

Efficacy of Application of Foliar Fungicides for Control of Cercospora Leaf Spot in Sugarbeet

W. W. Kirk and R. L. Schafer Department of Plant Pathology, Michigan State University, East Lansing, MI 48824

Sugar beet (*Beta vulgaris* L; cv. 5534N) was PAT-treated and planted at the Michigan State University Bean and Beet Farm, Saginaw, MI on 21 Apr. Seed was planted at 1" depth into four-row by 50-ft plots (ca. 4.375 in. between plants to give a target population of 275 plants/100ft. row) with 30" between rows replicated four times in a randomized complete block design. Fertilizer was drilled into plots immediately before planting, formulated according to results of soil tests (125 lb 46-0-0/A). No additional nitrogen was applied to the growing crop. Plots were inoculated by spreading sugarbeet foliar residue collected the previous season on 16 Jun across all plots. Fungicides were applied a) on the day of inoculation (16 Jun) and 1, 2, and 3 days after inoculation (DAI), Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v only or b) on a twenty-one-day interval (three applications), starting after the 55 Beetcast disease severity values were recorded in the area (Ontario Weather Network, Ridgetown, ON, Canada), starting on 16 Jul. Although four treatments were scheduled, disease pressure was low throughout the year and only three applications were made. Fungicides were applied with a hand-held R&D spray boom delivering 25 gal/A (80 p.s.i.) and using three XR11003VS nozzles per row. Weeds were controlled by cultivation and with a mixture of Pyramin DF at 5 lb/A plus Nortron at 4 pt/A applied at planting. Insects were controlled as necessary. Foliar leaf spot severity (%) was measured on 27 Aug and 17 Sep using a 1 – 10 scale. Foliar leaf spot severity was measured using a 1 - 10 scale; 1 = 1 - 5, 0.1%; 2 = 6 - 12, 0.35%; 3 = 13 - 25, 0.75%; 4 = 26 - 50, 1.5%; 5 = 51 - 75, 2.5%; spots/leaf or severity; respectively; 6 = 3% (proven economic damage); 7 = 6%; 8 = 12%; 9 = 25%; and 10 \geq 50% severity. Beet roots were machine-harvested on 3 Oct and individual treatments were weighed. Sugar content was measured at the Michigan Sugar Company analytical service laboratory. Meteorological variables were measured with a Campbell weather station located at the farm, latitude 43.3787 and longitude -84.1128 deg. Maximum, minimum and average daily air temperature ($^{\circ}$ F) from planting on 21 Apr were 80.8, 20.1 and 53.5 (Apr), 83.9, 27.3 and 53.6 (May), 92.5, 45.0 and 67.8 and 1-d with maximum temperature $>90^{\circ}$ F (Jun), 91.4, 43.3 and 70.3 and 1-d with maximum temperature $>90^{\circ}$ F (Jul), 90.3, 42.7 and 67.6 and 1-d with maximum temperature $>90^{\circ}$ F (Aug) and 89.5, 33.3 and 60.4 (to 3 Oct). Maximum, minimum and average daily soil temperatures ($^{\circ}$ F) over the same period were 60.9, 42.8 and 52.3 (Apr), 66.0, 47.3 and 52.6 (May), 76.2, 56.9 and 67.1 (Jun), 81.2, 60.8 and 71.5 (Jul), 80.0, 61.7 and 70.8 (Aug) and 77.1, 50.1 and 63.7 (to 3 Oct). Maximum, minimum and average daily relative humidity (%) over the same period was 96.1, 10.9 and 55.8 (Apr), 96.6, 10.5 and 61.4 (May), 96.1, 20.7 and 67.0 (Jun), 95.8, 27.1 and 67.1 (Jul), 96.0, 26.0 and 67.6 (Aug) and 96.0, 27.2 and 71.6 (Sep to 3 Oct). Maximum, minimum and average daily soil moisture (% of field capacity at 4" depth) was 83.8, 78.7 and 81.9 (Apr); 83.9, 61.0 and 80.2 (May); 93.2, 61.5 and 70.6 (Jun); 100.2, 73.4 and 80.5 (Jul), 99.9, 81.1 and 83.0 (Aug) and 103.5, 78.7 and 82.9 (Sep to 3 Oct). Precipitation was 0.10-in. (Apr), 1.13-in. (May), 3.88-in. (Jun), 3.94-in. (Jul), 2.1-in. (Aug) and 5.74-in. (Sep to 3 Oct). There were 175 Beetcast DSV values accumulated in the Saginaw area from 1 Apr to 23 Sep.

Cercospora leaf spot developed slowly throughout the growing season and reached an index of about 6 in the untreated control by 17 Sep. All treatments except the Enable program had significantly less Cercospora leaf spot than the untreated control at both evaluation dates. No treatment program or the untreated check exceeded the economic damage threshold (index = 6.0, about 50% foliar area affected spotted or necrotic). Treatments with indices of 0.3 to 1.0 and 1.0 to 2.3 at the first and second evaluation dates respectively were not significantly different and provided the best control of leaf spot.

There were no significant differences among treatments in terms of sugar content of beets (16.3 to 17.6%; average 16.9%); clear juice purity (94.9 to 96.3%; average 94.9%); recoverable white sucrose per ton (RWST; 242 to 264, average 253 lb/t); recoverable white sucrose per acre of sugarbeets (RWSA; 7049 to 8094, average 7646 t/A); or yield/A [range 28.5 to 31.7 to 26.1, average 30.3 t/A (29.8 = untreated)]. No phytotoxicity was observed from any treatments.

Treatment and rate/acre	Cercospora leaf spot ^z (1-10 scale)				Sugar %	CJP ^y (%)	RWST ^x (lb)	RWSA ^w (lb)	Yield (t/A)
	27 Aug		17 Sep						
Eminent 125SL 13 fl oz (B); SA140301 80WP 5 oz (C); Headline 2.08SC 9 fl oz (D).....	0.5	ef	1.0	f	17.1	95.9	257	7848	30.5
A7402 250EC 7 fl oz (B,D); Headline 2.08SC 9 fl oz (C).....	1.0	c-f	1.0	f	16.7	96.3	251	7979	31.7
A8122 500EC 5 fl oz (B,D); Headline 2.08SC 9 fl oz (C).....	0.3	f	1.5	ef	17.0	95.1	251	7505	30.0
A13703 325SC 8.5 fl oz (B,D); Super Tin 80WP 2.5 oz (C).....	0.8	def	1.3	ef	17.6	95.9	264	7874	29.9
Eminent 125SL 13 fl oz (B,D); Headline 2.08SC 9 fl oz (C).....	1.0	c-f	1.5	ef	17.3	95.6	259	7849	30.4
Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (B,D).....	0.8	def	1.5	ef	17.2	95.6	256	7843	30.6
Gem 500SC 3.5 fl oz (B); Eminent 125SL 13 fl oz (C); Super Tin 80WP 5 oz (D).....	1.0	c-f	1.3	ef	17.1	95.5	255	7749	30.4
Gem 500SC 3.5 fl oz (B); Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (C); Super Tin 80WP 5 oz (D).....	0.8	def	2.5	b-e	16.8	95.5	249	7810	31.3
Gem 500SC 3.5 fl oz (B); Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (C).....	0.5	ef	2.3	c-f	16.9	95.9	253	7810	30.9
Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (A); Gem 500SC 3.5 fl oz (C).....	0.8	def	1.5	ef	17.0	95.8	255	7898	31.0
Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (A).....	1.3	cde	2.5	b-e	17.3	96.1	260	8093	31.1
Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (A ₁).....	0.8	def	3.3	bc	17.1	96.0	257	7819	30.5
Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (A ₂).....	1.3	cde	3.8	b	17.2	95.4	256	7785	30.5
Proline 480SC 5 fl oz + Induce 480XL 0.125 % v/v (A ₃).....	1.8	bc	3.0	bcd	16.7	95.3	247	7050	28.5
Polyoxin D 2.5WP 1.5 lb (B,C,D).....	1.0	c-f	3.0	bcd	16.7	95.7	249	7722	30.9
Polyoxin D 2.5WP 2 lb (B,C,D).....	0.8	def	2.3	c-f	16.8	96.2	254	7457	29.4
Eminent 125SL 13 fl oz (B); Super Tin 80WP 5 oz (C); Headline 2.08SC 9 fl oz (D).....	0.5	ef	2.0	c-f	17.0	95.2	251	7579	30.3
Serenade Max 1.34WP 1 lb + Headline 2.08SC 9 fl oz (B,C,D).....	0.8	def	1.0	f	16.3	95.6	242	7314	30.2
Eminent 125SL 13 fl oz (B); Serenade Max 1.34WP 1 lb (C,D).....	1.5	bcd	3.0	bcd	17.0	95.1	251	7399	29.5
Topguard 1.04SC 7 oz (B,C,D).....	0.8	def	2.3	c-f	16.5	95.7	246	7281	29.6
Topguard 1.04SC 10 oz (B,C,D).....	0.8	def	1.0	f	17.0	95.1	251	7783	31.1
Topguard 1.04SC 14 oz (B,C,D).....	1.0	c-f	1.8	def	16.6	94.9	244	7140	29.3
Topguard 1.04SC 28 oz (B,C,D).....	0.5	ef	1.0	f	17.2	95.6	258	8095	31.5
Topguard 1.04SC 14 oz (B); Super Tin 80WP 5 oz (C); Headline 2.08SC 9 fl oz (D).....	1.3	cde	3.0	bcd	16.7	95.3	247	7373	29.8
Enable 2F 8 fl oz + COC 0.125 % v/v + Dithane 75DF 2 lb (B,C,D).....	2.3	ab	5.5	a	16.9	95.8	253	7434	29.3
Untreated Check.....	2.8	a	5.8	a	16.9	95.4	250	7452	29.8
LSD _{0.05}	0.87		1.45		0.66	0.86	12.5	803.1	2.83
Treatment prob (F)	0.001		0.001		0.105	0.09	0.15	0.48	0.93

^z Cercospora leaf spot severity was measured using as percent foliage affected by Cercospora leaf spot.

^y Clear juice purity

^x RWST = Recoverable White Sucrose per Ton of Sugarbeets

^w RWSA = Recoverable White Sucrose per Acre (Ton/A*RWST)

^v Application dates: A= 16 Jun; A1= 17 Jun; A2= 18 Jun; A3= 19 Jun; B= 16 Jul; C= 8 Aug; D= 25 Aug.

^u Means followed by same letter are not significantly different at P = 0.05 (Tukey multiple comparison method).