Cascade' are similar to 'Ruddy' (Bohac et al. 2002). The baked roots of 'Cascade' are dry with a mild flavor and cook to a yellow color. Bedded and greenhouse grown roots of 'Cascade' produce an average of 15 uniform sprouts (slips) per root that transplant well. 'Cascade' is desirable for growers that serve markets that prefer a dry, mild-flavored sweetpotato and is suitable for organic growers and home gardeners.

Origin

'Cascade' was developed using a recurrent mass selection breeding scheme (Jones et al. 1986) in Charleston, SC and originated as a seedling from an unknown maternal parent from an open-pollinated polycross breeding nursery consisting of 27 parental clones in 1993. All parental clones were selected for high levels of multiple-pest resistance combined with desirable horticultural traits. Pollination was by naturally occurring insects. Its original designation was 94-145, and it was later designated W-390.

Description

'Cascade' has the following plant data characteristics (Huamán 1991):

Habit. The habit of 'Cascade' is spreading to extremely spreading vine type with the length of the main vines exceeding 1.5 m 90 d after planting (Fig. 1). The stems of the vines correspond to color charts as [7.5 (green-yellow) 7/10] (Munsell Color, New Windsor, NY, USA). The estimated percent groundcover recorded 5 weeks after transplanting (WAT) was between 50% and 90% in Charleston, SC and over 90% at 9 WAT in Mount Vernon, WA.

Fig. 1. Clockwise from upper left corner: growth habit and foliage, freshly harvest storage roots, storage roots after curing and 6 months of storage, and baked storage root.

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Table 1. Yield by grade and insect damage ratings of 'Cascade' compared with six sweetpotato cultivars grown in replicated trials.

	Avg yield ($t \cdot ha^{-1}$)[i]				Insect damage[ii]				
Cultivar	US no. 1	Canner	Jumbo	Total marketable	Clean (%)	Wireworm index	Sweetpotato flea beetle (%)	Grub (%)	Sweetpotato weevil (%)
					2007, Charleston, SC				
Cascade	1.5 b[iii]	2.1 a	0.0 b	3.6 b	91.9 a	0.076 c	0.0 c	0.0 b	0.6 c
Beauregard	4.2 b	0.4 b	1.1 b	5.7 b	16.2 c	1.068 a	10.6 bc	1.9 b	20.1 bc
Liberty	9.0 a	1.6 a	4.4 a	15.0 a	19.1 c	0.656 b	21.7 ab	6.3 b	44.2 ab
Ruddy	2.5 b	1.8 a	0.0 b	4.3 b	86.9 a	0.087 c	3.9 bc	1.9 b	0.5 a
SC1149-19	3.3 b	0.7 b	0.0 b	4.0 b	11.2 c	0.849 ab	40.8 a	17.3 a	49.4 a
Sumor	1.5 b	2.3 a	0.0 b	3.8 b	64.9 b	0.293 c	3.6 bc	0.6 b	9.8 c
					2008, Charleston, SC				
Cascade	0.4 c	3.9 bc	0.0	4.3 d	88.4 ab	0.028 b	1.2 b	6.4 cd	1.3 a-c
Beauregard	2.3 ab	5.7 ab	0.0	8.0 ab	46.2 d	0.400 a	3.2 b	30.1 b	1.6 ab
Liberty	2.9 a	3.8 c	0.0	6.7 bc	74.7 c	0.105 b	1.0 b	15.2 c	0.4 bc
Ruddy	0.3 c	4.3 bc	0.0	4.6 d	93.4 a	0.050 b	0.5 b	2.3 d	0.1 c
SC1149-19	3.7 a	6.3 a	0.0	10.0 a	28.6 e	0.435 a	18.9 a	45.6 a	2.0 a
Sumor	0.9 bc	2.5 c	0.0	3.4 d	76.7 bc	0.138 b	3.8 b	9.3 cd	0.1 bc
					2009, Charleston, SC				
Cascade	0.6 c	0.7 c	0.0	1.3 c	95.1 a	0.050 c	0.0 b	0.0 b	0.0 d
Beauregard	5.5 a	2.3 a	0.0	7.8 a	18.0 c	1.062 a	10.6 b	10.7 a	19.5 b
Liberty	2.4 b	1.3 b	0.0	3.7 b	60.5 b	0.252 bc	5.5 b	5.8 ab	13.1 bc
Ruddy	2.0 bc	1.3 b	0.0	3.3 b	89.1 a	0.075 c	0.0 b	1.7 b	4.2 cd
SC1149-19	5.4 a	1.5 b	0.0	6.9 a	11.7 c	1.036 a	39.6 a	9.1 a	47.3 a
Sumor	1.1 bc	1.5 b	0.0	2.6 bc	54.7 b	0.406 b	8.5 b	4.6 ab	1.1 d
					2010, Charleston, SC				
Cascade	0.8 ab	1.2 bc	0.0	2.0 ab	96.7 a	0.033 c	0.0 b	0.0	0.0 b
Liberty	2.6 a	1.0 c	0.0	3.6 a	71.4 b	0.273 b	2.0 b	0.5	3.2 b
Ruddy	0.0 b	0.6 c	0.0	0.6 b	99.4 a	0.006 c	0.0 b	0.0	0.0 b
SC1149-19	1.7 a	1.6 ab	0.0	3.3 a	27.1 c	0.678 a	33.8 a	0.5	10.1 a
Sumor	1.0 ab	1.8 a	0.0	2.8 a	89.2 a	0.100 bc	1.1 b	0.0	0.3 b
					2011, Charleston, SC				
Cascade	1.1 bc	0.0 b	1.9 bc	3.0 bc	76.4 a	0.241 cd	0.0 c	0.0 b	0.0
Beauregard	7.3 a	1.2 a	2.8 ab	11.3 a	23.7 c	0.911 a	24.1 a	4.2 a	0.0
Liberty	1.1 bc	0.0 b	1.2 c	2.3 c	47.7 b	0.453 c	13.5 b	0.0 b	0.0
Ruddy	0.3 c	0.0 b	1.6 c	1.9 c	88.1 a	0.066 d	6.8 bc	0.0 b	0.0
SC1149-19	2.2 bc	0.0 b	3.2 a	5.4 b	23.0 c	0.701 b	30.2 a	4.6 a	0.0
Sumor	2.4 b	0.0 b	1.9 c	4.3 bc	52.2 b	0.463 c	8.9 bc	0.0 b	0.0
					2016, Charleston, SC				
Cascade	1.5 b	1.5	0.2 bc	3.2 bc	63.7 a	0.380 c	1.6 bc	0.2 b	0.0
Beauregard	3.3 b	2.4	1.5 a	7.2 ab	37.6 ab	1.219 b	8.4 bc	2.2 b	0.0
Liberty	6.3 a	2.5	0.6 b	9.4 a	15.8 bc	1.408 b	13.5 b	7.6 a	0.0
Ruddy	1.4 b	1.2	0.0 c	2.6 c	50.7 a	0.532 c	1.5 c	0.4 b	0.0
SC1149-19	2.3 b	2.4	0.2 bc	4.9 bc	6.7 c	2.166 a	30.4 a	6.6 a	0.0
Sumor	1.5 b	1.7	0.1 bc	3.3 bc	58.9 a	0.417 c	5.7 bc	1.1 b	0.0
					2023, Mount Vernon, WA				
Cascade	14.3	6.3	0.0	20.6	nt[iv]	1.548 b	nt	nt	nt
Covington	20.3	4.7	1.6	26.6	nt	3.343 a	nt	nt	nt
					2024, Mount Vernon, WA				
Cascade	2.4 b	1.5	0.0	3.9 b	nt	1.378	nt	nt	nt
Covington	12.7 a	2.9	0.0	15.6 a	nt	2.723	nt	nt	nt

[i] Sizes of roots: US no. 1: 5.1–8.9 cm diameter, 7.6–22.9 cm long; canner: 2.5–5.1 cm diameter, 5.1–17.8 cm long; jumbo: larger than US no. 1 in diameter or length or both, and without objectionable defects.

[ii] Wireworm index: 1 = 1–5 scars, 2 = 6–10 scars, and 4 = >10 scars, averaged overall roots. Minimum score = 0.0 and maximum score = 4.0. A higher value indicates more wireworm damage occurred on the roots. Clean = percent of roots free of insect damage. Grub = primarily white grub.

[iii] Within a column, means followed by the same letter are not significantly different at $P \leq 0.05$ (n = four replicates) using Fisher's protected least significant difference test.

[iv] nt = not tested.

Foliage. Immature leaves are purple-bronze colored [10 R (red) 5/2], whereas the mature leaves are green colored [5 GY (green-yellow) 6/10] and shaped reniform to cordate with a single leaf lobe (Fig. 1). The mature leaf averaged 9.1 cm long from the basal lobe to the leaf tip.

Roots. Storage roots of 'Cascade' are uniform and long elliptic shaped with an attractive rose-colored skin [5 R (red) 7/8] at harvest that fades in storage to light rose color [5 YR (yellow-red) 9/6] and creamy yellow colored flesh [2.5 Y (yellow) 9/4] (Fig. 1). The baked roots of 'Cascade' are dry (average dry matter ~30%), with a mild flavor, and cook to a yellow color [7.5 Y (yellow) 9/8] (Fig. 1).

Flowers. Flowers are sparsely distributed with a white corolla and purple throat [5 RP (red-purple) 4/12]. The stigma is slightly exerted compared with the highest anther.

Production

Under Charleston, SC growing conditions, 'Cascade' was similar in yield to 'Ruddy' and 'Sumor' but lower in yield compared with 'Beauregard' and 'Liberty' (Table 1). Grown for 2 years using organic production methods with black polyethylene mulch under Mount Vernon, WA conditions, yields of 'Cascade' were variable (Table 1). In 2023, the marketable yield was similar to 'Covington', whereas in 2024, marketable yield was significantly lower than 'Covington'. This indicates that 'Cascade' has good yield potential for organic production, but performance may be dependent on the growing conditions of a specific state or region. 'Cascade' is a mid- to late-season cultivar with respect to root maturity and ready to harvest around 120 d. Storage roots store well at 12 to 16 °C and maintain quality for up to 1 year in long-term

Table 2. Summary of greenhouse bioassays conducted on 'Cascade' using different root-knot nematode species.

Cultivar	*n*	Mean galling (%)[i] ± *SE*	Mean eggs per gram of root[ii]	Classification[iii]
		Meloidogyne incognita (South Carolina isolate)		
Cascade	3	0.0 ± 0.0 b[iv]	0.0 ± 0.0 b	Resistant
Beauregard	8	37.5 ± 10.4 a	20,338.6 ± 6,679.7 a	Susceptible
		Meloidogyne incognita (North Carolina isolate)		
Cascade	3	0.0 ± 0.0 b	24.2 ± 17.7 b	Resistant
Beauregard	10	53.0 ± 5.3 a	5,040.0 ± 1,794 a	Susceptible
		Meloidogyne javanica (isolate VW4)		
Cascade	4	0.0 ± 0.0 b	0.0 ± 0.0 b	Resistant
Beauregard	10	48.0 ± 7.3 a	5,040.0 ± 1,794 a	Susceptible
		Meloidogyne arenaria (South Carolina isolate)		
Cascade	4	5.8 ± 4.8 a	0.0 ± 0.0 b	Moderately resistant
Beauregard	10	28.5 ± 7.0 a	816.5 ± 414.2 a	Susceptible
		Meloidogyne enterolobii (isolate SC.1)		
Cascade	4	21.8 ± 5.2 a	387.9 ± 30.7 a	Susceptible
Beauregard	7	39.2 ± 8.9 a	14,312.4 ± 30.7 a	Susceptible

[i] The percentage of the root system showing nematode induced galls.

[ii] The total number of nematode eggs per root system divided by the dry weight of that root system.

[iii] Clones were classified 'resistant' if they showed statistically significant reductions in both root galling and nematode eggs per gram of root compared with the susceptible control cultivar Beauregard, 'moderately resistant' if they showed significant reductions in only one metric, or 'susceptible' if they showed no significant reductions in either metric.

[iv] Within a column, means followed by the same letter are not significantly different at $P \leq 0.05$ using Tukey's honest significant difference test.

storage. Sprouting of field bedded storage roots is excellent and plant production (slips) is comparable to 'Beauregard' in Charleston. At Mount Vernon in a heated greenhouse (26.6 °C with heat mats), slip production of 'Cascade' was more prolific and faster than 'Covington'. 'Cascade' slip production averaged 6 weeks to generate 15 slips per root, whereas 'Covington' required 8 weeks to produce nine slips per root.

Disease Reactions

In replicate greenhouse bioassays, 'Cascade' was resistant or moderately resistant to three of the most common species of root-knot nematode species in the southeastern United States, including the southern root-knot nematode (*Meloidogyne incognita*), the Javanese root-knot nematode (*M. javanica*), and the peanut root-knot nematode (*M. arenaria*). 'Cascade' showed significant reductions in percent root galling and/or nematode eggs per gram of root compared with the susceptible control 'Beauregard' (Table 2). Although it was found to be susceptible to guava root-knot nematode (*M. enterolobii*), it did show a nonsignificant 97% reduction in nematode eggs per gram of root and a 56% reduction in the mean percent root galling compared with the susceptible control 'Beauregard' (Table 2). No other disease reactions were tested.

Insect Response

In 6 years of field tests in Charleston, SC (Table 1), storage roots of 'Cascade' were significantly less damaged by soil insect pests than the highly susceptible 'SC1149-19' and 'Beauregard' and the intermediately resistant 'Liberty'. Insect damage of 'Cascade' was statistically similar to the insect-resistant cultivars Ruddy and Sumor. In field tests in Mount Vernon, WA (Table 1), 'Cascade' had significantly lower wireworm damage compared with 'Covington' in 2023, whereas in 2024, wireworm damage of 'Cascade' was half that of 'Covington' but statistically similar. Methods of testing and evaluation were previously described (Jackson and Bohac 2006; Jones et al. 1986).

Availability

Foundation seed roots, slips, and cuttings of 'Cascade' will be available in limited quantities to breeders, other researchers, and growers. Requests for plant material should be made to Dr. Phillip Wadl, USDA, ARS, US Vegetable Laboratory, 2700 Savannah Highway, Charleston, SC 29414, USA (e-mail: phillip.wadl@usda.gov) or Dr. Carol Miles, Washington State University, Northwestern Washington Research and Extension Center, 16650 State Route 536, Mount Vernon, WA 98273, USA (e-mail: milesc@wsu.edu). Genetic material of 'Cascade' has been deposited and assigned as PI 666141 in the Sweetpotato Clonal Repository, Plant Genetic Resources Conservation Unit (PGRCU), 1109 Experiment Street, Griffin, GA 30223, USA, where it will be available for research purposes, including the development and commercialization of new cultivars. The material placed in storage at the PGRCU was virus tested tissue culture plantlets that tested negative for *Sweetpotato virus G* (SPVG), *Sweetpotato virus C* (SPVC), *Sweetpotato virus feathery mottle virus* (SPFMV), *Sweetpotato virus 2* (SPV2), *Sweetpotato chlorotic stunt virus* (SPCSV), *Sweetpotato leaf curl virus* (SPLCV), *Sweetpotato collusive virus* (SPCV), and *Sweetpotato vein clearing virus* (SPVCV). It is requested that appropriate recognition be made if 'Cascade' is used in catalogue descriptions or contributes to the development of a new cultivar(s), germplasm release(s), and/or scientific discovery(s).

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