MICHIGAN STATE UNIVERSITY EXTENSION

Michigan State University AgBioResearch

Evaluation of Cercospora leaf spot and postharvest rot pathogen impacts on sugarbeet storage, 2020-21

Carly Hendershot[1], Chris Bloomingdale[1], Holly Corder[1], Tom Goodwill[2], Sarah Ruth[1], Cameron Pincumbe[1], Randy Beaudry[1], Linda E. Hanson[1,2], and Jaime F. Willbur[1]; [1]Michigan State University; [2]USDA-ARS

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

Location: Saginaw (SVREC)	**Treatments:** Non-treated (high CLS), grower standard (low CLS)
Planting Date: April 7, 2020	**Variety:** C-G333NT (Inoculated July 9 and July 23, 2020)
Harvest: September 18, 2020	**Replicates:** 4 plots/treatment in field, 3 roots/plot in storage

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

Location: Saginaw (SVREC)	**Treatments:** Inoculated (high CLS), non-inoculated (low CLS)
Planting Date: May 22, 2020	**Varieties:** F1042, EL50/2, C-G333NT, HIL-9865
Harvest: October 15, 2020	**Inoculated:** July 9 and July 23, 2020

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 (foliage dead). At time of harvest, non-treated beets had an average rating of 5.44 (classified as high CLS) and treated beets averaged 2.34 (low CLS). Beets were harvested by hand and stored at 7 °C in plastic bags with wood shavings. Healthy beets of each variety were removed from storage every 4 weeks, 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 2019-20 samples, *Penicillium vulpinum*, *Botrytis cinerea*, *Geotrichum* sp. 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 and compared across varieties. Four timepoints were completed at 30, 90, 120 and 150 days postharvest.

Summary: Results show no evidence that CLS levels in the field affect rot development in storage for *Botrytis cinerea, Fusarium graminearum, Geotrichum* spp. or *Penicillium vulpinum* for the varieties tested. 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 ($P > 0.05$, Figure 1). In trial 2, no significant effects were observed between CLS severity and rot diameter or depth at any timepoint ($P > 0.05$, data not shown). For all trials, lesions formed by *Geotrichum* sp. were not statistically different from the control ($P > 0.05$); additional screening will be conducted to assess diversity and aggressiveness. There were significant varietal differences in lesion development across the various pathogens at all storage timepoints ($P < 0.05$, Figure 2).

The relationship between beet variety and storage pathogen symptom development on beet root response to storage pathogens will be evaluated again during storage 2021-22. Depending on results from 2021-22 experiments, additional investigations of CLS impacts on beet storability may also be conducted. In 2022-23, varieties of interest are: EL-A18-0002, EL-A021482, C-G932NT and HIL-9865, with storage pathogens *B. cinerea*, *F. graminearum*, and *P. vulpinum*.

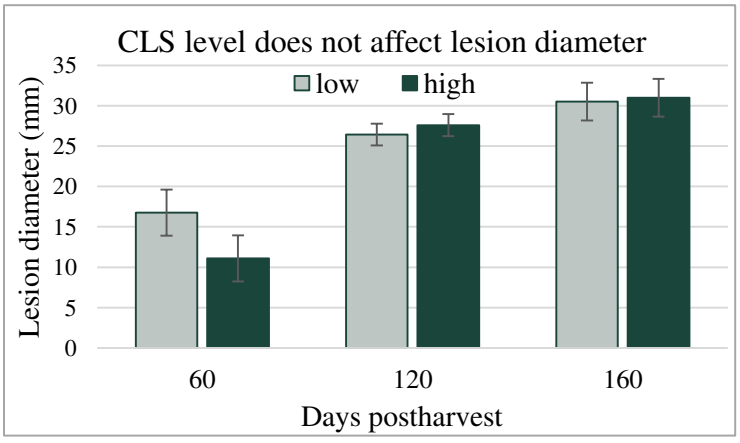

Figure 1: **Mean lesion diameters measured from trial 1 roots inoculated with postharvest pathogens 160 days postharvest (n=54 beet slices per treatment).**

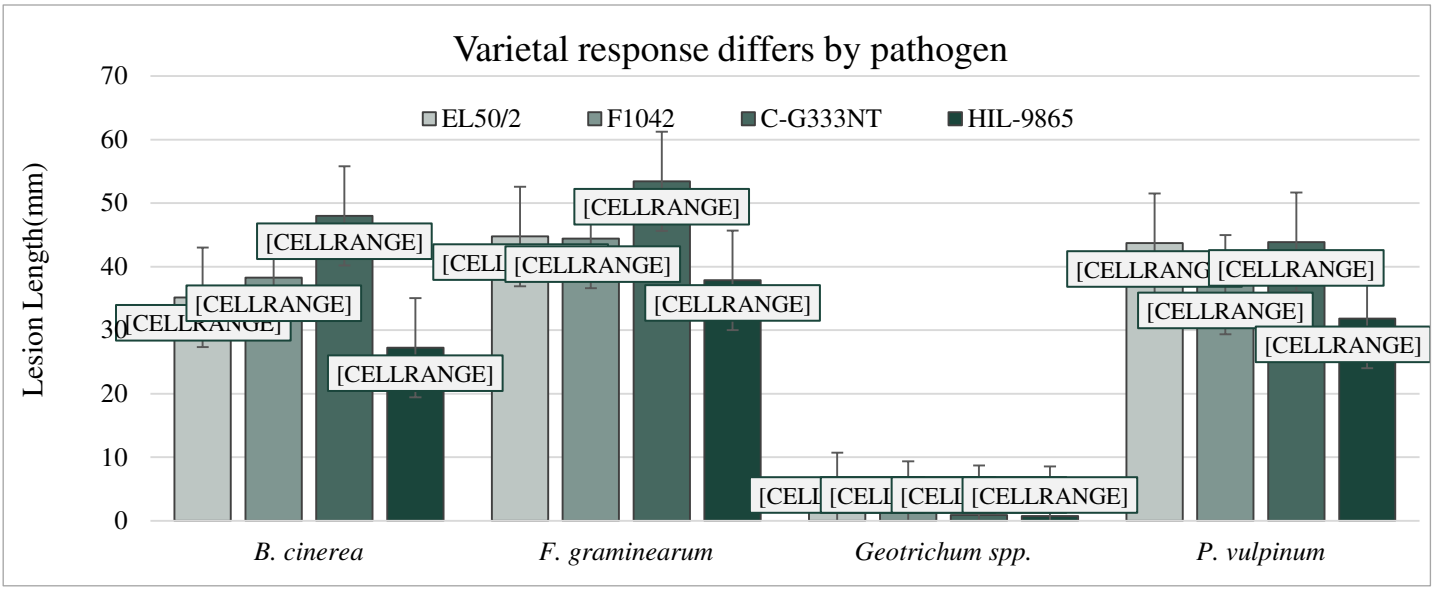

Figure 2: **Mean lesion diameter on roots of 4 varieties inoculated with storage pathogens 160 days postharvest (n=8 variety x pathogen replications per timepoint).**

Objective 2: Investigate the effect of CLS infection and post-harvest rot on beet respiration rate in storage. The effect of in-season CLS severity on storage respiration was also evaluated in collaboration with Dr. Randolph Beaudry. Roots of C-G333NT and HIL-9865 with high and low CLS levels were stored in vented respirometry chambers at 6°C/42°F. These beets were not inoculated with storage pathogens. Samples were taken monthly throughout the storage season to measure respiration rate (mL CO_2/kg/hr).
A preliminary inoculated respiration trial was completed using the Objective 2 beet varieties. Beets were inoculated at the crown by removing a 4-mm plug of beet tissue, inserting a 4-mm plug of 7-10 day old *P. vulpinum* or PDA control, replacing the beet plug, and sealing with petroleum jelly. Respiration was measured weekly for two months.

Summary: There was no difference in rate of respiration per kilogram of beet weight between beets with high and low CLS in the field ($P > 0.05$), although there was a difference in respiration rate among varieties. We will continue to evaluate the difference in varietal respiration in the future. Preliminary results show beets inoculated with *P. vulpinum* had a significantly increased respiration rate ($P < 0.05$), but no difference between high and low CLS levels ($P > 0.05$, Figure 4). In 2021-22, beets of variety C-G932NT with high and low CLS levels were placed in respirometry chambers as described above. These beets were inoculated at the crown with *F. graminearum, P. vulpinum, B. cinerea* or a PDA control in the method described previously. The respiration rate will be measured weekly throughout the storage season to examine the effects of storage pathogen infection on beet respiration.

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[1] Campbell, L. G. 2015. PI 674103, *Beta vulgaris* L. subsp. *vulgaris*. U.S. National Plant Germplasm System. https://npgsweb.ars-grin.gov/gringlobal/accessiondetail?id=1923721 ; [2] McGrath, J.M. 2012. Germplasm releases: EL50/2; EL58 through EL66; SR99 through SR101 [CD-ROM]. 2012 Annual Beet Sugar Development Foundation Research Report. Denver, Colorado: Beet Sugar Development Foundation