MICHIGAN STATE UNIVERSITY EXTENSION

Michigan State University AgBioResearch

Evaluation of Cercospora leaf spot and postharvest rot pathogen impacts on sugarbeet storage, 2021-22

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Objective 1: Evaluate the impacts of variety and Cercospora leaf spot (CLS) field infection on rate of storage rot symptom development. CLS was rated on the KWS scale of 0 (disease-free) to 10 (>50% necrotic). Beets were harvested by hand and stored at 7 °C in plastic bags with wood shavings. Healthy-appearing 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 sterile potato dextrose agar (PDA) plug as a control. There were four replications of each variety x pathogen combination. Based on common pathogens from 2019-21 MSC pile samples, *Penicillium vulpinum*, *Botrytis cinerea*, and *Fusarium graminearum* were chosen for storage trials (REACh, 2020). Inoculated beets were incubated for 24 hours before removal of agar plugs, and after one week at ambient temperature, the lesion length and depth were measured.

Trial 1: CLS infection impact on susceptibility of sugarbeet to three postharvest diseases

Location: Saginaw (SVREC)	**Treatments:** Non-treated (high CLS), grower standard (low CLS)
Planting Date: May 6th, 2021	**Variety:** C-G932NT
Harvest: October 11th, 2021	**Inoculated:** July 12th, 2021
"High CLS" average rating: 10	**"Low CLS" average rating:** 4.75

Summary: There was no evidence that CLS levels in the field affect rate of rot development for *Botrytis cinerea, Fusarium graminearum*, or *Penicillium vulpinum*. There were no significant differences between storage rot development in beets with high and low CLS levels at any timepoint in 2020 or 2021 ($P > 0.05$, Figure 1).

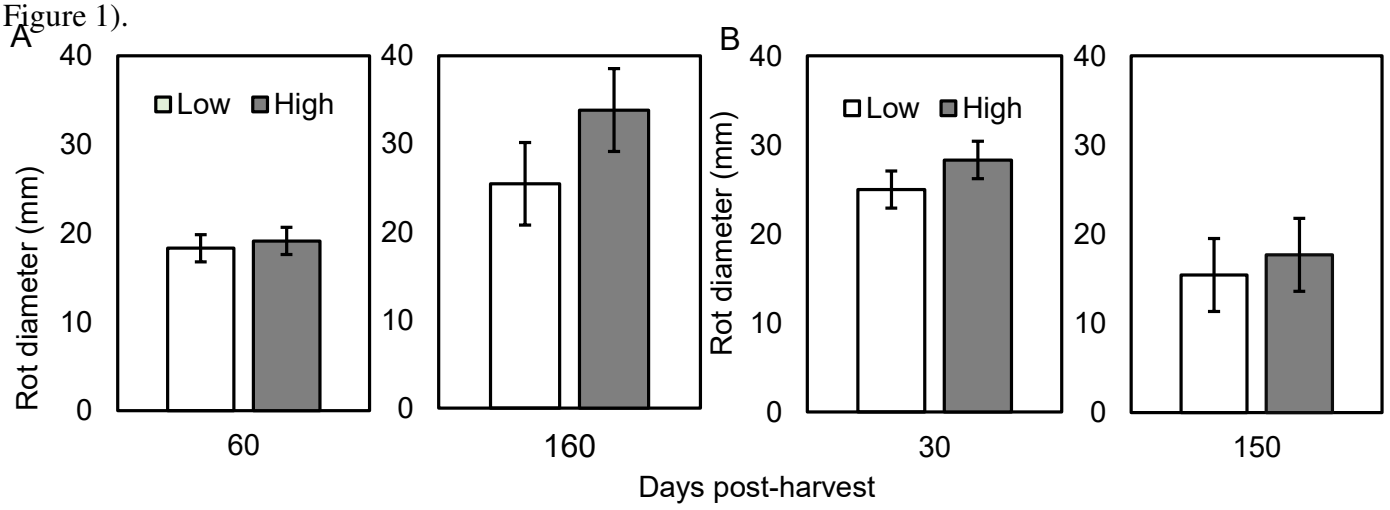

Figure 1. Mean diameter of necrotic tissue on beet slices with low and high CLS in the field after one week incubation. There was no significant difference between CLS levels in rate of rot development at any timepoint ($P > 0.05$) in 2020 (A) or 2021 (B). Observations were similar regardless of storage pathogen used, thus means across all pathogens are shown. Bars indicate 32 and 24 replicate roots for 2020 and 2021, respectively, and error bars indicate standard error. First and last timepoints shown of 3 timepoints in 2020 and 4 total timepoints in 2021.

Trial 2: CLS inoculation and variety impacts on susceptibility of sugarbeet to three postharvest diseases

Location: Saginaw (SVREC)	**Treatments:** Inoculated (high CLS), non-inoculated (low CLS)
Planting Date: May 6th, 2021	**Varieties:** F1042, EL50/2, C-G932NT, HIL-9865
Harvest: November 5th, 2021	**Inoculated:** July 12th, 2021
"High CLS" average rating: 6.58	**"Low CLS" average rating:** 3.79

Summary: There were no significant differences between rot susceptibility in beets with high or low CLS in the field at any timepoint among the four varieties ($P > 0.05$, data not shown). There were significant varietal differences in lesion development across the three pathogens at all storage timepoints ($P < 0.05$, Figure 2). There were also significant differences (P<0.05) in rate of rot development among varieties in 2020 (data not shown).

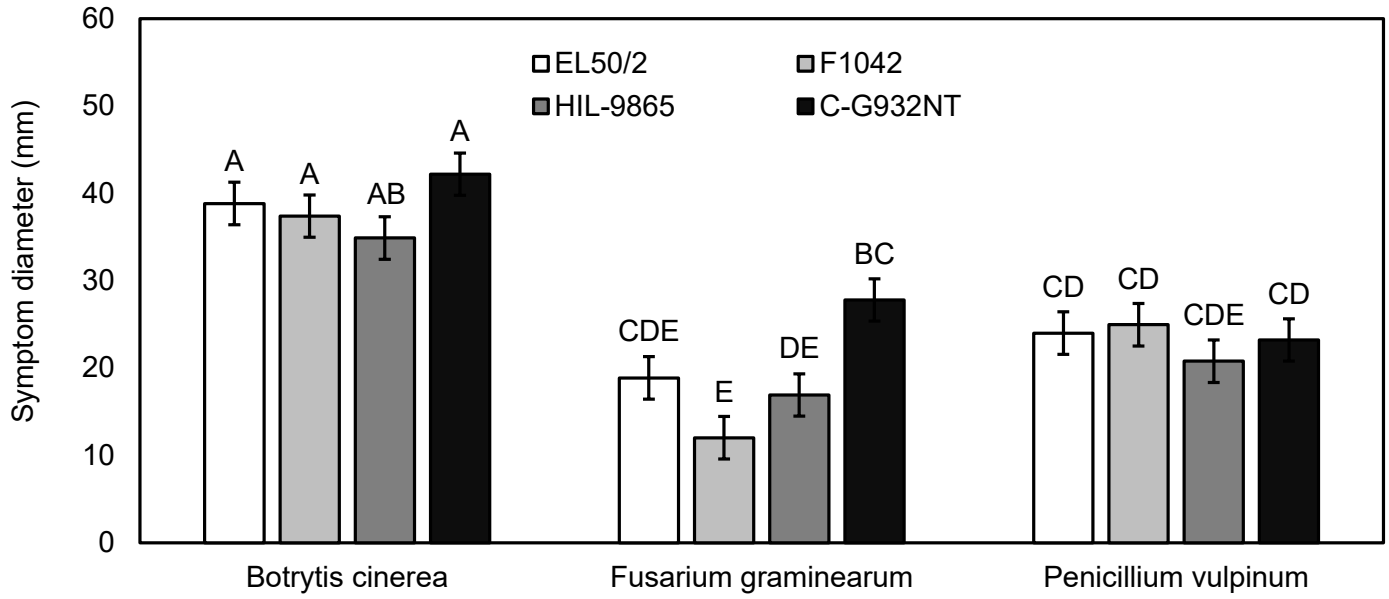

Figure 2: Comparison of mean diameter of necrotic tissue on beet slices among three storage pathogens, inoculated on roots originating from Trial 2, after one week incubation. Graph showing results from the 60-days postharvest timepoint tested in 2021. Bars indicate 8 replicate roots and error bars indicate standard error.

Objective 2: Investigate the effect of CLS infection and postharvest rot on beet respiration rate in storage. Roots of C-G932NT with high and low CLS levels (collected from Trial 1 described above) were inoculated at the crown by removing a plug of beet tissue, inserting a plug of *B. cinerea, F. graminearum*, *P. vulpinum* or PDA control, replacing the beet plug, and sealing with petroleum jelly. Respiration was measured weekly for two months.

Summary: Across three storage pathogens and a single beet variety, 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 ($P > 0.05$, data not shown), consistent with work from K. Fugate (Fugate et al. 2022). Differences were observed in respiration rate among varieties. In addition, beets inoculated with *B. cinerea* had a significantly increased respiration rate compared to other storage pathogens by the end of the storage season ($P < 0.05$, Figure 3); this was not related to in-season CLS levels ($P > 0.05$).

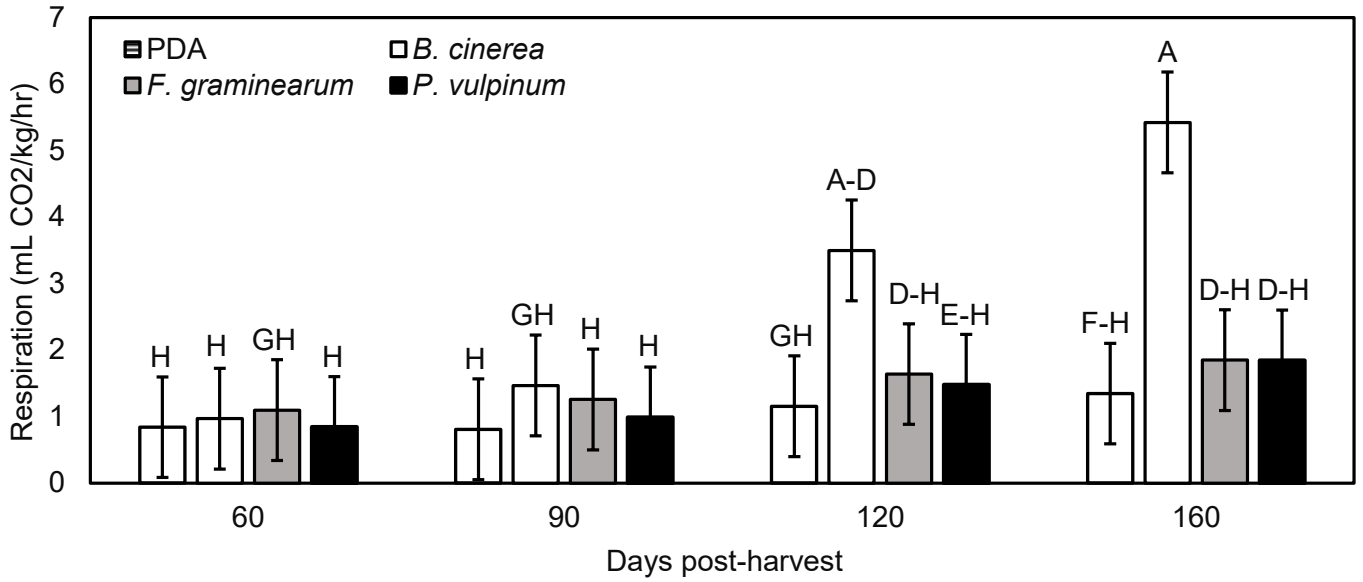

Figure 3. Comparison of mean respiration rate of beets inoculated with three storage pathogens or PDA control. Roots originated from Trial 1 in 2021. Bars indicate 6 replicate chambers and error bars indicate standard error.

Summary

- There is no evidence that CLS in the field causes an increase in rate of rot development or respiration in intact beets.
- There is variation among varieties in storage rot responses to different pathogens.
- One of the storage rots showed evidence of increasing respiration, we are repeating this experiment.
- We will continue to investigate the effects of CLS on storage pathology and beet storability.

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