

SUGAR BEET (*Beta vulgaris* 'C-G333NT')  
Cercospora Leaf Spot; *Cercospora beticola*

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### **Evaluation of cultural practices to manage *Cercospora* leaf spot of sugar beet in Michigan, 2019-20.**

The trial was established at the Saginaw Valley Research and Extension Center in Frankenmuth, MI. A randomized complete block design was used, and treatments were replicated four times. Beets were planted 7 May at a rate of 50,000 seed/A, using 30-in. row spacing. Plot dimensions were four rows wide by 60 ft long. Soybean was planted in 10-ft buffer zones surrounding each plot. Inoculations were made 9 Jul using a tractor mounted field sprayer applying a *C. beticola* spore solution (approximately 100 spores/mL by hemocytometer) at 15 gal/A. The four treatments tested in this study included a non-treated control, plow with a 10-ft tandem disc set to invert soil 6 in. immediately post-harvest, heat treatment using a propane-fueled burner calibrated to heat foliage to 1200-1600°F at 1 mph prior to defoliation, and a desiccant (Sharpen 1 fl oz/A) applied seven days pre-harvest. Treatments were applied pre- or at-harvest on 17 Oct or 24 Oct, respectively. The desiccant was applied with a CO<sub>2</sub> powered backpack sprayer equipped with four TJ 8004XR nozzles (30-in. spacing) calibrated at 15 gal/A. Root subsamples were collected from each control and heat-treated plot on 24 Oct and sent to Michigan Sugar Company (Bay City, MI) to determine percent sugar and recoverable white sugar per ton (RWST). Plots were scouted regularly to monitor *Cercospora* leaf spot (CLS) progression. In addition, four leaf samples were collected: one was destructively sampled and three were placed in mesh bags and left in each plot to be evaluated 45-, 90-, and 135-days post-harvest (DPH). Bags were incorporated into the soil to mimic soil conditions after treatment application, 6 in. for plow-treated plots and <1 in. for all other plots. At each timepoint, leaf samples were assessed for percent lesion sporulation, following a 3-d incubation in a moist chamber at 70-75°F, and percent *C. beticola* viability, determined from morphological confirmation of *C. beticola* growth *in vitro*. Following harvest, winter wheat was planted in the 10-ft buffer zones surrounding each plot and maintained during the 2020 season.

In 2020, the trial was continued and planted on 17 Apr using the previously described experimental design and plot layout. Beginning 26 May, boxes of four highly susceptible sentinel beets (USDA germplasm F1042) were placed in each plot for one week; sampling continued until 20 Jul. Sentinel beets were placed in 5-ft by 10-ft enclosures of 4-mm polyethylene sheeting and galvanized steel posts; total CLS lesions were counted after beets were incubated for 3 d in a humidity chamber at 77°F and maintained for two weeks in a greenhouse. Plot CLS ratings were initiated 16 Jun and continued until 28 Jul. Plots were assigned a severity using the following scale based on infected leaf area: 1=0.1% (1-5 spots/leaf), 2=0.35% (6-12 spots/leaf), 3=0.75% (13-25 spots/leaf), 4=1.5% (26-50 spots/leaf), 5=2.5% (51-75 spots/leaf), 6=3%, 7=6%, 8=12% 9=25%, 10=50%. The ratings were used to calculate area under the disease progress curve for CLS severity (AUDPC). Roots were harvested from the center two rows of each plot 8 Oct and subsamples sent to Michigan Sugar Company (Bay City, MI) to determine percent sugar and RWST. A generalized linear mixed model procedure was used to conduct the ANOVA ( $\alpha=0.05$ ) and mean separations (SAS version 9.4).

Significant treatment differences were detected in percent lesion sporulation ( $P < 0.001$ ) and percent *C. beticola* viability ( $P < 0.05$ ) from at-harvest leaf samples. No significant differences were detected in leaf samples evaluated at 45-, 90-, and 135-DPH. Heat treatment resulted in significantly fewer lesions on sentinel beets from 26 May – 2 Jun ( $P < 0.05$ ) and 2 Jun – 9 Jun ( $P < 0.01$ ). AUDPC values were significantly different among treatments ( $P < 0.01$ ), and the heat treatment resulted in significantly lower CLS than all other treatments. No significant differences were detected in percent sugar or RWST in either year ( $P > 0.05$ ).

Table 1. Overwintered leaf sample and root sugar information collected in 2019-20

#	Treatment <sup>z</sup>	At-harvest		45 DPH <sup>y</sup>		90 DPH		135 DPH		At-harvest		Post-harvest	
		Sp <sup>x, w</sup> (%)	Vb <sup>v</sup> (%)	Sp (%)	Vb (%)	Sp (%)	Vb (%)	Sp (%)	Vb (%)	RWST <sup>u</sup>	Sugar (%)	RWST	Sugar (%)
1	Control	76.7 a	36.1 a	17.3	13.7	1.2	0	0.3	0	220.1	15	211.8	19.6
2	Plow	62.1 b	42.2 a	0.5	0.5	0	0	0	0	-	-	-	-
3	Heat	5.5 c	4.6 b	0.7	0.7	0	0	0	0	222.3	15.2	218.9	20.3
4	Desiccant	59.9 b	33.6 a	13.2	11.4	0.6	0	0.1	0	-	-	-	-

<sup>z</sup> Non-treated control, plow with a 10-ft tandem disc set to invert soil 6 in. immediately post-harvest 24 Oct, heat treatment using a propane-fueled burner (Multi-Trail Enterprises LLC) calibrated to heat foliage to 1200-1600°F at 1 mph prior to defoliation 24 Oct, and a desiccant (Sharpen 1 fl oz/A, methylated seed oil 1% v/v, ammonium sulfate 17 lb/100 gal) applied seven days pre-harvest 17 Oct

<sup>y</sup> Days post-harvest (DPH)

<sup>x</sup> Percent lesion sporulation (Sp) determined following a 3-d incubation in a moist chamber at 70-75°F

<sup>w</sup> Column values followed by the same letter were not significantly different based on Fisher's Protected LSD ( $\alpha=0.05$ ).

<sup>v</sup> Percent *C. beticola* viability (Vb) determined from morphological confirmation of *C. beticola* growth from 15 representative lesions plated on half-strength clarified V8 juice agar amended with 0.5 g/L streptomycin and 0.25 g/L ampicillin

<sup>u</sup> Pounds recoverable white sugar per ton (RWST)

Table 2. Sentinel beet, CLS severity, and sugar information collected in 2020

#	Treatment <sup>z</sup>	Sentinel <sup>y, x</sup> (26 May – 2 Jun)	Sentinel (2 Jun – 9 Jun)	Sentinel (14 Jul – 20 Jul)	AUDPC <sup>w</sup>	RWST <sup>v</sup>	Sugar (%)
1	Control	284 a	60 b	199	19.9 a	203.1	14.1
2	Plow	337 a	51 b	219	22.3 a	218.2	14.9
3	Heat	65 b	16 c	130	8.5 b	207.8	14.3
4	Desiccant	482 a	212 a	320	20.2 a	211.2	14.5

<sup>z</sup> Non-treated control, plow with a 10-ft tandem disc set to invert soil 6 in. immediately post-harvest 24 Oct, heat treatment using a propane-fueled burner (Multi-Trail Enterprises LLC) calibrated to heat foliage to 1200-1600°F at 1 mph prior to defoliation 24 Oct, and a desiccant (Sharpen 1 fl oz/A, methylated seed oil 1% v/v, ammonium sulfate 17 lb/100 gal) applied seven days pre-harvest 17 Oct

<sup>y</sup> Total CLS lesions were counted on sentinel beets (USDA germplasm F1042) after one-week exposure in the field, 3 d incubation in a 77°F humidity chamber, and two weeks in a greenhouse.

<sup>x</sup> Column values followed by the same letter were not significantly different based on Fisher's Protected LSD ( $\alpha=0.05$ ).

<sup>w</sup> Area under the disease progress curve (AUDPC) was calculated using disease severity (0-10 scale).

<sup>v</sup> Pounds recoverable white sugar per ton (RWST)