POTATO (*Solanum tuberosum* 'Chieftain')
Early blight; *Alternaria solani*
Black dot; *Colletotrichum coccodes*
Black scurf; *Rhizoctonia solani*
Silver scurf; *Helminthosporium solani*
Common scab; *Streptomyces scabies*

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Biofungicides and sustainable products compared with conventional fungicides for potato production, 2006.

Potato seed pieces were planted into a Howard gravelly loam on 18 May at the Thompson Research Farm, Freeville, NY. Twelve seed piece/in-furrow treatments in combination with twelve foliar treatments (with and without sprays) were arranged in a randomized complete block design with four replications. Each treatment block consisted of 18 hills of Chieftain in each of the four 14-ft rows with a 34-in. bed width, with the middle two rows serving as the data rows. Atlantic and Keuka Gold were planted at the front and back 3ft of each block in replications 1 and 2 and 3 and 4, respectively, to serve as a buffer. Dry seed piece fungicides Plant Shield (*Trichoderma harzianum*), Maxim MZ, and Moncoat MZ, were applied to cut seed a day prior to planting. Arclay, Amistar 80WG, and Platinum Ridomil Gold were applied as in-furrow sprays while the seed pieces were in the ground but still uncovered. The Arclay treatments received no foliar fungicides. Treatment 7 had Plant Shield also sprayed onto their lower stems on 22 Jun and irrigated later that day, and once as a foliar spray on 25 Jul. Final seed emergence data were recorded on 20 Jun. Rainfall (in.) was 1.38, 7.77, 7.54, 5.02, and 2.01 for May-Sep, respectively, and was supplemented with overhead irrigation when needed. Every plant in the first of the four rows was field-inoculated with a 25,000 spores/ml suspension of *A. solani* on 21 Jul. Fungicide sprays were applied with a CO_2 pressurized boom sprayer at 60 psi, delivering 23.0 gal/A through eight TeeJet XR11003 flat fan nozzles spaced 20 in. apart. Fungicide sprays were applied on a weekly schedule (25 Jul; 1, 9, 16, 23, 30 Aug). Canopy health was assessed on foliage using the Horsfall-Barratt scale (0-11) on 11, 18, 25 Aug; 4 Sep. Vines were killed with Diquat (1.5pt/A) on 6 Sep. Ten stems from the two data rows from each block were randomly chosen in order to quantify black dot sclerotia on 8 Sep. Stems were trimmed to 12 in. from the soil line and the amount of black dot length (in.) was measured. Tubers were harvested on 28 Sep and graded on 29 Sep. A sub-sample of 40 tubers were thoroughly graded after storing at 45F for 51days and assessed for the presence of black scurf, common scab and silver scurf on 20-21 Nov, with data recorded as the percentage of surface area affected for each disease. Foliar data were converted using the area under the disease progress curve (AUDPC) model to account for foliar disease that progressed over time, analyzed using a one-way ANOVA at P=0.05 with mean separation determined by the Waller-Duncan k-ratio t-test at P=0.05. The tuber data underwent an arcsin transformation and the resulting data were analyzed using a Mixed Procedure at P=0.05 with means separated using the Tukey-Kramer test at α=0.05.

There was no significant difference among treatments for final seed piece emergence. Tuber appearance for black scurf, silver scurf and common scab was significantly affected by treatment (P<0.0001 for all three). Overall, the control had the most blemishes on the tubers for black scurf and silver scurf, and had a high degree of common scab. Three treatments employing Plant Shield were not significantly different from the control for scab and black scurf (treatments 4, 5, and 7), and were not significantly different from the control for silver scurf (treatments 5 and 6). Arclay provided control of common scab. It was significantly better than the control, than three of the four Plant Shield treatments (Treatments 4, 5, and 7), and comparable with the remaining treatments. Arclay also performed well for black scurf. Although it was not significantly different from the control, it provided control comparable to the Maxim MZ treatments, and only Moncoat MZ performed better. The effect of Arclay on black scurf control may have been even more dramatic if the highest black scurf ratings were not localized to only one of the four replications. Arclay was also significantly better than the control in terms of silver scurf and was comparable to the treatments using Maxim MZ at 8 oz (treatments 9 and 11). The best control of silver scurf was achieved with the Maxim MZ + Amistar 80WG combination (treatments 10 and 12) and Moncoat MZ. Overall the traditional fungicides Moncoat MZ and Maxim MZ combined with Amistar 80WG were most effective at producing tubers with cleaner skin. There were also significant differences among the fungicide treatments for canopy health (P<0.0001). Headline 2.09EC alternated with Endura 70WG + Dithane 75DF had the least defoliation of all the treatments, a result also achieved in 2005 (F&N Vol 61:V027). Additional treatments significantly better than the control included QRD 22097 at the 4 gm rate, Scala 60SC + Echo Zn alternated with Bravo WS, and CGA 169347 250EC alternated with Bravo WS. There were no significant differences in total or marketable yields (P=0.2773 and 0.1185, respectively), although numerically the highest marketable yields were noted for treatments 10 and 11. The lowest total and marketable yields occurred with treatment 7, when Plant Shield was used as a seed piece, drench and a single foliar spray treatment. No phytotoxicity was observed.

Seed piece treatment/cwt[z] or row length in-furrow (IF) treatment	Emerged seed pieces 20 Jun	Percent black scurf	Percent scab	Percent silver scurf
1 Control, untreated	70	5.8 d[y]	6.8 d	24.9 g
2 Arclay 1.4 oz/0.53 gal (IF)	70	4.4 bcd	3.4 a	19.3 def
3 Arclay 2.7 oz/0.53 gal (IF)	69	3.8 bcd	3.9 ab	14.6 bcd
4 Plant Shield 2 oz/cwt (seed)	70	5.0 cd	7.3 d	17.4 de
5 Plant Shield 2 oz/cwt (seed)	69	3.9 bcd	6.2 cd	20.0 efg
6 Plant Shield 2 oz/cwt (seed)	70	2.8 ab	4.9 abc	23.9 fg
7 Plant Shield 2 oz/cwt (seed); 0.4 oz/1000 ft row (plant drench)	70	5.3 cd	6.9 d	18.3 def
8 Moncoat MZ 12 oz/cwt (seed)	69	1.3 a	4.3 abc	12.3 abc
9 Maxim MZ 8 oz/cwt (seed)	68	3.5 bc	5.7 bcd	15.5 cd
10 Maxim MZ 4 oz/cwt (seed); Amistar 80WG 0.15 oz/1000 ft row (IF)	68	2.1ab	4.6 abc	12.1 ab
11 Maxim MZ 8 oz/cwt (seed); Platinum Ridomil Gold 2.2 oz/1000ft row (IF)	69	4.5 cd	4.0 abc	16.3 cde
12 Maxim MZ 4 oz/cwt (seed); Amistar 80WG 0.15 oz/1000 ft row (IF)	69	2.5 ab	4.0 ab	10.3 a

Foliar treatment and rate/A	AUDPC[x] for canopy disease	Black dot (in.)	Total yield cwt/A	Market yield cwt/A
1 Control, unsprayed	119.8 ab	10.5	360	303
2 Unsprayed	99.6 bcde	10.5	372	314
3 Unsprayed	110.5 abc	10.0	359	300
4 QRD 22097 1 gm (A-F)[w]	125.1 a	11.1	365	310
5 QRD 22097 2 gm (A-F)	127.9 a	9.8	344	298
6 QRD 22097 4 gm (A-F)	97.9 cdef	10.5	368	307
7 Plant Shield (*Trichoderma harzianum*) 0.4 oz (A)	125.6 a	10.8	328	272
8 Headline 2.09EC 9 fl oz (ACE); Endura 70WG 2.5 fl oz + Dithane 75DF 1.5 lb (BDF)	78.4 f	10.9	375	316
9 Echo Zn 2.1 pt (A); Scala 60SC 7 fl oz + Echo Zn 2.1 pt (BDF); Reason 500SC 4 fl oz +Echo Zn 2.1 pt (CE)	112.5 abc	10.6	355	303
10 Scala 60SC 7 fl oz + Echo Zn 1.5 pt (ACE); Bravo WS 1.5 pt (BDF)	80.3 ef	11.1	380	335
11 Quadris Opti 1.6 pt (ACE); Bravo WS 1.5 pt (BDF)	102.1 bcd	10.3	373	330
12 CGA 169347 250EC 0.34 pt (ACE); Bravo WS 1.5 pt (BDF)	90.2 def	9.8	373	317

[z] cwt/A = hundred weight per acre.
[y] Means within a columns followed by the same letter are not significantly different (Waller-Duncan k-ratio t-test, *P*=0.05).
[x] Area under the disease progress curve.
[w] A-F refers to fungicide application dates: A= 25 Jul; B=1 Aug; C=9 Aug; D=16 Aug; E=23 Aug; F=30Aug.