

Beet Leafhopper and BCTV Strain Survey

✓ SRSRSA Funded Project

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Screening for resistance to *Beet curly top virus* (BCTV) in sugarbeet both in the field and with agro-inoculation clones in the greenhouse suggest that at least some sources of resistance are strain-specific. In addition, beet leafhopper populations can vary by location and year.

Host resistance is the most economical means of control, particularly for season-long control. Sugarbeet plants are most susceptible at early growth stages, particularly with the low to intermediate levels of resistance found in commercial cultivars. Six viruliferous beet leafhoppers per sugarbeet plant is usually enough to kill most commercial cultivar plants infected at the 4-6 leaf stage based on recent curly top nursery evaluations. Further, most pathogens including BCTV have been shown to have a negative influence on roots in storage. Therefore, host resistance even late in the season may prove to be important even if chemical controls are utilized early in the season to supplement resistance and mitigate yield losses at harvest. This project will aim to establish the BCTV strains for which host plant resistance is needed and the time frame for when control of leafhoppers is necessary.

Research Objectives

- Characterize the leafhopper species and numbers present over the growing season in the desert and sugarbeet and dry bean fields.
- Determine if biotypes are present in the beet leafhopper population
- Identify the BCTV strains present in the various leafhoppers and fields
- Track phytoplasmas to prove relevancy
- Compare captures on cards oriented horizontally and vertically

Methodology

At the request of a sugarbeet industry stakeholder, beet leafhopper (BLH; *Circulifer tenellus*) populations in southern Idaho were tracked in desert areas and sugarbeet and dry bean fields in four and five southern Idaho counties during 2020 and 2021, respectively. Samples were collected on a weekly basis from mid-Apr through mid-Sep (22 weeks; the first 3 weeks were missed in 2020 because of the COVID shut down) to assess all leafhopper population levels and the presence of BCTV strains. Crop plants from monitored fields were also assessed for the presence of BCTV strains. This report represents an update of preliminary data collected to this point. We anticipate providing a final report at this time next year.

Results

Elmore County. Elmore County had green plants in the desert coming out of the winter and through the summer the past two years. Once BLH populations in Elmore County began increasing in May they were present in at least double-digit numbers through most of the summer at all sites both years. In 2020, the BLH populations peaked in the Elmore desert (avg. 401 BLH per card) on 20 May, while in 2021 the population peaked (avg. 222) on the 2 Jun. At this desert site, the horizontal cards averaged 75 and 45% fewer beet leafhoppers than the vertical cards during the 2020 and 2021 seasons, respectively. On the Elmore beet cards, the BLH



Photo 1. Sugarbeet plant infected with *Beet curly top virus* in Twin Falls County on July 23, 2021.

populations peaked both years on 4-5 Aug (avg. of 69 and 55 in 2020 and 2021, respectively). Elmore bean field populations peaked at an avg. of 24 per card in late Jun to mid-Jul in 2020 and at an avg. 54 in 2021 on 14 Jul.

Minidoka, Twin Falls, Bingham, and Owyhee County Desert Sites. Coming out of the winter, the desert sites in Minidoka County both years, Twin Falls County in 2020, and Owyhee County in 2021 were dry and had no green plants. At the 2021 Twin Falls desert site, the only live vegetation was sagebrush. Thus, BLH numbers at these desert sites were at or near zero. The BLH found in crop fields in these counties were likely coming from weedy areas near the fields and not the desert. The Bingham County desert site had green vegetation in the spring both years, but only trace levels of BLH were found in both years. Sequencing proved the hoppers found in 2021 were a different leafhopper and not BLH.

Minidoka, Twin Falls, Bingham, and Owyhee County Field Sites. In Twin Falls County beet fields (Photo. 1), the BLH peaked at 27 per card on 21 Jul in 2020 and at 44 per card on 9 Jun in 2021. At the 2021 Owyhee County beet field once BLH reached 5 per card on 9 Jun, BLH numbers varied from 5 to 22 per card the rest of the season. In the Bingham County beet field (Photo. 2), there were almost no BLH detected in 2020 while in 2021 they peaked on 18 Aug at 16 per card. In Minidoka County both the beet and bean field sites both years had few to no BLH. In Twin Falls County, the bean site had very few to no BLH both years. In 2020 the Bingham County bean site had a peak on the 26 Aug of 23 BLH per card, but in 2021 the bean site had few to no BLH. In Owyhee County, the bean site was close to the river (numerous weeds next to the river) and had two peaks in its BLH population (avg. of 59 per card on 9 Jun and 96 on 28 Jul).

Discussion

A total of 657 BLH samples were collected in 2020 and the cytochrome oxidase gene was successfully amplified from 90% of the samples. The 2020 preliminary data suggest two haplotypes (based on cytochrome oxidase gene) were dominant in the BLH population.

In 2020, 42% of the BLH samples were positive for the BCTV coat protein: Elmore County 64%, Twin Falls County 25%, Bingham County 9%, Minidoka County 9%. In Elmore County the percentage of BCTV coat protein positive samples was low early and late in the season while 81 to 95% of the samples were positive between 10 Jun and 5 Aug. Within the coat protein positive samples, the BCTV strain distribution was as follows: Worland 95%, Colorado 22%, Severe (formerly CFH) 2%, and CA/Logan 1%. Mixed infections were evident in 21% of the positive samples.

In 2020 bean samples, 11 of 40 samples were positive for BCTV coat protein and all were the Worland strain. In 2020 beet samples, 4 of 40 were coat protein positive but all were negative for strain specific primers.

Preliminary data from 2020 suggests other leafhoppers collected on cards included the following genera: *Acinopterus*, *Amblysellus*, *Anoscopus*, *Aphrodes*, *Athysanus*, *Auridius*, *Balclutha*, *Ceratagallia*, *Chlorotettix*, *Commellus*, *Dikraneura*, *Empoasca*, *Eucelidius*, *Gloridonus*, *Hardya*, *Hebecephalus*, *Hecalus*, *Idiocerus*, *Limotettix*, *Macrosteles*, *Norvellia*, *Paraphlepsius*, *Psammotettix*, and *Texananus*.

The 2021 BCTV strains, morphotypes, and phytoplasma identification is currently a work in progress.

Report photos by Carl Strausbaugh



Photo 2. Sugarbeet plant infected with *Beet curly top virus* in Bingham County on July 24, 2021.