

POTATO (*Solanum tuberosum*)  
Early Blight; *Alternaria solani*  
Late Blight; *Phytophthora infestans*  
Pink Rot; *Phytophthora erythroseptica*

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**Evaluation of Potato Cultivars and Breeding Selections to Identify Resistance in Tubers to Early Blight, Late Blight and Pink Rot, 1999:** Seventy-five cultivars and breeding selections were evaluated in field plots at the Hancock Agricultural Research Station to identify foliar resistance to early blight in 1999 (Biological and Cultural Tests 15:108-109). Tubers from this trial were harvested and stored at ~13 C, 90% RH until inoculation. Replicate sets of tubers were inoculated with: *P. infestans* US-8 genotype, isolate ME93-2a (US-8); *P. infestans* US-1 genotype, isolate WI93-13 (US-1); *A. solani*, WI isolate 100 (As); or *P. erythroseptica*, ND isolate PR-02 (Pe). *P. infestans* inoculum was prepared from cultures grown 11-18 days on rye A agar at 22 C. Tubers were inoculated 16 Nov 99 with US-1,  $1.8 \times 10^5$  sporangia/ml or 30 Nov 99 with US-8,  $7.4 \times 10^4$  sporangia/ml. Tubers were inoculated 14 Jan 00 with As,  $2.3 \times 10^4$  spores/ml, prepared from cultures grown 12 days on V8 agar at room temperature (modification of technique of Fry & Pelletier, Phytopathology 79:511-517). Tubers were inoculated 20 Jan 00 with Pe,  $5 \times 10^3$  zoospores/ml, grown three days in V8 broth in darkness at 20-22 C, then under continuous light for 48 hr. Zoospore production was induced by incubation at 8 C for 1 hr followed by room temperature for 0.5 hr. For each test line, three replicates of five tubers each were inoculated with each pathogen. Four shallow wounds (2 mm diam, 2 mm deep, spaced 2 cm apart along a line) were made on each tuber and a 10  $\mu$ l drop of inoculum was placed on each wound. Tubers inoculated with *Phytophthora* were incubated 68-70 hr at 22 C, and 100% RH. Tubers inoculated with US-1 or US-8 were then stored at 13 C, 90% RH until evaluated (US-1, 6 Dec 99; US-8, 14 Dec 99). Tubers to be evaluated for pink rot were stored at 22 C until rated 28 Jan 00. Tubers to be tested for early blight were placed in a growth chamber at 13 C, 90% RH immediately after inoculation until evaluated 31 Mar - 4 Apr 00. Storage temperature and relative humidity were typical of conditions used for processing potatoes. For each inoculation, severity of symptoms and incidence of infection (the number of inoculation sites with symptoms) were recorded for each tuber. For late blight, up to one half of each tuber (with the line connecting the inoculation points at the center) was peeled and the percentage of this area with late blight symptoms was estimated. For early blight the length and width were recorded for each lesion. For early and late blight, each tuber was cut in half, along the line connecting the inoculation points and the depth of symptoms was recorded. One depth reading per tuber was taken for late blight (the point of deepest symptom development) but the depth of each lesion was measured for early blight. For pink rot, the tuber was cut in half through the line of inoculation and the percentage of cross sectional area with pink rot symptoms was estimated after incubation at room temperature for 30 minutes.

Each of four pathogens was successfully inoculated to separate groups of tubers belonging to 75 entries. Dark Red Norland was used as the susceptible standard because of its high susceptibility to each of the pathogens used in this trial. All of the lines were susceptible to one or more pathogens. Several entries exhibited high levels of resistance to the US#1 genotype of *P. infestans*. While most entries were susceptible to the US#8 genotype of *P. infestans*, the percentage of surface area exhibiting disease symptoms varied widely from 17.8 (AF 1668-60) to > 90%. There seemed to be little correlation between the reaction to the US#1 or US#8 genotypes. Most entries were highly susceptible to *P. erythroseptica*. There were, however, large differences between entries in the incidence of infection and the mean area of symptomatic tissue. No pink rot symptoms were observed on tubers of LB2-96. Early blight infection spreads much slower than late blight and pink rot and lesions tend to be shallow and confined. Several plot entries appeared to be less susceptible to *A. solani* than the Dark Red Norland standard. There appeared to be no single source of resistance to all pathogens, but individual entries appear to have useful resistance to at least one pathogen.

Cultivar or Breeding Selection	Data From Field (1999)					Data From Tuber Inoculation														
	Relative AUDPC <sup>1</sup>			Yield <sup>2</sup>		<i>P. infestans</i> (US-1 genotype)					<i>P. infestans</i> (US-8 genotype)					<i>P. erythroseptica</i>		<i>A. solani</i>		
	Early Blight	Late Blight	Com-bined	Total cwt/A	% US#1 size	Incidence of infection (%)	% Surface area infected	Maximum Lesion depth (cm)	Mean area affected <sup>3</sup> (cm <sup>2</sup> )	Estimated lesion volume <sup>4</sup> (cm <sup>3</sup> )	Incidence of infection (%)	% Surface area infected	Maximum Lesion depth (cm)	Mean area affected <sup>3</sup> (cm <sup>2</sup> )	Estimated lesion volume <sup>4</sup> (cm <sup>3</sup> )	Incidence of infection (%)	Mean area affected <sup>5</sup> (cm <sup>2</sup> )	Incidence of infection (%)	Mean Lesion area (cm <sup>2</sup> )	Mean Lesion depth (cm <sup>3</sup> )
A082611-7	0.36	0.02	0.37	455.0	66.8	100.0	20.0	1.1	10.5	8.9	100	89.9	0.8	52.6	27.9	93	65.7	35	0.1	0.03
A84118-3	0.48	0.00	0.48	244.9	46.9	0.0	0.0	0.0	0.0	0.0	100	82.3	0.5	30.3	10.4	93	87.0	20	0.1	0.01
A90586-11	0.28	0.00	0.28	456.9	73.0	20.0	2.2	0.4	1.3	0.8	98	59.0	0.6	30.4	12.4	69	45.3	40	0.3	0.09
AC83064-6	0.36	0.00	0.36	394.0	72.9	93.3	57.0	1.5	24.0	30.8	100	79.5	1.1	33.2	22.8	89	68.7	40	0.2	0.04
AF 1668-60	0.54	0.03	0.54	298.1	85.7	0.0	0.0	0.0	0.0	0.0	92	17.8	0.3	6.8	1.8	87	67.0	53	0.4	0.16
AF 1775-2	0.34	0.03	0.35	458.8	79.0	95.8	60.2	0.9	32.5	19.7	100	71.3	0.7	32.8	15.5	93	60.3	65	1.4	1.05
AF1638-5	0.24	0.03	0.27	235.7	87.8	23.3	1.3	0.1	0.5	0.2	100	62.4	0.8	24.4	13.6	100	77.2	80	0.4	0.12
AND 9552-7 Russ	0.29	0.03	0.32	365.9	47.2	75.0	6.5	0.8	2.8	1.9	100	73.3	1.0	28.2	18.0	93	77.0	27	0.1	0.02
Atlantic	0.40	0.01	0.41	367.8	81.8	0.0	0.0	0.0	0.0	0.0	98	31.0	0.5	11.9	4.4	100	65.3	55	0.2	0.06
B0288-17	0.40	0.00	0.40	396.9	67.5	45.0	6.2	0.6	3.0	1.9	100	66.0	0.9	28.3	15.7	93	75.3	25	0.1	0.03
B0766-3	0.39	0.01	0.39	274.9	89.7	98.3	76.7	2.5	37.4	66.1	95	60.7	0.6	26.1	11.2	93	78.7	72	0.7	0.23
B0767-2	0.20	0.00	0.20	224.6	67.7	71.7	11.2	0.6	3.5	2.1	93	67.7	1.3	24.6	22.6	82	64.3	73	0.5	0.17
B9922-11	0.40	0.01	0.40	232.6	86.1	0.0	0.0	0.0	0.0	0.0	98	80.7	0.9	32.0	19.5	100	90.0	83	1.2	0.53
BC0894-2	0.51	0.01	0.51	219.7	62.3	0.0	0.0	0.0	0.0	0.0	100	53.3	0.4	16.3	4.8	93	85.3	60	0.2	0.03
CO083008-1	0.38	0.01	0.39	247.8	77.8	75.0	30.9	0.8	13.7	10.3	100	86.8	0.6	32.7	14.2	98	83.5	10	0.2	0.05
CO86218-2	0.36	0.00	0.37	245.9	63.3	96.7	74.3	1.4	25.9	24.1	100	70.0	0.6	22.8	8.7	93	77.0	28	0.2	0.05
D. R. Norland	0.60	0.03	0.60	221.7	67.5	95.8	72.8	1.2	23.8	18.7	100	56.3	0.7	17.8	8.8	87	73.7	73	1.5	0.69
Dorita	0.34	0.03	0.37	196.5	19.1	10.4	0.8	0.1	0.2	0.1	93	71.3	0.8	15.9	8.0	60	43.7	72	0.7	0.27
DT6063-1R	0.51	0.02	0.51	323.3	68.1	0.0	0.0	0.0	0.0	0.0	100	73.0	0.7	28.1	14.1	67	48.7	63	0.4	0.16
Elba	0.27	0.02	0.29	759.9	87.8	100.0	78.3	1.7	45.4	50.8	100	49.5	0.6	26.3	11.0	84	51.7	87	1.3	0.38
Goldrush	0.40	0.01	0.40	355.7	77.0	100.0	69.3	1.5	33.8	36.7	100	94.3	1.6	46.5	50.0	81	66.9	65	0.5	0.35
J101 K27	0.29	0.00	0.29	338.8	53.2	63.3	14.6	0.7	6.1	4.2	98	80.7	1.4	35.2	32.8	100	53.3	30	0.3	0.08
J101 K6	0.30	0.00	0.30	171.3	26.2	15.0	0.9	0.2	0.3	0.1	80	35.0	1.0	10.4	8.6	89	72.7	77	0.2	0.03
J101 K9	0.22	0.00	0.22	105.5	33.3	33.3	5.3	0.2	1.1	0.4	-- <sup>6</sup>	--	--	--	--	44	24.4	51	0.7	0.22
J103 K7	0.21	0.00	0.21	727.9	28.2	81.7	22.5	0.8	8.3	5.0	100	74.3	1.0	34.6	23.2	80	49.7	15	0.1	0.04
J138 A12	0.40	0.00	0.40	472.4	73.2	0.0	0.0	0.0	0.0	0.0	95	76.0	0.7	28.7	13.6	87	57.3	17	0.0	0.01
J138 A4	0.36	0.00	0.36	407.5	55.3	13.3	1.4	0.2	0.5	0.2	100	51.5	0.5	21.4	7.9	63	27.8	67	0.6	0.19
LB1-14	0.29	0.00	0.29	442.4	63.9	0.0	0.0	0.0	0.0	0.0	100	67.3	1.7	21.6	23.8	89	73.0	47	0.2	0.06
LB2-101	0.08	0.00	0.08	676.6	64.0	0.0	0.0	0.0	0.0	0.0	95	60.3	0.6	23.8	10.0	93	54.7	12	0.0	0.01
LB2-215	0.24	0.01	0.25	553.7	83.4	75.0	23.0	0.9	12.6	9.7	98	69.7	1.4	36.1	39.8	83	54.2	93	1.8	2.20

Cultivar or Breeding Selection	Data From Field (1999)					Data From Tuber Inoculation														
	Relative AUDPC <sup>1</sup>			Yield <sup>2</sup>		<i>P. infestans</i> (US-1 genotype)					<i>P. infestans</i> (US-8 genotype)					<i>P. erythroseptica</i>		<i>A. solani</i>		
	Early Blight	Late Blight	Com-bined	Total cwt/A	% US#1 size	Incidence of infection (%)	% Surface area infected	Maximum Lesion depth (cm)	Mean area affected <sup>3</sup> (cm <sup>2</sup> )	Estimated lesion volume <sup>4</sup> (cm <sup>3</sup> )	Incidence of infection (%)	% Surface area infected	Maximum Lesion depth (cm)	Mean area affected <sup>3</sup> (cm <sup>2</sup> )	Estimated lesion volume <sup>4</sup> (cm <sup>3</sup> )	Incidence of infection (%)	Mean area affected <sup>5</sup> (cm <sup>2</sup> )	Incidence of infection (%)	Mean Lesion area (cm <sup>2</sup> )	Mean Lesion depth (cm <sup>3</sup> )
LB2-299	0.34	0.00	0.34	413.3	54.6	66.7	43.3	1.2	18.4	19.3	85	26.0	0.3	11.9	3.0	53	46.7	35	0.7	0.21
LB2-35	0.25	0.03	0.28	375.6	73.1	66.7	8.5	0.5	5.1	7.0	100	85.0	1.1	36.0	26.3	100	80.0	82	1.1	0.56
LB2-74	0.21	0.00	0.21	466.6	79.9	35.0	5.3	0.3	3.2	1.4	52	18.3	0.4	8.5	4.2	53	27.3	63	1.2	0.27
LB2-96	0.42	0.00	0.42	148.8	79.2	25.0	22.5	0.8	8.5	8.5	67	46.7	0.3	14.6	3.1	0	0.0	50	0.5	0.23
LBR <sub>1</sub> R <sub>2</sub> R <sub>3</sub> R <sub>4</sub>	0.26	0.01	0.27	238.4	19.4	0.0	0.0	0.0	0.0	0.0	100	78.7	1.0	18.8	12.7	93	72.0	25	0.3	0.06
LBR <sub>2</sub>	0.47	0.01	0.47	53.2	18.7	61.8	32.2	0.6	6.2	4.0	94	71.5	0.7	10.7	5.7	67	59.6	21	0.1	0.02
LBR <sub>3</sub> tbr	0.26	0.02	0.27	188.3	14.7	32.2	3.7	0.5	0.9	1.1	100	86.0	1.2	17.6	13.9	100	96.3	28	0.1	0.03
LBR <sub>5</sub>	0.27	0.01	0.27	353.6	19.4	0.0	0.0	0.0	0.0	0.0	90	62.0	0.8	14.9	9.7	90	85.5	13	0.0	0.01
LBR <sub>7</sub>	0.34	0.00	0.34	282.7	49.6	8.3	0.6	0.0	0.2	0.0	100	66.7	0.8	19.8	9.9	96	72.7	40	0.1	0.03
LBR <sub>8</sub>	0.18	0.00	0.18	54.9	3.9	0.0	0.0	0.0	0.0	0.0	71	58.8	1.1	7.2	6.7	67	64.6	58	0.2	0.04
NDO2438-7R	0.37	0.00	0.38	417.5	74.8	0.0	0.0	0.0	0.0	0.0	100	48.1	0.8	15.6	8.7	100	73.0	82	0.7	0.31
NorDonna	0.45	0.02	0.45	364.9	53.3	1.7	0.1	0.0	0.0	0.0	100	43.6	0.4	13.2	3.8	100	94.7	70	0.7	0.11
NorValley	0.41	0.01	0.42	375.6	78.4	0.0	0.0	0.0	0.0	0.0	97	36.3	0.7	14.3	6.8	67	48.3	78	0.6	0.34
NY 101	0.37	0.00	0.37	433.7	79.9	91.7	48.7	1.2	20.3	14.5	97	70.9	0.9	27.6	15.7	53	32.7	77	1.0	0.28
NY 103	0.34	0.03	0.36	284.6	84.6	96.7	68.3	1.3	27.1	23.0	92	57.3	0.5	22.1	7.6	64	45.3	42	0.3	0.10
NY 112	0.35	0.03	0.37	639.8	88.2	70.0	9.3	0.7	5.4	3.5	93	60.3	1.0	31.7	20.1	80	48.0	35	0.3	0.09
NY 115	0.51	0.04	0.53	437.5	74.4	0.0	0.0	0.0	0.0	0.0	95	54.7	0.8	22.0	13.5	80	49.3	10	0.0	0.01
NY 120	0.42	0.00	0.43	591.4	88.7	95.0	57.0	1.0	35.3	26.4	100	70.7	0.8	40.7	22.4	82	55.0	30	0.1	0.05
NY 123	0.46	0.01	0.47	490.8	76.5	98.3	41.5	1.9	16.8	23.5	100	76.5	0.9	30.9	18.6	93	83.3	95	2.7	0.66
Pike	0.31	0.04	0.33	255.6	57.6	0.0	0.0	0.0	0.0	0.0	92	37.7	0.6	10.4	4.3	87	77.0	57	0.2	0.02
Pimpernel	0.18	0.03	0.22	531.4	33.4	93.3	8.9	0.7	2.5	1.7	100	56.8	1.1	15.8	11.7	51	28.7	60	0.6	0.13
Q237-25 (NY 121)	0.46	0.02	0.46	190.0	76.5	98.3	49.7	1.2	14.4	12.1	98	50.0	0.5	13.9	5.1	100	89.7	18	0.1	0.02
Ranger Russet	0.28	0.03	0.29	363.0	62.8	93.3	44.0	1.0	20.0	15.7	100	76.3	1.2	40.7	34.9	53	41.7	85	2.6	1.12
Red LaSoda	0.39	0.00	0.39	260.4	67.5	100.0	67.3	1.6	24.1	26.7	100	42.3	0.8	14.9	8.4	84	70.7	90	1.7	0.47
Robijn	0.16	0.00	0.17	295.2	5.2	60.4	17.0	0.6	2.8	1.1	100	58.7	0.6	11.7	4.2	47	38.7	72	0.2	0.01
Rus. Norkotah	0.48	0.00	0.48	215.2	77.3	100.0	81.3	1.2	31.6	24.8	98	94.8	0.9	36.2	23.0	100	90.4	73	1.2	0.40
Russet Burbank	0.28	0.01	0.29	223.6	54.1	98.3	51.0	0.6	19.0	9.4	100	85.7	0.9	32.7	19.3	100	87.3	52	0.3	0.09
Shepody	0.35	0.01	0.35	358.2	72.0	0.0	0.0	0.0	0.0	0.0	100	85.3	1.2	42.8	33.6	93	64.8	10	0.1	0.02
Snowden	0.32	0.01	0.33	277.8	88.2	0.0	0.0	0.0	0.0	0.0	100	78.7	1.1	33.2	24.0	67	50.3	44	0.5	0.15
Superior	0.43	0.01	0.44	404.1	78.9	90.0	59.3	2.6	26.6	46.9	100	60.3	0.7	23.8	11.4	100	80.0	45	0.5	0.30
UW C75-5	0.26	0.06	0.31	282.7	24.0	97.5	63.0	1.2	17.5	13.8	90	66.7	0.5	20.2	7.6	67	62.1	37	0.1	0.02

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	Early Blight	Late Blight	Com-bined	Total cwt/A	% US#1 size	Incidence of infection (%)	% Surface area infected	Maximum Lesion depth (cm)	Mean area affected <sup>3</sup> (cm <sup>2</sup> )	Estimated lesion volume <sup>4</sup> (cm <sup>3</sup> )	Incidence of infection (%)	% Surface area infected	Maximum Lesion depth (cm)	Mean area affected <sup>3</sup> (cm <sup>2</sup> )	Estimated lesion volume <sup>4</sup> (cm <sup>3</sup> )	Incidence of infection (%)	Mean area affected <sup>5</sup> (cm <sup>2</sup> )	Incidence of infection (%)	Mean Lesion area (cm <sup>2</sup> )	Mean Lesion depth (cm <sup>3</sup> )
UW C75-5-297	0.18	0.04	0.23	756.0	65.8	98.3	50.0	1.0	21.3	14.4	97	30.7	0.5	12.4	3.7	70	38.4	29	0.1	0.04
UWH93-1600	0.31	0.02	0.32	428.8	91.9	66.7	24.9	0.9	11.1	11.5	100	68.3	0.6	29.1	12.1	100	68.0	8	0.0	0.00
UWH93-426	0.40	0.02	0.41	294.3	63.3	96.7	67.7	1.4	23.7	22.9	98	68.3	0.8	24.4	13.1	93	80.7	58	0.5	0.12
UWH93-911	0.61	0.00	0.61	208.6	59.5	0.0	0.0	0.0	0.0	0.0	100	68.7	0.5	18.3	6.1	80	76.3	68	0.7	0.36
UWH-G53	0.09	0.00	0.09	256.0	52.0	11.7	4.7	0.2	1.1	0.5	68	37.6	0.8	12.5	8.1	67	61.3	60	2.7	5.28
UWH-G85	0.22	0.00	0.22	506.7	36.2	21.7	3.9	0.4	1.6	1.2	75	53.7	0.9	24.8	22.4	81	57.5	28	0.2	0.14
W 1151 rus	0.41	0.00	0.41	491.7	86.2	100.0	51.3	2.2	32.5	50.2	98	77.7	1.3	49.7	44.4	87	53.3	85	2.0	1.40
W 1313	0.32	0.02	0.33	218.0	60.8	95.8	41.6	1.0	12.8	8.0	93	25.8	0.5	7.5	3.4	53	50.0	63	0.5	0.17
W1100 R	0.43	0.02	0.45	315.1	84.0	1.7	0.1	0.0	0.1	0.0	100	47.3	0.6	16.8	7.0	100	95.0	75	0.4	0.12
W1348 rus	0.35	0.03	0.36	605.7	70.4	96.7	61.3	2.4	36.5	68.3	100	93.0	1.4	56.5	52.0	100	85.0	68	0.7	0.28
W1355-1	0.25	0.03	0.26	583.7	76.3	88.3	58.7	1.9	25.1	37.1	100	51.7	1.1	20.5	16.7	93	70.3	65	0.6	0.30
W84-75 R	0.55	0.00	0.55	188.3	24.4	0.0	0.0	0.0	0.0	0.0	96	61.3	0.7	13.0	6.8	85	73.5	67	0.1	0.00
W870P90	0.41	0.01	0.41	362.0	81.9	0.0	0.0	0.0	0.0	0.0	100	74.7	0.8	31.3	16.5	67	56.0	33	0.2	0.07
W91-945a	0.18	0.07	0.24	302.0	31.2	88.3	62.5	1.2	15.0	13.2	98	59.3	0.6	15.4	7.4	80	62.0	80	1.3	0.49
Pr>F <sup>7</sup>	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.09
LSD	0.08	0.03	0.07	124.8	17.0	28.9	20.3	0.6	9.1	12.6	15.7	20.1	0.4	9.2	10.2	36	32.3	43.0	1.0	1.68*

- 1 Relative area under the disease progress curve. Data for each observation date were plotted on a graph and the relative area under the line was calculated for each treatment providing a measure of the relative severity of disease throughout the season. A disease rating of 100% foliage infection for the entire season would produce a value of 1.0. All relative AUDPC values are expressed as the proportion of this value. Either decreased disease severity or later disease development will contribute to lower relative areas under the disease progress curve. Early and late blight AUDPC's are calculated for 25 Jun - 1 Sep. Combined AUDPC is calculated for 25 Jun - 8 Sep (based on early blight ratings through 9 Aug and combined foliage infection ratings for the rest of the season). (Biological and Cultural Tests: 15:108-109).
- 2 Yield from 5-ft of row, converted to cwt/A. Tubers were graded by hand. They were placed on a section of chain from a grading machine; those that passed through were classed as undersize (<1 7/8 in. diameter), and those that did not were classed as US#1 size or culls.
- 3 An estimate of the actual surface area affected by late blight calculated from tuber dimensions and % of tuber surface showing late blight symptoms.
- 4 Estimated as one half the volume of an ellipsoid. The volume of an ellipsoid = 4/3 x area x depth. Area and maximum lesion depth were used for the calculation.
- 5 Potatoes were cut in half through the line of inoculation. This is the % of the surface of the cross section with symptoms of pink rot.
- 6 Not tested (too few tubers).
- 7 ANOVA was performed, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at the  $P = 0.05$  (or  $P = 0.10$ ) level. \* = Differences between pairs of treatments were significant at  $P = 0.10$  (but not at  $P = 0.05$ ).