

TOMATO (*Lycopersicon esculentum*)
Late blight; *Phytophthora infestans*
Powdery mildew; *Oidium lycopersicum*
Septoria leaf spot; *Septoria lycopersici*

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Evaluation of late blight resistance in tomato cultivars and an experimental hybrid, 2014.

The experiment was conducted at the Long Island Horticultural Research and Extension Center in Riverhead, NY, in a field with Haven loam soil that has been dedicated to organic research since 2001. A combination of Pro-Grow, Cheep Cheep, and Cotton seed blend fertilizers was spread at 700 lb/A (105 lb/A total N) over rows to be planted, then incorporated on 28 Apr. Drip irrigation tape was laid as the rows were covered with black plastic mulch. A living mulch of annual ryegrass was planted between rows by broadcasting seed with a hand-operated spreader, then lightly raking to incorporate on 6 May. The ryegrass plus weeds that grew were mowed routinely. Some weeds were removed by hand. Tomato seed were sown in an organic seeding mix in the greenhouse on 23 May. Seedlings were transplanted by hand on 30 Jun into holes pre-made by a waterwheel transplanter that also applied starter fertilizer, Neptune's Harvest Benefits of Fish (2-4-1 N-P-K). Additional drench applications of this fertilizer to the base of plants were made on 8, 15, and 29 Aug, and 5 and 12 Sep. A completely randomized block design with four replications was used. Plots consisted of 10 plants in a single row with 24-in. plant spacing and 68-in. row spacing. Plots for each of the four replications were in single adjacent rows. A yellow cherry-type tomato plant (cv. SunGold) separated plots within rows. This cultivar was also planted in a spreader row between the second and third replication. Single plots of cultivars Clackamas Blueberry, Fahrenheit Blues, Blue Pitts, and Stripe of Yore were planted next to the experiment; limited seed prevented replication. Plants were staked and trellised using a Florida weave trellising system with 4-ft stakes according to standard commercial practices. Water was provided as needed through the drip tape. Thrips, tomato fruit worms, and other insect pests were managed by applying Entrust (8 oz/A) on 17 and 25 Jul, 4 Aug, and 2 Sep. Leaves were examined for symptoms of any foliar disease 16 times from 16 Jul to 8 Oct. Late blight and other diseases observed were assessed by estimating the percentage of leaves in each plot with symptoms (incidence) and the severity of symptoms on these affected leaves. Canopy severity was calculated by multiplying these values. Area Under Disease Progress Curve (AUDPC) was calculated for late blight severity from 17 Sep through 8 Oct. All diseases resulted from natural inoculum. Ripe fruit were harvested on 26 Aug, 8, 15, 23, and 30 Sep and 8 Oct. Green fruit were also harvested on 8 Oct. Fruit quality attributes assessed included taste rated on a 1-5 scale with 5 being excellent. Average monthly high and low temperatures (°F) were 79/60 in Jun, 82/67 in Jul, 81/64 in Aug, 77/61 in Sep, and 66/53 in Oct. Rainfall (inches) was 2.47, 2.24, 2.42, 1.86, and 5.43 for these months, respectively.

Late blight was first observed on 20 Jun on Long Island, NY. Very few symptoms were found that day in a commercial potato crop in Suffolk County located about 5 miles from the research field for this experiment. Source of inoculum for this crop could not be determined. Symptoms were found in three additional crops before being found in this experiment on 15 Aug. US-23 was the only genotype of *P. infestans* found in the region, including at LIHREC. Late blight became moderately severe on the late blight-susceptible cultivar (Mountain Fresh Plus), reaching 52% leaves with symptoms and 46% canopy severity on 22 Sep. Subsequently many leaves died. Defoliation was 94% on 8 Oct. Late blight severity was significantly and substantially less on all cultivars when compared to Mountain Fresh Plus, including Pruden's Purple and Wapsipinicon Peach, which were not bred to be resistant but were less severely affected by late blight in other experiments. No symptoms of late blight were observed on cv. Mountain Merit (red slicer type fruit) or Mountain Magic (campari type), which are both heterozygous for *Ph2* and *Ph3* major genes for resistance. Plum Regal is homozygous for *Ph3*. Powdery mildew and Septoria leaf spot were both most severe on Wapsipinicon Peach and least severe on Mountain Magic. JTO 1175, an experimental cultivar from Johnny's Selected Seeds, exhibited the least defoliation on 29 Sep, but this was only significantly different from Pruden's Purple and Wapsipinicon Peach. Late blight symptoms were also not found in the non-replicated plantings (single plots) of four varieties developed by Tom Wagner: Clackamas Blueberry, Fahrenheit Blues, Blue Pitts, and Stripe of Yore. Seed of these were provided by a local grower-breeder who felt they might have resistance from her observations.

Entry name	Disease severity (% canopy affected) ^z						Defoliation (%) ^z	Yield ^x (no./plant)
	Late blight		Powdery mildew		Septoria leaf spot			
	17 Sep	AUDPC ^y	17 Sep	AUDPC	29 Sep	AUDPC		
Mountain Fresh Plus	33.4 a	377.3 a	8.4 c	383.2 bc	2.8	7.6 ab	46.3 ab	18.7 cd
Pruden's Purple	1.2 b	10.1 b	14.6 bc	248.9 cd	1.4	1.9 bc	50.0 a	9.3 d
Wapsipinicon Peach	0.8 b	1.8 b	64.0 a	1499.6 a	1.6	2.6 a	50.0 a	40.6 bc
JTO 1175	1.0 b	9.2 b	1.7 c	255.2 cd	0.6	0.4 b	5.5 b	47.3 b
Plum Regal	0.4 b	1.5 b	2.6 c	257.6 cd	2.1	4.3 ab	17.8 ab	48.8 b
Mountain Merit	0.0 b	0.0 b	45.5 ab	934.8 ab	2.6	6.9 ab	38.8 ab	17.9 cd
Mountain Magic	0.0 b	0.0 b	0.2 c	23.8 d	0.1	0.0 c	15.0 ab	148.4 a
<i>P-value</i>	<i>0.0001</i>	<i>0.0001</i>	<i>0.0001</i>	<i>0.0001</i>	<i>0.6601</i>	<i>0.0001</i>	<i>0.0069</i>	<i>0.0001</i>

^z Numbers in each column with a letter in common are not significantly different from each other (Tukey's HSD, $P=0.05$).

^y All presented AUDPC values were square root transformed before analysis. Table contains de-transformed values.

^x Yield includes marketable and unmarketable fruit, which included those that had rotted, split, or were damaged by insect feeding plus unripe fruit present at last harvest. Fruit were harvested once a week starting on 26 Aug.