Inoculum reduction strategies for improved management of Cercospora leaf spot on sugar beets, 2020-21

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Background: This research aims to identify, develop, and deploy novel, long-term CLS management strategies. Observations of *C. beticola* survival over the winter, early-season inoculum and spore presence, and disease pressure overtime have helped us to identify opportunities for further improvement in CLS management. End-of-season management strategies were assessed to reduce *C. beticola* inoculum levels and CLS disease pressure in the field.

Location: Saginaw (SVREC)	**Treatments:** described below
Planting Date: May 7, 2021	**Variety:** C-G932NT (Inoculated July 9 and July 23, 2020)
Harvest: September 17, 2021	**Replicates:** 4

Methods: From 2020-21, experiments were repeated to evaluate the following fall treatments: 1) nontreated control, 2) plow immediately post-harvest, 3) heat treatment at 1 mph prior to defoliation at-harvest, 4) desiccant (saflufenacil) 7 days pre-harvest, and 5) heat treatment at 3 mph. In 2020, treatments were applied to 10 x 60 ft plots, surrounded by a 10-ft buffer of winter wheat followed by soybean, and replicated four times in a randomized complete block design. Leaf samples were collected from each plot at harvest before topping and evaluated 0-, 45-, 90-, and 135-days post-harvest (DPH) to assess *C. beticola* survival over the winter, determined using the percentage of lesion sporulation and isolation frequency from treated leaves. Leaf degradation over time was also evaluated.

In 2021, highly susceptible sentinel beets (germplasm F1042) and bi-weekly CLS ratings in re-planted plots were used to assess the efficacy of inoculum reduction strategies. Yield and sugar data were collected to assess the long-term efficacy of inoculum reduction strategies. Statistical analyses (mixed model ANOVA) were conducted in SAS v. 9.4 and evaluated at the $\alpha=0.05$ significance level. Fisher's protected Least Significance Difference was used for mean comparisons.

Summary: In 2020 (following treatment application), significant differences were detected in percent lesion sporulation at-harvest ($P < 0.0001$, Fig. 1A), 45-DPH ($P < 0.01$, Fig 1B), and 90-DPH ($P < 0.05$, Fig. 1C) samples (N=160 leaves and 200 lesions per timepoint). No differences were detected in isolation frequencies of *C. beticola* from leaf samples evaluated at-harvest, 45-, 90-, and 135-DPH. Additionally, no differences were observed in percent sugar or RWST. Significant differences in percent leaf degradation, calculated using initial leaf weight at-harvest and final weight post-harvest, were detected in 90- ($P < 0.05$) and 135-DPH ($P < 0.01$) leaf samples. In 2021 (the year following treatment application), both heat treatments resulted in significantly fewer lesions on sentinel beets from June 1-8 ($P < 0.05$, Fig. 2A) and the 1 mph heat treatment resulted in significantly fewer lesions on sentinel beets June 15-22 ($P < 0.05$, Fig. 2B) compared to the non-treated control (N=60 beets per timepoint). Area under the disease progress curve (AUDPC) values were significantly different among treatments ($P < 0.01$, Fig. 2C); the plow and heat treatments resulted in significantly lower CLS than the non-treated control. Results from repeated experiments (2019-20 and 2020-21) consistently suggest the use of a foliar burner at-harvest has the potential to significantly reduce inoculum overwintering and CLS levels the following year.

An additional trial is in-progress to evaluate the following additional fall treatments: wheeler rye cover crop at 67 kg/ha planted immediately post-harvest, factory lime at 3 and 6 tons/acre applied immediately post-harvest, and heat treatment at 3 mph prior to defoliation. Evaluations will continue into the 2022 growing season.

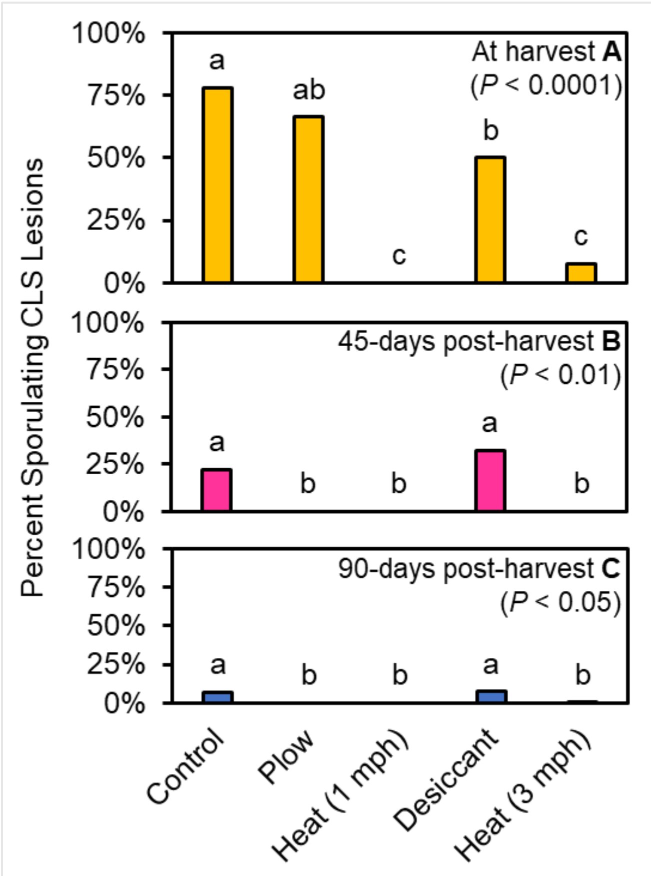

***Figure 1. A)** At-harvest, **B)** 45-, and **C)** 90-day post-harvest lesion sporulation following fall treatments applied in 2020. Leaf samples from each treated plot were placed in a moist chamber for three days. Then CLS lesions were assessed by observing characteristic C. beticola sporulation under a stereomicroscope (X7-X30 magnification). Means of bars with the same letters were not different based on Fisher's protected LSD at α=0.05.*

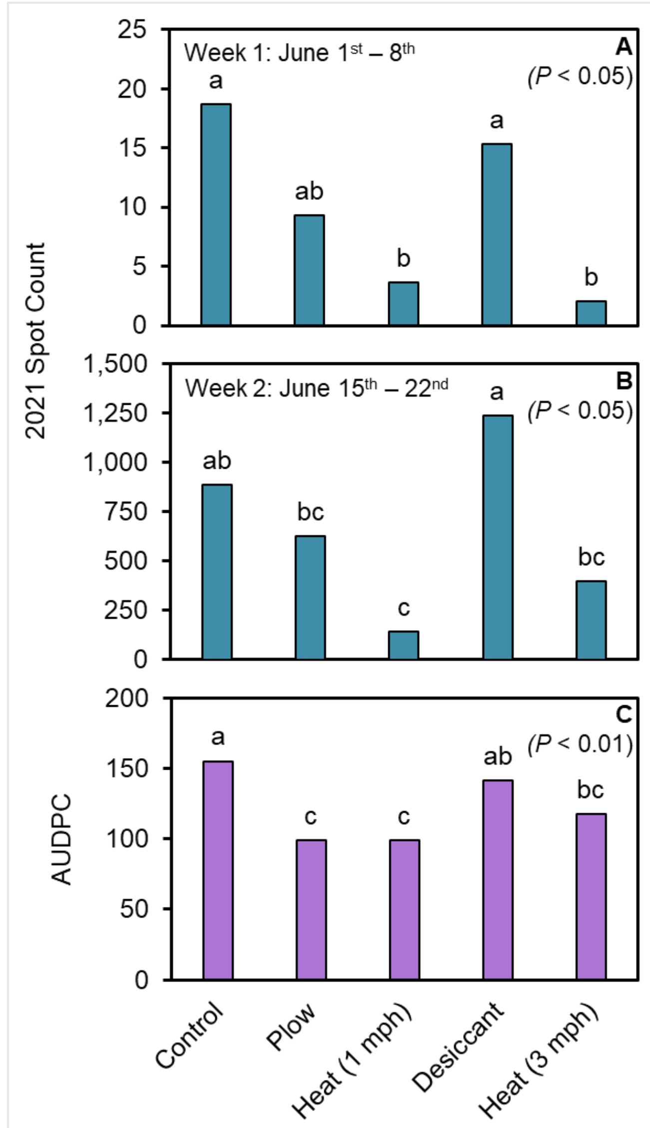

***Figure 2.** Early-season inoculum and subsequent CLS observations in 2021 following end-of-season treatments applied in 2020. **A-B)** Spot counts were collected from four sentinel beets placed in the center of each treated plot, left for seven days, incubated in a moist chamber for 3 days, and kept in a greenhouse for 21 days to promote symptom development. **C)** Area under the disease progress curve (AUDPC) generated from CLS ratings (0-10 scale) collected 15 Jun to 10 Aug. Means of bars with the same letters were not different based on Fisher's protected LSD at α=0.05.*

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