

POTATO (*Solanum tuberosum*)

Early Blight; *Alternaria solani*

Late Blight; *Phytophthora infestans*

Black Scurf; *Rhizoctonia solani*

Silver Scurf; *Helminthosporium solani*

Leak; *Pythium spp.*

Pink Rot; *Phytophthora erythroseptica*

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EVALUATION OF THE EFFECT OF FOLIAR FUNGICIDES ON POTATO STORAGE QUALITY, 2000: A field trial was conducted at the Hancock Agricultural Research Station in central Wisconsin during the summer of 2000 to evaluate the efficacy of 63 foliar fungicide treatments to control early and late blight on Russet Burbank potatoes. Fungicide treatments were applied at weekly intervals from 28 Jun to 23 Aug, according to treatment protocol, for a total of 9 weeks. Tubers were harvested and graded 25-27 Sep 2000 and, for selected treatments, a 30-40 pound sample was stored from each replicate plot. Any diseased tubers observed were discarded during the grading process and recorded as culls. Stored tubers included a mix of sizes from the four middle size grades, ranging from 4-16 oz. Tubers were placed in the potato storage area at the Hancock Agricultural Research Station, maintained at approximately 50° F and 90% RH until evaluation on 01 Mar 2001. All tubers were rated for presence or absence of symptoms of late blight, soft rot, pink rot, silver scurf, black scurf and early blight.

Table 1. Hancock Fungicide Trial, 2000 - Effect of treatment on relative AUDPC, yield and quality after storage.

Treatment, rate/acre formulated ; product (and active ingredient in []) and schedule summary ¹	Relative AUDPC ²			Yield (cwt/A)		% of tubers with:							Silver scurf index ³	Rhizoc-tonia index ⁴
	Early blight	Late blight	Com-bined	Total	US#1	No symp-toms	Late blight	Soft rot	Pink rot	Silver scurf ONLY	Rhizoc-tonia ONLY	Early blight		
1 Untreated	0.057	0.512	0.560	273.9	214.9	6.9	0.4	0.3	0.0	92.5	22.4	0.0	52.3	9.0
15 EXP 10623A 0.35 pt [0.18 lb] + Bond 8.33 EC 0.25 pt (A-I)	0.046	0.012	0.188	464.8	386.8	6.6	0.8	0.0	8.3	84.3	16.3	1.5	35.0	11.7
16 EXP 10623A 0.53 pt [0.28 lb] + Bond 8.33 EC 0.25 pt (A-I)	0.035	0.006	0.161	484.2	414.2	12.1	0.0	0.4	0.0	87.2	29.2	0.0	37.7	15.8
17 Walabi 4.38 F 1.7 pt [0.93 lb] (A-I)	0.059	0.029	0.251	421.7	349.7	9.0	1.0	0.0	0.0	89.7	28.5	0.7	35.2	1.0
Bravo WS 6F 0.75 pt [0.56 lb] (A,B,C); Bravo WS 6F 0.75 pt [0.56 lb] + Scala 40 SC 0.63 pt (D,E,F,G,H); Bravo WS 6F 0.75 pt [0.56 lb] + Scala 40 SC 0.84 pt (I)	0.075	0.019	0.260	427.2	340.8	9.0	0.0	0.0	0.0	90.7	34.7	0.0	37.5	18.1
18 Tattoo C 6.25 F 1.3 pt [1.0 lb] (A,B,D,E,G,H); Quadris 2.08 SC 0.78 pt [0.2 lb] (C,F,I)	0.033	0.008	0.130	482.9	394.5	9.3	0.0	0.6	0.0	90.0	10.6	0.0	40.0	4.4
19 Echo Zn 2.125 pt [1.11 lb] (A-I)	0.063	0.005	0.205	454.3	371.7	0.3	0.0	1.6	0.0	97.6	44.1	0.0	49.7	19.2
20 Dithane Rainshield 0.53 lb [0.4 lb] (A); 1.0 lb [0.75 lb] (B,C); 1.6 lb [1.2 lb] (D); 2.0 lb [1.5 lb] (E-I); + Acrobat 50 WP 0.4 lb [0.2 lb] (B-H)	0.119	0.030	0.317	437.9	349.3	3.4	0.0	2.1	0.0	94.3	34.6	0.3	49.2	9.2
23 Bravo Zn 6F 1.5 pt [1.11 lb] (A-I); + Acrobat 50 WP 0.4 lb [0.2 lb] (B-H)	0.113	0.007	0.279	436.4	348.6	8.6	0.4	0.0	0.0	91.0	9.2	0.4	36.7	1.3
24 Quadris 2.08 SC 0.78 pt [0.2 lb] (A,C,E); + Acrobat 50 WP 0.4 lb [0.2 lb] (C,E); Bravo Zn 6F 1.5 pt [1.11 lb] (B,D,F-I); + Acrobat 50 WP 0.4 lb [0.2 lb] (B,D,F-H)	0.030	0.008	0.129	517.3	435.0	6.1	0.0	0.0	0.0	93.5	10.1	0.4	37.7	2.3
25 Quadris 2.08 SC 0.78 pt [0.2 lb] (A,C,E); + Acrobat 500 SC 0.39 pt [0.2 lb] (C,E); Bravo Zn 6F 1.5 pt [1.11 lb] (B,D,F-I); + Acrobat 500 SC 0.39 pt [0.2 lb] (B,D,F-H)	0.027	0.005	0.122	517.8	422.9	9.7	0.0	0.6	0.0	89.7	16.4	0.4	43.3	2.9
26 Penncozeb 75DF 1.25 lb [0.94 lb] + Bravo WS 6F 0.75 pt [0.56 lb] (A-I)	0.067	0.012	0.245	441.3	363.3	5.0	0.0	2.3	0.0	91.3	29.5	1.4	56.2	4.8
27 Penncozeb 75DF 2.0 lb [1.5 lb] (B,C,E,F,H,I); Quadris 2.08 SC 0.78 pt [0.2 lb] (A,D,G)	0.025	0.023	0.148	491.6	408.8	3.2	0.0	1.4	0.4	94.9	15.6	0.0	41.7	9.4
28 TD-2390-01 Cuprofix 30WG 5.0 lb [1.5 lb] (B,C,E,F,H,I); Quadris 2.08 SC 0.78 pt [0.2 lb] (A,D,G)	0.023	0.051	0.178	475.6	380.0	9.7	0.3	0.3	0.0	89.7	23.8	0.0	42.5	13.8
32 Bravo Zn 6F 1.5 pt [1.11 lb] (A-C); Confidential Product 00P-1 0.22 pt [0.12 lb] (D-I)	0.065	0.003	0.207	473.8	385.8	25.6	0.0	0.4	0.0	73.7	12.4	0.3	36.7	6.0
35 Bravo Zn 6F 1.5 pt [1.11 lb] (A-C); Confidential Product 00P-1 0.27 pt [0.144 lb] (D-I)	0.060	0.003	0.190	438.1	326.7	8.0	0.0	0.0	0.0	92.0	8.0	0.0	42.5	1.5
36 Bravo Zn 6F 1.5 pt [1.11 lb] (A-C); Confidential Product 00P-2 0.30 lb [0.12 lb] (D-I)	0.053	0.004	0.186	483.8	395.6	10.1	0.0	0.4	0.0	89.2	31.0	0.0	36.2	9.6
37 Bravo Zn 6F 1.5 pt [1.11 lb] (A-C); Confidential Product 00P-2 0.375 lb [0.146 lb] (D-I)	0.067	0.003	0.199	449.9	344.6	8.3	0.3	2.8	0.0	88.6	24.4	0.0	50.8	3.8
38 Quadris 2.08 F 0.39 pt [0.1 lb] (A,C,E); Dithane Rainshield 2.0 lb [1.5 lb] (B); Gavel 75 DF 2.0 lb [1.5 lb] (D,F,G,H,I)	0.030	0.014	0.147	509.7	434.4	22.0	0.0	0.4	0.0	77.0	22.6	0.7	40.3	6.5
39 Quadris 2.08 F 0.39 pt [0.1 lb] (A,C,E); Gavel 75 DF 2.0 lb [1.5 lb] (B,D,F,G,H,I)	0.025	0.009	0.119	488.1	404.3	10.1	0.0	0.0	0.0	89.5	11.7	0.3	36.7	0.2
40 Champ 2 2.0 pt + Bravo Zn 6F 1.0 pt [0.75 lb] (A,C,E,G,I); Agri Tin 0.188 lb [0.15 lb] + Dithane Rainshield 2.0 lb [1.5 lb] (B,D,F,H)	0.082	0.010	0.256	465.4	376.6	1.3	0.0	0.3	0.0	98.1	47.5	0.3	46.7	23.5
42 Quadris 2.08 SC 0.78 pt [0.2 lb] (A,C,E); Bravo Zn 6F 1.5 pt [1.11 lb] (B,D,F,G,H,I)	0.026	0.007	0.119	501.3	388.8	19.4	0.0	0.0	0.0	80.6	17.1	0.0	40.8	2.3
44 Quadris 2.08 SC 0.78 pt [0.2 lb] (A,C,E,G,I); Bravo Zn 6F 1.5 pt [1.11 lb] (B,D,F,H)	0.027	0.006	0.113	510.8	415.3	14.1	0.0	0.7	0.0	83.4	13.6	0.4	39.2	5.4
45 DPX-KQ667 68.75WG 0.75 lb [0.52 lb] (A-I)	0.037	0.041	0.216	449.3	365.6	7.0	0.0	2.3	0.0	90.3	14.6	0.4	53.2	5.8
46 DPX-KQ667 68.75WG 1.0 lb [0.688 lb] (A-I)	0.050	0.027	0.211	453.8	369.1	4.2	0.3	0.7	0.0	93.7	27.8	0.4	39.0	10.8
47 DPX-KQ667 68.75WG 1.5 lb [1.03 lb] (A-I)	0.037	0.027	0.188	500.7	412.5	0.0	0.0	0.3	0.0	99.7	26.9	0.0	57.8	7.7
48 DPX-KQ667 68.75WG 2.0 lb [1.38 lb] (A-I)	0.032	0.003	0.143	481.4	390.3	14.9	0.0	1.4	0.0	83.7	28.6	0.0	48.3	7.5
49 Headline EC (BAS 500F) 2.09 SC 0.78 pt [0.2 lb] (A-I)	0.024	0.011	0.110	530.5	419.7	4.2	0.4	0.8	0.0	94.2	44.7	0.0	43.0	22.1

Treatment, rate/acre formulated ; product (and active ingredient in []) and schedule summary ¹	Relative AUDPC ²			Yield (cwt/A)		% of tubers with:							Silver scurf index ³	Rhizoc-tonia index ⁴
	Early blight	Late blight	Com-bined	Total	US#1	No symp-toms	Late blight	Soft rot	Pink rot	Silver scurf ONLY	Rhizoc-tonia ONLY	Early blight		
56 Headline EC (BAS 500F) 2.09 SC 0.78 pt [0.2 lb] (A,C,E,G,I); Bravo Ultrex 82.5 WDG 1.4 lb [1.125 lb] (B,D,F,H).....	0.026	0.005	0.114	535.7	446.7	11.1	0.0	1.5	0.0	87.0	10.9	0.0	41.2	5.0
57 Headline EC (BAS 500F) 2.09 SC 0.78 pt [0.2 lb] (A,C,E,G,I); Dithane Rainshield 2.0 lb [1.5 lb] (B,D,F,H).....	0.029	0.014	0.152	490.3	404.9	2.4	0.0	0.3	0.0	97.2	60.3	0.0	48.2	33.3
60 Quadris 2.08 F 0.78 pt [0.2 lb] (A,C); Polyram 80 DF 2 lb [1.6 lb] (D,E,F,G,H); + Super Tin 80 WP 0.156 lb [0.125 lb] (E,F,G,H); Bravo WS 6F 1.5 pt [1.125 lb] (B,I).....	0.025	0.023	0.156	479.8	387.7	6.9	0.3	0.7	0.0	91.4	28.7	0.7	41.3	5.6
Pr > F ⁴	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.41	0.74	0.38	0.48	0.56	0.04	0.78	0.59	< 0.01
LSD (P = 0.05) ⁴	0.027	0.050	0.051	42.4	47.7	NS	NS	NS	NS	NS	27.9	NS	NS	12.1

- 1 WISDOM Integrated Pest Management software was used to calculate daily accumulation of P-Days and severity values. Treatments were initiated at 300 P-Days. Application dates: A = 28 Jun (300 P-Days), B = 5 Jul (350 P-Days), C = 12 Jul (400 P-Days), D = 19 Jul (450 P-Days), E = 26 Jul (500 P-Days), F = 2 Aug (550 P-Days), G = 9 Aug (600 P-Days), H = 16 Aug (650 P-Days), I = 23 Aug (700 P-Days).
- 2 Relative area under the disease progress curve. Data for each observation date were plotted on a graph and the 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 blight AUDPC was calculated from Jun 27 - Aug 21. Late blight AUDPC was calculated from 10 Jul (when late blight was first observed) through 21 Aug. Disease had progressed sufficiently that it was difficult to evaluate early blight and late blight separately for a number of plots on 28 Aug and 5 Sep. The combined AUDPC was calculated from early blight data for Jun 27 and Jul 3 and the combined foliar disease severity data for the remainder of the season, through 5 Sep.
- 3 Silver scurf index: Tubers were spread out and the % of the top surface area with silver scurf symptoms was rated on a 5 point scale with 0 = none; 1 = 1-10% of the surface area of the tuber affected; 2 = 10-25% affected; 3 = 25-50% affected; 4 = 50-75% affected; 5 = > 75% affected. The lesion area index was calculated by summing the number in each class times the class number / 5 times the total number of tubers rated. The index represents a percentage of the worst possible case (if all tubers were rated 5, the index would = 100).
- 4 Rhizoctonia index: Tubers were spread out and the severity of Rhizoctonia symptoms on the top surface was rated on a 5 point scale with 0 = none; 1 = 1-5 sclerotia; 2 = 5-10 sclerotia; 3 = 10-20 sclerotia; 4 = > 20 sclerotia. The Rhizoctonia index was calculated by summing the number in each class times the class number / 4 times the total number of tubers rated. The index represents a percentage of the worst possible case (if all tubers were rated 4, the index would = 100).
- 5 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at the P = 0.05 level.

Table 2. Hancock Fungicide Trial, 2000 – Effect of treatment on internal quality of stored tubers (treatment numbers as listed in table 1).

trt	% with no internal defects	% with any kind of internal defect	Com-bined Defect Rating ¹	Hollow Heart ²				Internal Browning ²				Black Spot/Bruising				
				% with ANY HH	% with SLIGHT HH	% MODER-ATE HH	% SEVERE HH	% with ANY IB	% with SLIGHT IB	% MODER-ATE IB	% SEVERE IB	% Bruise Free	% with 1 spot (< 1cm)	% with 1 spot (> 1cm)	% with 2-3 spots	% with > 3 spots
1	45.0	55.0	0.8	2.5	0.0	2.5	0.0	0.0	0.0	0.0	0.0	47.5	40.0	7.5	5.0	0.0
15	12.5	87.5	2.0	7.5	2.5	2.5	2.5	15.0	15.0	0.0	0.0	22.5	27.5	10.0	37.5	2.5
16	15.0	85.0	2.0	12.5	10.0	2.5	0.0	15.0	12.5	2.5	0.0	20.0	37.5	5.0	35.0	2.5
17	22.5	77.5	1.5	7.5	5.0	0.0	2.5	2.5	2.5	0.0	0.0	25.0	45.0	5.0	25.0	0.0
18	17.5	82.5	1.9	5.0	2.5	2.5	0.0	10.0	7.5	2.5	0.0	20.0	27.5	22.5	27.5	2.5
19	17.5	82.5	1.8	0.0	0.0	0.0	0.0	12.5	7.5	2.5	2.5	27.5	30.0	5.0	32.5	5.0
20	35.0	65.0	1.3	10.0	5.0	2.5	2.5	15.0	12.5	2.5	0.0	52.5	25.0	2.5	17.5	2.5
23	30.1	69.9	1.6	2.3	2.3	0.0	0.0	5.3	5.3	0.0	0.0	34.9	25.2	2.3	32.7	5.0
24	25.0	75.0	2.0	10.0	2.5	0.0	7.5	12.5	7.5	2.5	2.5	30.0	32.5	0.0	32.5	5.0
25	20.0	80.0	2.1	2.5	0.0	0.0	2.5	30.0	22.5	5.0	2.5	32.5	20.0	7.5	37.5	2.5
26	27.5	72.5	1.6	7.5	2.5	2.5	2.5	10.0	7.5	2.5	0.0	32.5	37.5	2.5	25.0	2.5
27	19.3	80.7	1.6	7.5	5.0	2.5	0.0	7.3	0.0	7.3	0.0	26.6	39.3	7.5	24.1	2.5
28	22.5	77.5	1.9	0.0	0.0	0.0	0.0	15.0	10.0	5.0	0.0	35.0	15.0	5.0	35.0	10.0
32	21.8	78.2	1.9	0.0	0.0	0.0	0.0	19.5	12.3	2.5	4.8	26.6	31.8	12.3	14.3	15.0

trt	% with no internal defects	% with any kind of internal defect	Com-bined Defect Rating ¹	Hollow Heart ²				Internal Browning ²				Black Spot/Bruising				
				% with ANY HH	% with SLIGHT HH	% MODER-ATE HH	% SEVERE HH	% with ANY IB	% with SLIGHT IB	% MODER-ATE IB	% SEVERE IB	% Bruise Free	% with 1 spot (< 1cm)	% with 1 spot (> 1cm)	% with 2-3 spots	% with > 3 spots
35	35.0	65.0	1.5	5.0	2.5	0.0	2.5	32.5	17.5	10.0	5.0	50.0	30.0	5.0	15.0	0.0
36	19.8	80.2	2.0	14.3	5.0	7.0	2.3	14.8	12.3	2.5	0.0	34.5	22.0	5.0	28.9	9.5
37	20.0	80.0	1.6	5.0	0.0	5.0	0.0	22.5	17.5	5.0	0.0	27.5	45.0	2.5	25.0	0.0
38	22.5	77.5	1.9	5.0	0.0	5.0	0.0	15.0	5.0	7.5	2.5	27.5	27.5	12.5	30.0	2.5
39	25.0	75.0	1.7	10.0	2.5	5.0	2.5	7.5	5.0	0.0	2.5	32.5	27.5	12.5	27.5	0.0
40	20.0	80.0	1.9	12.5	7.5	5.0	0.0	25.0	15.0	5.0	5.0	30.0	42.5	0.0	20.0	7.5
42	40.0	60.0	1.2	2.5	0.0	2.5	0.0	7.5	7.5	0.0	0.0	47.5	22.5	5.0	22.5	2.5
44	17.5	82.5	1.6	2.5	0.0	0.0	2.5	27.5	20.0	7.5	0.0	35.0	30.0	15.0	20.0	0.0
45	12.3	87.7	2.0	9.3	9.3	0.0	0.0	14.5	9.8	2.5	2.3	29.1	26.6	2.3	32.0	10.0
46	12.3	87.7	2.2	4.8	2.5	2.3	0.0	14.1	9.5	0.0	4.5	19.5	24.5	9.5	39.3	7.0
47	25.0	75.0	1.5	5.0	2.5	2.5	0.0	10.0	10.0	0.0	0.0	35.0	25.0	15.0	20.0	5.0
48	27.3	72.7	1.6	7.3	0.0	7.3	0.0	10.0	7.5	2.5	0.0	32.3	34.5	4.8	21.6	6.8
49	27.5	72.5	1.5	2.5	0.0	0.0	2.5	12.5	10.0	0.0	2.5	35.0	37.5	2.5	17.5	7.5
55	20.0	80.0	1.6	7.5	2.5	2.5	2.5	12.5	10.0	2.5	0.0	25.0	47.5	2.5	25.0	0.0
56	10.8	89.2	1.8	5.0	5.0	0.0	0.0	10.0	5.0	0.0	5.0	15.8	48.6	7.8	25.3	2.5
57	20.8	79.2	1.6	2.5	0.0	0.0	2.5	25.3	20.3	5.0	0.0	36.1	33.1	10.3	18.1	2.5
60	15.0	85.0	1.6	0.0	0.0	0.0	0.0	12.5	12.5	0.0	0.0	25.0	42.5	2.5	25.0	5.0
Pr>F ³	0.17	0.17	0.57	0.31	0.16	0.40	0.59	0.16	0.18	0.31	0.36	0.27	0.06	0.21	0.38	0.61
LSD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	19.6*	NS	NS

1. The worst possible rating would be 10. Hollow heart and internal browning categories given values of 1(slight), 2 (moderate), 3 (severe); bruising categories given values of 1 (1 spot<1cm) to 4 (> 3 spots). Combined defect rating = sum of Hollow heart, int. browning and bruising values//10 (the worst defect value a tuber could have if hh=3, ib=3 and bruise=4).
2. Hollow heart and internal browning evaluation: slight – longest dimension < 1 cm; moderate 1-2 cm; severe > 2cm.
3. Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at the P = 0.05 level.