

# 'Neptune', a Heat-tolerant, Bacterial-wilt-tolerant Tomato

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'Neptune' is an open-pollinated, determinate, heat-tolerant, fresh-market tomato (*Lycopersicon esculentum* Mill.) with partial resistance, hereafter referred to as tolerance, to bacterial wilt (*Pseudomonas solanacearum* E.F. Smith). In several years of testing, it has had a high level of tolerance to biovar 1 race 1 of the pathogen, which is prevalent in Florida.

## Origin

'Neptune' was tested as Fla. 7421. Seed was increased in the F<sub>11</sub> generation after a cross of a heat-tolerant line with a bacterial-wilt-tolerant line (Fig. 1). Hawaii 7997 was the source of bacterial wilt resistance. It was crossed with line 645, which later became 'Florida 1C' (Augustine et al., 1981). Heat

tolerance was primarily derived from Cl 11d, which was developed at the Asian Vegetable Research and Development Center, Taiwan, and 'Campbell 28'. Almost all selections leading to 'Neptune' were made in the summer under hot and rainy weather that was ideal for selecting for heat tolerance, bacterial wilt tolerance, and crack resistance.

## Description

'Neptune' has a determinate vine that generally provides good fruit cover. Vines are quite similar to those of 'Campbell 28'. Fruit set is concentrated and of early season maturity, similar to 'Solar Set'. Fruit have jointed

pedicels and are medium in size. Shoulders are light green and have excellent crack and rain-check tolerance. Blossom scars are irregular and sometimes enlarged, especially on fruit at the base of the plant. Fruit generally ripen well, but some uneven ripening occurs. In Fall 1993, external and internal red pigmentation ("a" value) was similar to fruit of 'Solar Set' and 'Campbell 28' and higher than for 'Sunny' (Table 1). The internal yellow pigment component ("b" value) for 'Neptune' exceeded those for the other cultivars. Soluble solids concentration was similar to that of 'Solar Set', 'Campbell 28', and 'Sunny'. Citric acid concentration of 'Neptune' was similar to that of 'Solar Set' and 'Campbell 28' but higher than for 'Sunny' (Table 1). There were no significant differences in the soluble solids : citric acid ratio. 'Neptune' fruit were firmer than those of 'Campbell 28' and similar to those of 'Solar Set' and 'Sunny' (Table 1). Over several seasons, field ratings by J.W.S. and a technician indicated flavor was good (scale = poor, fair, good, very good, excellent). 'Neptune' sometimes expresses blossom-end rot, but it has not been a major problem under Florida conditions. Early yield for 'Neptune' was less than for 'Solar Set' in Spring 1993, but higher than 'Sunny' and 'Caraibo' (Table 2). In Spring and Fall 1993 trials, 'Neptune' had higher total marketable yield and fewer culls than 'Caraibo', a bacterial-wilt-tolerant cultivar from Guadeloupe (Table 2). Total marketable yield for 'Neptune' was similar to that for 'Solar Set' and 'Sunny' in spring and

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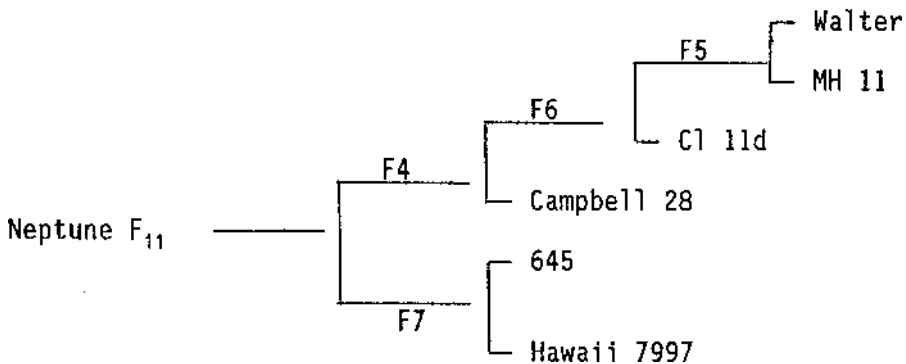


Fig. 1. Pedigree of 'Neptune' tomato.

Table 1. External and internal color, soluble solids (SSC) and citric acid concentrations, and firmness for 'Neptune' and other tomato cultivars grown at Bradenton, Fla., in Fall 1993.<sup>z</sup>

Cultivar	Fruit color <sup>y</sup>						SSC (%)	Citric acid (%)	SSC : acids <sup>x</sup>	Firmness (mm deformation) <sup>w</sup>
	External			Internal						
	L	a	b	L	a	b				
Neptune	41.1 a <sup>v</sup>	20.1 a	23.6 b	43.0 ab	19.1 a	21.1 a	3.9 ab	0.46 a	8.34	6.8 b
Campbell 28	36.9 b	18.2 ab	22.0 b	39.5 b	17.8 ab	18.5 b	3.7 ab	0.45 ab	8.25	8.1 a
Solar Set	39.9 a	21.3 a	26.7 a	43.2 ab	19.3 a	18.3 b	4.0 a	0.50 a	8.03	6.2 b
Sunny	37.1 b	16.0 b	22.7 b	43.9 a	16.3 b	19.3 b	3.5 b	0.39 b	9.08	7.3 ab
									NS	

<sup>z</sup>Fruit harvested at breaker stage and ripened to table-ripe for noncolor variables. Measurements of fruit color were obtained from fruit harvested at the table-ripe stage.

<sup>y</sup>Data taken with a Minolta CR-300 chromameter; higher "L" numbers indicate lighter color (value), higher "a" and "b" numbers indicate more red and yellow pigmentation (hue), respectively.

<sup>x</sup>percent SSC : percent citric acid.

<sup>w</sup>Determined with an Institute of Food and Agricultural Sciences pressure tester using a 1-kg weight for 5 sec with a fruit contact plate 1.5 cm in diameter. Pressure applied over a locule in equatorial plane. Lower values indicate greater firmness.

<sup>v</sup>Mean separation in columns by Duncan's multiple range test at P ≤ 0.05.

<sup>ns</sup>Nonsignificant.

Table 2. Yield, fruit weight, and percentage of culls for 'Neptune' and other tomato cultivars grown in Spring and Fall 1993, at Bradenton, Fla.

Cultivar	Spring 1993				Fall 1993 <sup>z</sup>			
	Marketable yield (kg/plant)		Fruit wt (g)	Culls (%)	Marketable yield (kg/plant)		Fruit wt (g)	Culls (%)
	Early	Total			Early	Total		
Solar Set	1.05 a <sup>y</sup>	9.45 a	177 a	18 b	0.50	1.91 a	149 ab	12 bc
Sunny	0.41 c	7.42 a	151 b	25 b	0.09	1.18 ab	171 a	21 b
Neptune	0.75 b	6.82 a	136 bc	25 b	0.66	1.83 a	123 b	10 c
Caraibo	0.31 d	2.43 b	126 c	72 a	0.33	0.65 b	111 b	37 a
NS								

<sup>z</sup>Fall yields and fruit weight were reduced by infection with tomato mottle virus.

<sup>y</sup>Mean separation in columns by Duncan's multiple range test at  $P \leq 0.05$ .

<sup>ns</sup>Nonsignificant.

fall (Table 2). Cull percentages for 'Neptune' were similar to those of 'SolarSet' and 'Sunny' in the spring. In the fall, cull percentages were similar to those for 'Solar Set' but lower than for 'Sunny'. 'Neptune' fruit weighed less than 'Solar Set' fruit in the spring and 'Sunny' fruit in the fall, but about equalled that of 'Sunny' and 'Caraibo' in the spring and 'Solar Set' and 'Caraibo' in the fall.

**Disease resistance**

In commercial fields infested with the bacterial wilt pathogen, 'Neptune' had significantly less bacterial wilt than susceptible 'Solar Set' and was similar in this respect to other bacterial-wilt-tolerant cultivars ('Caravel', 'Capitan', 'Calinago') and accessions (Hawaii 7997, CRA 66, Ga 219, Ga 1565) (Table 3). In a separate study also conducted in a bacterial-wilt-infested field, 3% of the 'Nep-

tune' plants were diseased compared to 36% of the 'SolarSet' plants (Chellemi et al., 1993). Over several years, 'Neptune' has had a tolerance level similar to released tolerant cultivars but less than the accessions listed above (data not shown). The suitability of this tolerance will depend on the race of the pathogen and the severity of the infection. Only race 1, biovar 1 of *P. solanacearum* is found in regions where 'Neptune' was evaluated (Chellemi et al., 1994).

'Neptune' is also resistant to fusarium wilt races 1 and 2 [*Fusarium oxysporum* Schlecht f. sp. *lycopersici* (Sacc.) Snyder and Hansen], verticillium wilt race 1 (*Verticillium dahliae* Kleb.), and gray leafspot (*Stemphyllium solani* Weber).

**Availability**

'Neptune' is an open-pollinated (pure line)

Table 3. Bacterial wilt incidence for selected tomato cultivars grown in a bacterial-wilt-infested field in Gadsden County, Fla., Fall 1993.

Genotype	Disease incidence (%)
Hawaii 7997	0.0 b <sup>z</sup>
CRA 66	0.0 b
Ga. 219	0.0 b
Ga. 1565	2.5 b
Caravel	13.1 b
Capitan	20.0 b
Neptune	22.5 b
Calinago	39.3 ab
Solar Set	70.3 a

<sup>z</sup>Mean separation in columns by Duncan's multiple range test at  $P \leq 0.05$ .

release. Distribution of seed is through the Florida Foundation Seed Producers, P.O. Box 309, Greenwood, FL 32443.

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