Impacts of Cercospora leaf spot, mechanical damage, and variety on postharvest beet rot susceptibility, 2022-23

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Objective 1: Evaluate the impact of Cercospora leaf spot (CLS) field infection on storage rot symptom development on bruised beets. Previous results indicate CLS levels in the field do not affect rot development in hand-harvested beet roots for three pathogens and multiple varieties tested (Hendershot et al. REACh 2021, 2022). Feedback from the industry indicated CLS may impact storability following commercial harvest.

Methods: CLS was rated on the KWS scale of 0 (disease-free) to 10 (>50% necrotic). Visually healthy beets were harvested by hand (field location details below), washed with water, and bruised on one side using a 1.5-kg weight dropped from a 1-meter height. Beets were stored at 7 °C in plastic bags with wood shavings to reduce free moisture. At each timepoint, roots were removed from storage and inoculated with a known storage rot pathogen or with a sterile clarified V8 (CV8) plug as a control. Based on common pathogen genera identified from Michigan Sugar pile samples, virulent isolates of *Penicillium vulpinum*, *Botrytis cinerea*, and *Fusarium graminearum* were chosen for storage trials. Inoculated beets were incubated with the agar plug at ambient temperature for 7 days before the plug was removed. Rot length, width and depth were measured after 50 and 90 days for timepoints 1 and 2, respectively.

Location: Saginaw (SVREC)	**Variety:** C-G932NT	**Harvest:** 9/22/22
Planting Date: 4/29/2022	**Inoculated:** July 12, 2022	**Replicates:** 4 plots/treatment in field
High CLS Average at harvest: 7.86	**Low CLS average at harvest:** 1.86	

Summary: There was no significant difference in rot development between CLS levels for any pathogen during either timepoint. Bruising led to significantly increased length, width, and depth of rot for beets infected with *Botrytis cinerea* and *Penicillium vulpinum* 50 days postharvest ($P < 0.05$, Figure 1). Bruising impacted rot length at 90 days postharvest in beets inoculated with *P. vulpinum*, but no other pathogen or measurement was significant at that timepoint.

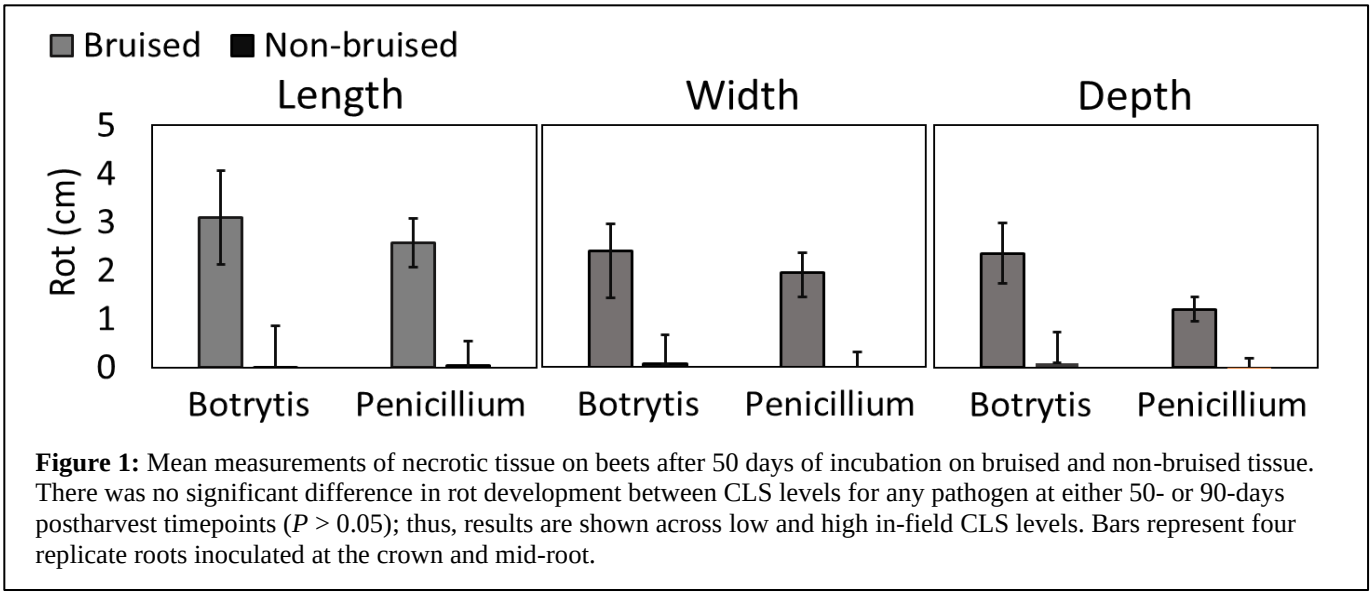

Figure 1: Mean measurements of necrotic tissue on beets after 50 days of incubation on bruised and non-bruised tissue. There was no significant difference in rot development between CLS levels for any pathogen at either 50- or 90-days postharvest timepoints ($P > 0.05$); thus, results are shown across low and high in-field CLS levels. Bars represent four replicate roots inoculated at the crown and mid-root.

Objective 2: Determine effect of CLS infection and pathogen colonization on respiration rate in storage. In 2021, there was no difference in rate of respiration per kilogram of beet weight between beets classified as having high and low CLS in the field ($P > 0.05$) across three storage pathogens and the tested variety (Hendershot et al. REACh 2022). Beets inoculated with *Botrytis cinerea* had a significantly increased respiration rate compared to other storage pathogens by the end of the storage period ($P < 0.05$); this observation was not related to in-season CLS levels ($P > 0.05$).

Summary: In 2022, storage rot development was poor in the inoculated respiration trial due to technical failure resulting in unfavorably cold conditions for infection. Our limited results indicate there was no significant difference in respiration rate between the beets inoculated with pathogens and those inoculated with the control ($P > 0.05$). For these reasons, we are currently repeating this trial during the 2023-24 storage period.

Objective 3: Determine susceptibility of varieties to post-harvest rot pathogens. Twelve commercial varieties grown in a Michigan Sugarbeet Advancement trial (details below) were tested for storage rot susceptibility. Beets were harvested by hand and stored at 7 °C in plastic bags with wood shavings. At each timepoint, visually healthy beets of each variety were removed from storage, washed, and cut into approximately 3-cm thick sections. Root sections were inoculated with a known storage rot pathogen or with a CV8 plug as a control. There were four replications of each variety x pathogen combination. Inoculated beets were incubated for 24 hours before removal of agar plugs. After one week at ambient temperature, the length and depth of rot were measured.

Location: Sandusky, Sanilac County	**Varieties:** BTS-1065, BTS-1606N, BTS-1703, C-G021, C-G049, C-G675, C-G932NT, HIL-2332NT, HIL-2361, HIL-9865, SX-2295, SX-2296N
Planting Date: May 8, 2022	
Harvest: October 27, 2022	

Summary: Significant variability in responses was observed among the twelve tested varieties, although no varieties consistently performed better or worse than others across the three tested pathogens (Figure 2). Interestingly, some varieties with the largest mean rot diameters for one pathogen may have exhibited the smallest diameters for another. These observations will inform future breeding efforts. This experiment is being repeated for the 2023-24 storage season.

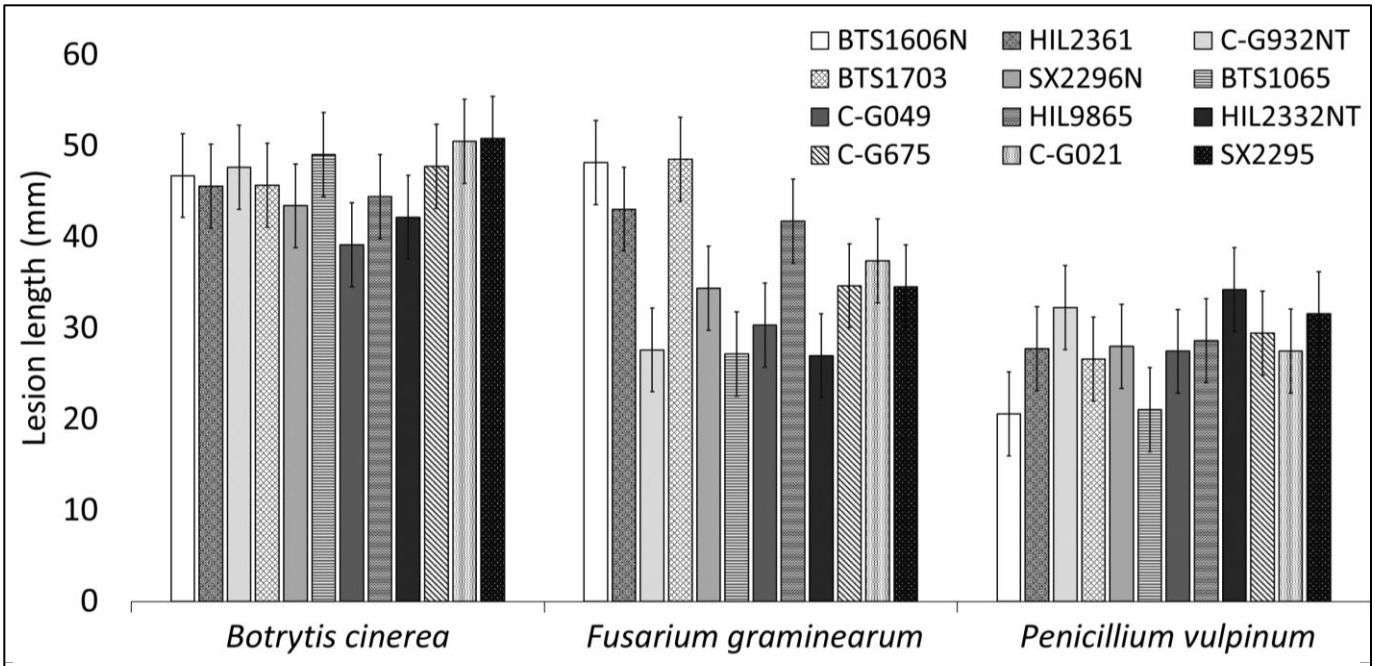

Figure 2: Mean lesion length following inoculation by three storage rot pathogens among twelve commercial beet varieties at 60-days post-harvest. Measurements collected after one week incubation. Significant differences were observed in variety responses to storage pathogens ($P < 0.05$). Bars represent four replicate sugar beet root slices.

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