

PEPPER, BELL (*Capsicum annuum*)  
Phytophthora blight, *Phytophthora capsici*

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### **Evaluation of pepper breeding lines and cultivars for *Phytophthora*-tolerance in southern New Jersey, 2009.**

These experiments, arranged as a randomized complete block design with 4 replications, were conducted in a field artificially-infested with *Phytophthora capsici* at the Rutgers Agricultural Research and Extension Center (RAREC), Bridgeton, New Jersey and in a field naturally- infested with *Phytophthora capsici* at the Martino farm in Vineland, New Jersey. Bell pepper seeds were obtained from cooperating agencies, treated on 13 with a solution of 4 parts water to 1 part Clorox and seeded on 14 April into 128-cell trays. On 27 May at RAREC, bell pepper breeding lines or cultivars were hand transplanted into double rows (18" in row) on black plastic mulch on 5 ft centers (18 plants per plot) with drip irrigation. Treatment plots were 15 ft long with guard rows of *Phytophthora*-susceptible bell pepper 'Alliance' planted on the outside of plots at RAREC. Fertility schedule and management of insect and weeds were done according to local recommendation guidelines. Although research trial was established in a field with a known history of *P. capsici* pressure from the disease was low in the early stages of this trial. Therefore, on 30 Jul and 6 Aug, sporangia were washed from the surface of infected cucumber fruit into ~2 gallons of water. Water containing sporangia was filtered through layered cheese cloth five times to remove any large organic matter and debris and then subsequently injected during scheduled irrigation on the above dates.

Each week, the number of *Phytophthora*-infected plants (out of a total number of 18) were counted and recorded from each plot. All mature pepper fruit from 15 ft of each treatment row were harvested on 5 and 18 Aug. All fruit were graded, separated and weighed for statistical analysis. Rainfall for the months of Jun, Jul and Aug were 5.02, 2.42 and 8.04 in., respectively.

Marketable yield varied significantly among cultivars and breeding lines at harvest 1 (Table 1). The best performing breeding lines included IL7057 at 513 boxes/A, S8302 at 490 boxes/A, IL7059 at 441 boxes/A and ACR283 at 441boxes/A and were comparable to Alliance at 549 boxes/A, Aristotle at 510 boxes/A, Declaration at 498 boxes/A and Revolution at 485 boxes/A (Table 1). Camelot, Snapper, Enza #1 and Enza #3, and ACR75312 and ACR75230 were among the lowest yielding cultivars and breeding lines at harvest 1 (Table 1). Percents skin separation, or 'silvering' was negligible at harvest 1 across all cultivars and/or breeding lines (Table 1).

Marketable yield varied significantly among cultivars and breeding lines at harvest 2 (Table 2). The best performing breeding lines were ACR75312 at 260 boxes/A, ACR285at 206 boxes/A, Enza#4 at 198 boxes/A, and Enza#2 at 172 boxes/A (Table 2). Alliance, Intruder and Declaration were among the lowest yielding cultivars at harvest 2 (Table 2). Percents skin separation, or 'silvering' was negligible at harvest 2 across all cultivars and/or breeding lines (Table 2).

There were no significant differences in AUPDC values among cultivars and breeding lines (Table 3). The artificial inoculation of the field with *P. capsici* via drip irrigation killed a large percentage of the standard phytophthora-resistant cultivars 'Paladin' and 'Aristotle' in this trial determining pressure due to crown rot phase of phytophthora blight was severe (Figure 1).

Table 1. Number and weight of good fruit, fruit with silvering, and marketable fruit and boxes/A at harvest 1 in southern New Jersey in 2009.

Cultivar/Breeding Line	Good Fruit <sup>z</sup>		Fruit with Silvering <sup>y</sup>		Marketable <sup>x</sup>		Boxes/A <sup>w</sup>
	No.	Wt.	No.	Wt.	No.	Wt.	
Alliance	69.25	27.89	0.00	0.00	66.00	26.51	549.03
IL 7057	58.50	24.62	0.25	0.17	58.75	24.78	513.35
Aristotle (X3R)	64.25	24.42	0.75	0.21	65.00	24.63	510.14
Declaration	59.75	24.01	0.00	0.00	59.75	24.01	498.28
0992-8302	57.50	23.68	0.00	0.00	57.75	23.68	490.46
Revolution	50.50	23.45	0.00	0.00	50.50	23.45	485.80
IL 7059	61.25	22.33	0.00	0.00	61.25	22.33	462.50
ACR 283	51.00	20.41	2.00	0.92	53.00	21.33	441.84
Enza #4	63.25	21.17	0.00	0.00	63.25	21.17	438.57
0996-7922A	57.25	20.88	0.00	0.00	57.25	20.88	432.57
Paladin	61.25	20.66	0.00	0.00	61.25	20.66	428.01
0994-1819	49.25	20.52	0.00	0.00	49.25	20.52	425.16
Enza #2	53.25	20.29	0.00	0.00	53.25	20.29	420.34
Intruder	48.25	19.51	0.25	0.09	48.50	19.59	405.95
ACR 285	55.00	18.64	0.00	0.00	55.00	18.64	386.01
ACR 75229	52.75	17.77	0.00	0.00	52.75	17.77	368.88
Enza #1	45.75	17.62	0.00	0.00	45.75	17.62	364.88
Enza #3	48.25	16.38	0.00	0.00	48.25	16.38	339.20
Snapper	40.75	15.56	0.00	0.00	40.75	15.56	322.31
ACR 75312	43.00	14.17	0.00	0.00	43.00	14.17	293.52
ACR 75230	40.25	13.01	0.00	0.00	40.25	13.06	270.43
Camelot	38.00	12.99	0.00	0.00	38.00	12.99	268.98
LSD	18.22	7.15	1.29	0.58	18.59	7.32	151.72

<sup>z</sup> Number and weight (in lbs/15 ft plot) of harvested good fruit which equals all marketable extra-large, large and medium size fruit without 'silvering'.

<sup>y</sup> Number and weight (in lbs/15 ft plot) of fruit with visible 'silvering' on surface.

<sup>x</sup> Number and weight (in lbs/15 ft plot) of marketable fruit which includes all good and fruit with silvering.

<sup>w</sup> Average number of 28 lb. boxes/acre.

Means within a column followed by the same letter are not statistically different from each other, Fisher's Protected LSD ( $P = 0.05$ ).

Table 2. Number and weight of good fruit, fruit with silvering, and marketable fruit and boxes/A at harvest 2 in southern New Jersey in 2009.

Cultivar/Breeding Line	Good Fruit		Fruit with Silvering		Marketable		Boxes/A
	No.	Wt.	No.	Wt.	No.	Wt.	
Aristotle (X3R)	32.75	12.56	0.25	0.03	33.00	12.59	260.84
ACR 75312	34.25	12.09	0.00	0.00	34.25	12.09	250.38
ACR 285	29.00	9.57	2.00	0.38	31.00	9.94	206.00
Enza #4	27.25	9.60	0.00	0.00	27.25	9.60	198.91
Enza #2	24.50	8.24	0.75	0.07	25.25	8.31	172.08
Snapper	19.75	7.39	0.25	0.09	20.00	7.48	154.84
Camelot	19.00	6.82	0.00	0.00	19.00	6.82	141.27
0992-8302	16.25	6.49	0.00	0.00	16.25	6.49	134.33
0994-1819	16.50	6.43	0.25	0.03	16.75	6.46	133.71
IL 7059	16.00	6.14	0.00	0.00	16.00	6.14	127.24
Paladin	17.00	5.85	0.75	0.06	17.75	5.91	122.32
Enza #3	18.25	5.77	0.00	0.00	18.25	5.77	119.42
Enza #1	16.25	5.51	0.00	0.00	16.25	5.51	114.24
Revolution	11.25	4.31	0.00	0.00	11.25	4.31	89.18
ACR 75229	15.25	4.23	0.00	0.00	15.25	4.23	87.67
0996-7922A	10.00	4.03	0.00	0.00	10.00	4.03	83.38
ACR 283	11.00	3.89	0.00	0.00	11.00	3.89	80.48
Alliance	10.50	3.72	0.00	0.00	10.50	3.72	77.06
IL 7057	8.50	2.56	0.00	0.00	8.50	2.56	53.03
ACR 75230	10.00	2.37	0.00	0.00	10.00	2.37	48.99
Intruder	7.00	2.19	0.25	0.03	7.25	2.21	45.83
Declaration	6.25	2.03	0.00	0.00	6.25	2.03	42.00
LSD	19.49	7.24	0.92	0.14	19.39	7.26	150.47

<sup>z</sup> Number and weight (in lbs/15 ft plot) of harvested good fruit which equals all marketable extra-large, large and medium size fruit without 'silvering'.

<sup>y</sup> Number and weight (in lbs/15 ft plot) of fruit with visible 'silvering' on surface.

<sup>x</sup> Number and weight (in lbs/15 ft plot) of marketable fruit which includes all good and fruit with silvering.

<sup>w</sup> Average number of 28 lb. boxes/acre.

Means within a column followed by the same letter are not statistically different from each other, Fisher's Protected LSD ( $P = 0.05$ ).

Table 3. Cultivar or breeding line, company name and the percentage of plants killed by *P. capsici* by rating date and AUDPC values at RAREC in 2009.

Cultivar/ Breeding Line	Company	1-Jul	8-Jul	15-Jul	24-Jul	31-Jul	7-Aug	13- Aug	20- Aug	27- Aug	3-Sep	9-Sep	16- Sep	24- Sep	30- Sep	AUDPC Value
Alliance	Harris Moran	0.00	0.00	0.00	0.00	0.00	20.00	28.00	56.00	77.00	86.00	82.00	100.00	100.00	100.00	3626.72
Aristotle X3R	Seminis	1.00	2.00	0.00	0.00	0.00	0.00	4.00	24.00	42.00	61.00	85.00	100.00	100.00	100.00	2872.32
Camelot X3R	Stokes	0.00	0.00	0.00	0.00	0.00	47.00	29.00	42.00	75.00	86.00	97.00	100.00	100.00	100.00	3799.45
Revolution	Harris Moran	0.00	0.00	0.00	0.00	0.00	0.00	11.00	50.00	60.00	77.00	86.00	97.00	97.00	99.00	3232.86
Paladin	Syngenta	2.00	2.00	2.00	2.00	2.00	24.00	25.00	54.00	47.00	58.00	65.00	77.00	79.00	83.00	3033.39
Declaration	Harris Moran	0.00	0.00	0.00	0.00	0.00	0.00	28.00	58.00	70.00	76.00	88.00	96.00	97.00	99.00	3335.19
Entruder	Syngenta	1.00	0.00	0.00	0.00	0.00	0.00	24.00	40.00	61.00	72.00	74.00	90.00	93.00	95.00	3091.20
Snapper	Enza Zaden	0.00	0.00	0.00	0.00	0.00	18.00	40.00	60.00	68.00	71.00	79.00	96.00	97.00	100.00	3470.63
0994-1819	Seminis	0.00	0.00	0.00	0.00	0.00	0.00	27.00	51.00	64.00	81.00	89.00	100.00	100.00	100.00	3401.63
0992-8302	Seminis	0.00	0.00	0.00	0.00	0.00	0.00	10.00	35.00	74.00	92.00	99.00	100.00	100.00	100.00	3462.89
0996-7922A	Seminis	0.00	0.00	0.00	0.00	0.00	0.00	34.00	64.00	79.00	83.00	75.00	100.00	100.00	100.00	3623.96
ACR 283	A&C	0.00	0.00	0.00	0.00	0.00	14.00	29.00	43.00	51.00	57.00	68.00	86.00	92.00	95.00	3063.46
ACR 285	A&C	0.00	2.00	2.00	2.00	2.00	2.00	10.00	31.00	54.00	58.00	75.00	98.00	98.00	97.00	3032.70
ACR 75312	A&C	0.00	0.00	0.00	0.00	0.00	18.00	27.00	32.00	49.00	78.00	93.00	97.00	99.00	100.00	3286.80
ACR 75229	A&C	0.00	0.00	0.00	0.00	0.00	18.00	25.00	60.00	76.00	88.00	97.00	100.00	100.00	100.00	3716.10
ACR 75230	A&C	2.00	2.00	2.00	2.00	2.00	18.00	36.00	64.00	75.00	82.00	82.00	93.00	96.00	100.00	3729.83
Enza#1	Enza Zaden	2.00	2.00	2.00	2.00	2.00	22.00	33.00	54.00	70.00	75.00	77.00	93.00	97.00	96.00	3584.10
Enza#2	Enza Zaden	0.00	0.00	0.00	0.00	0.00	27.00	27.00	35.00	62.00	81.00	99.00	100.00	100.00	100.00	3591.68
Enza#3	Enza Zaden	0.00	0.00	0.00	0.00	0.00	24.00	40.00	61.00	77.00	96.00	100.00	100.00	100.00	100.00	3910.90
Enza#4	Enza Zaden	0.00	0.00	0.00	0.00	0.00	0.00	18.00	39.00	49.00	57.00	78.00	93.00	97.00	97.00	2988.37
IL 7057	Harris Moran	0.00	2.00	3.00	3.00	3.00	0.00	29.00	58.00	78.00	93.00	100.00	100.00	100.00	100.00	3963.02
IL 7059	Harris Moran	0.00	0.00	0.00	0.00	0.00	0.00	22.00	42.00	52.00	61.00	71.00	88.00	88.00	90.00	2887.44
	LSD	1.3	NS	2.5	2.5	2.5	40.4	35.7	NS	NS	NS	NS	NS	12.7	9.7	NS

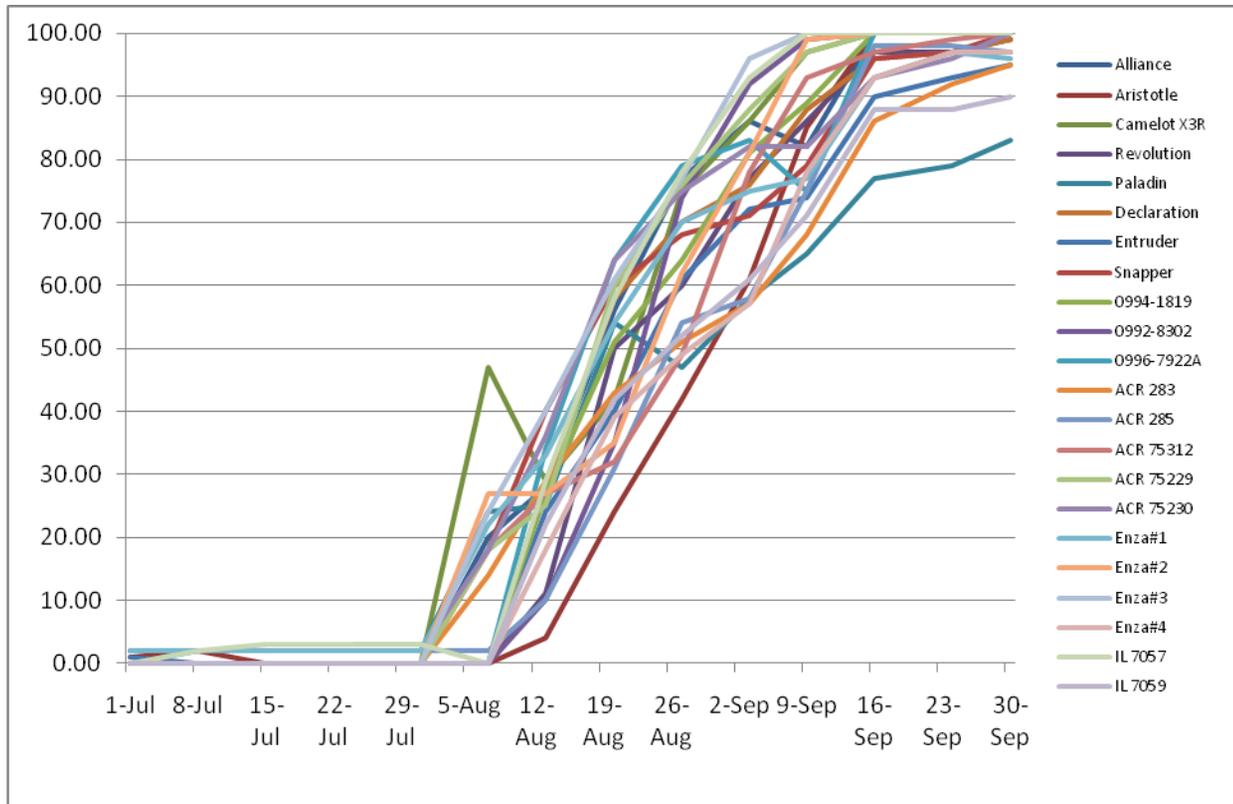


Figure 1. Disease progress curves for the percentage of plants killed by *P. capsici* for cultivars and breeding lines Evaluated at RAREC in 2009.

Note: in some cases, where the percentage decreases, those plants may have shown symptoms of wilting during week evaluated, but were not killed completely by *P. capsici* until later in the growing season.