

Evaluation of late blight resistant tomato cultivars and experimental hybrids on Long Island, 2012.

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 research on organically-produced crops since 2001. Pro-Grow 5-3-4 organic fertilizer at 2000 lb/A (100 lb/A N) was spread over rows to be planted, then incorporated on 29 Jun. Next, drip tape was laid as the rows were covered with black plastic mulch. Annual ryegrass was planted between rows of plastic mulch to establish a living mulch by broadcasting seed with a hand-operated spreader, then lightly raking to incorporate on 7 Jun. 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 6 Jun. Seedlings were transplanted by hand on 5 Jul into holes opened in the plastic mulch by a waterwheel transplanter that also placed in the holes a starter fertilizer, Neptune's Harvest Benefits of Fish (2-4-1 N-P-K). 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. A yellow cherry-type tomato plant (cv. Sungold) separated plots within rows. Plots for each of the four replications were in three adjacent rows. Following standard procedure for fresh-market tomato production on Long Island, plants were staked and trellised as they grew using the Florida weave trellising system with 4-ft stakes placed between plants. Water was provided as needed through drip tape laid beneath the plastic mulch. Insect pests were managed by applying Entrust (2 oz/A) on 7 Aug, 14 Aug, and 7 Sep. Fungicides approved for organic production were applied to all plots to suppress late blight after finding symptoms in the plots. The copper fungicide Badge X2 (1.75 lb/A) was applied with Actinovate AG (12 oz/A) on 14 Aug and 22 Aug, and with Regalia (2 qt/A) on 17 Aug, 31 Aug and 7 Sep. Sonata ASO (3 qt/A) was also applied on 7 Sep. The onset of late blight was considered to be at a time in the growing season that left unmanaged it could adversely affect other experiments and commercial crops nearby. All applications were made using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 68 gal/A at 65 psi and 2.3 mph. Leaves were examined for symptoms of any foliar disease eight times from 31 Jul to 12 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 20 Aug through 19 Sep for all entries, and also through 12 Oct for entries exhibiting resistance. Ripe fruit were harvested on 11, 18, and 27 Sep and 3 Oct. Fruit quality attributes assessed included taste rated on a 1-5 scale with 5 being excellent. Yield was not measured for the two entries with cherry-type fruit. Average monthly high and low temperatures (°F) were 85/68 in Jul, 83/67 in Aug, 75/60 in Sep, and 66/52 in Oct. Rainfall (inches) was 4.35, 3.24, 3.75, and 2.17 for these months, respectively.

Late blight started to develop early in 2012 in Suffolk County on Long Island, NY. First symptoms were found on 29 May in a commercial potato crop. Symptoms were found in this experiment on 31 Jul. US-23 was the only genotype of *P. infestans* found in the region, including at LIHREC. Excellent resistance was exhibited through late Aug by all entries with *Ph2* and/or *Ph3* major genes for resistance, which were Plum Regal (homozygous *Ph3*), JTO-545 (heterozygous *Ph3*), Legend OP (*Ph2*), Matt's Wild Cherry (undetermined resistance, possibly *Ph3*), Jasper (undetermined resistance), and Defiant PHR, Mountain Magic, Mountain Merit, and three experimentals from the Cornell University Dept of Plant Breeding (all heterozygous *Ph2* + *Ph3*). Late blight became severe in New Yorker (*Ph1*). Late blight did not differ significantly in severity from any of the varieties without major resistance genes, which were Mountain Fresh Plus, Juliet and Brandywine. Legend, the only entry with just the *Ph2* gene, was numerically, but not significantly, more severely affected by late blight than the other resistant entries, except at the last assessment when extensive defoliation may have affected ratings. Plum Regal and JTO-545, the two entries with just the *Ph3* gene, were numerically more severely affected by late blight than the other resistant entries at all assessments. The difference was significant at the last assessment (12 Oct), which was 35 days after the last fungicide application for late blight. In conclusion, best suppression of the US-23 genotype was achieved with tomato possessing both the *Ph2* and *Ph3* resistance genes. Only a few fruit with symptoms of late blight were observed on these entries. Powdery mildew and Septoria leaf spot developed to a very limited extent in this experiment. Most tomatoes evaluated produce red slicer-type fruit. Juliet, Plum Regal and JTO-545 are plum types. Mountain Magic is a campari type. Matt's Wild Cherry and Jasper are cherry types. Fruit of Defiant PHR started to ripen before other non-cherry entries. It was the only one with ripe fruit at the first harvest on 11 Sep with an average of 2.7 fruit/plant.

Cultivar or experimental (resistance; fruit type) ^y	Late blight canopy severity (%) ^z					
	20 Aug	29 Aug	14 Sep	19 Sep	AUDPC ^x	12 Oct
Mountain Fresh Plus (none; red slicer).....	75.0 a	52.5 ab	67.5 ab	72.3 ab	2294.4 a	ND
Brandywine (none; red slicer).....	50.5 ab	47.3 ab	76.3 ab	85.0 a	2169.2 a	ND
Juliet (none; small plum).....	70.0 a	37.8 abc	41.3 bcd	38.9 bcd	1703.6 ab	ND
New Yorker OP (<i>Ph1</i> ; red slicer).....	74.3 a	55.6 a	88.8 a	59.5 abc	2522.6 a	ND
Legend OP (<i>Ph2</i> ; red slicer).....	26.6 bc	18.9 bcd	42.8 bc	33.5 cde	906.0 bc	32.0 b
JTO- 545 (<i>Ph3</i> ; plum).....	18.4 c	11.8 cd	22.0 cd	17.3 de	502.9 c	75.5 a
Plum Regal (<i>Ph3</i> ; plum).....	11.3 c	12.7 cd	17.3 cd	13.5 de	428.5 c	81.3 a
Mountain Magic (<i>Ph2</i> + <i>Ph3</i> ; campari).....	0.3 c	0.1 d	0.1 d	0.1 e	3.2 d	0.0 c
Jasper (unknown; cherry).....	1.8 c	0.2 d	1.9 cd	0.1 e	25.0 d	17.8 bc
Matt's Wild Cherry (unknown - <i>Ph3?</i> ; cherry).....	0.2 c	0.3 d	0.1 d	0.1 e	4.6 d	5.8 bc
Mountain Merit (<i>Ph2</i> + <i>Ph3</i> ; red slicer).....	0.2 c	1.9 d	0.1 d	0.2 e	15.0 d	5.0 bc
Defiant PHR (<i>Ph2</i> + <i>Ph3</i> ; red slicer).....	0.2 c	0.2 d	0.6 d	0.0 e	8.9 d	5.5 bc
NC123S x CU-TR5 ^w (<i>Ph2</i> + <i>Ph3</i> ; red slicer).....	0.3 c	0.7 d	0.5 d	0.2 e	14.4 d	29.6 b
NC123S x CU-TR3 ^w (<i>Ph2</i> + <i>Ph3</i> ; red slicer).....	0.1 c	0.1 d	0.1 d	0.0 e	1.2 d	11.5 bc
Brandywine x CU-TR3 ^w (<i>Ph2</i> + <i>Ph3</i> ; red slicer).....	0.0 c	0.1 d	0.1 d	0.0 e	1.3 d	0.3 c
<i>P</i> -value (treatment)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

^z Numbers in each column followed by the same or no letter are not significantly different from each other (Tukey's HSD, $P=0.05$).

^y Entries are listed based on a combination of severity, resistance genes, and fruit type.

^x AUDPC values were square root transformed before analysis. Table contains de-transformed values.

^w Experimental developed by Cornell University Department of Plant Breeding listed as 'female pedigree' X 'male pedigree'.