

Simulated Canopy Loss due to Cercospora Leaf Spot

SUGAR BEET RESEARCH



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Introduction

Canopy health is an important factor for plant growth and sugar accumulation. Insects, pathogens, and abiotic factors like hail can cause significant damage to the sugar beet canopy. Cercospora leaf spot (CLS) is a major threat to the sugar beet production causing significant damage to the canopy if left uncontrolled. Some studies have investigated the effects of partial or full defoliation as a single event caused by hail or insect damage, but we are not aware of studies looking at multiple canopy losses such as multiple burndowns caused by CLS throughout the growing season.

Research Objectives

Comparison of different defoliation dates and their effects on beet root temperature, sucrose content and yield.

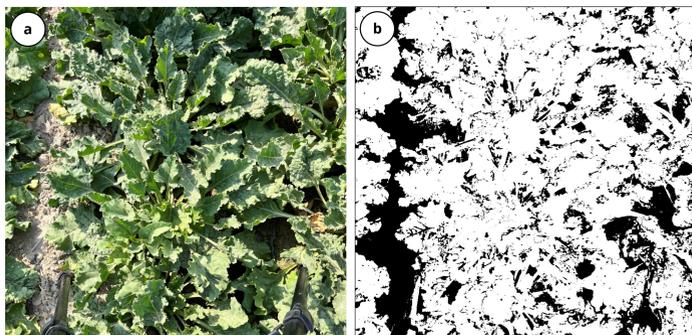


Photo 1. a) Untreated check plots; b) analyzed with Canopeo application.

Methodology

Plot layout. Randomized complete plot design, 6 replications, planted on 4/4/2024 using Crystal A862NT. Plot size 7.33 by 24 ft, row spacing 22 in., final plant spacing 8 in. Plots were drip irrigated and managed to minimize unwanted effects from fertility, pests, weeds, or diseases.

Table 1. Dates of Defoliation

Single Defoliations	Multiple Defoliations
July 8 th	July 8 th fb. ^z August 5 th
July 22 nd	August 5 th fb. September 2 nd
August 5 th	July 8 th fb. Aug 5 th fb. Sep 2 nd
August 19 th	July 22 nd fb. Aug 19 th
September 2 nd	

^z A gas powered Stihl hedge trimmer was used to defoliate plots at the specific dates. fb = followed by.

Applications. Plots were defoliated using a gas-powered Stihl hedge trimmer. Special care was taken not to injure the crown or shoulder tissue of the beet root. Table 1 lists the dates used for defoliation.

Assessments. Canopeo application (Oklahoma State University) was used to assess canopy loss pre harvest.

Pictures of individual rows were taken using a tripod mounted camera with a soil surface to camera distance of 54 in. (Photo 1 & 2) Ambient and internal temperature of three randomly selected beet roots were measured using a digital thermometer (QA Supplies) and ΔT (ambient - root temperature) was calculated. The two middle rows of each plot were harvested (10/2), weighed, and three 20-25 lbs samples were sent to the Amalgamated Sugar Company Beet Quality Laboratory for analysis.

Results

Table 2. Dates of Defoliation

Dates	Canopy Ground Coverage (%)	Canopy lost ^z (%)
Untreated Check	82.4 a ^y	---
July 8	65.5 b	20.5
July 22	41.6 c	49.6
August 5	31.8 cd	61.4
August 19	19.9 de	75.9
September 2	10.7 e	87.0
July 8 fb August 5	43.6 c	47.1
July 22 fb Aug 19	22.6 de	72.6
August 5 fb September 2	12.5 e	84.8
July 8 fb Aug 5 fb Sep 2	13.1 e	84.1
LSD (P=0.05) ^x	12.202	
P>F	0.0001	

^z Percent canopy lost was calculated based on untreated check.
^y Means followed by the same letter are not significant.
^x LSD: least significant difference. NS: not significant different.

Percent Canopy Ground Coverage (Table 2). Untreated plots never reached 100 % canopy ground coverage (Photo 1 a, b) despite adequate fertility and irrigation. Plots defoliated earlier in the season (7/8) showed the least canopy loss but never recovered to the level of the untreated control. Starting 7/22, defoliations resulted in a canopy loss of 49.6% or higher. Plots defoliated on 9/2 (as standalone treatment or as part of multiple defoliation events) had the highest loss (Photo 2 a, b) with 84.1 to 87.0 %.

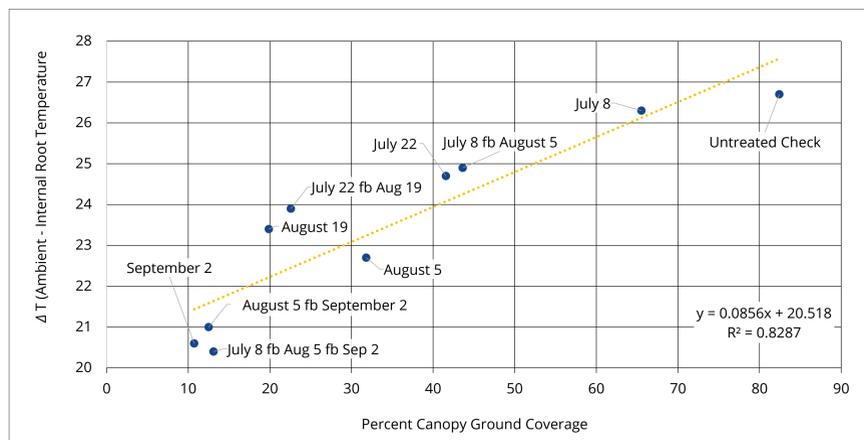


Figure 1. Internal root temperatures affected by canopy ground coverage.

Internal beet root temperature (Figure 1). Strong correlation ($R^2 = 0.8287$) between degree of defoliation and lower ΔT was observed. Higher percent of canopy loss caused by late or multiple defoliation events resulted in lower ΔT .

No significant differences between the untreated control, defoliations on 7/8, 7/22, 7/8 fb. 8/15, and 7/22 fb. 8/19 were observed. Single defoliations up to 7/22 had the least effects on internal root temperatures, however a second year is needed to confirm these findings

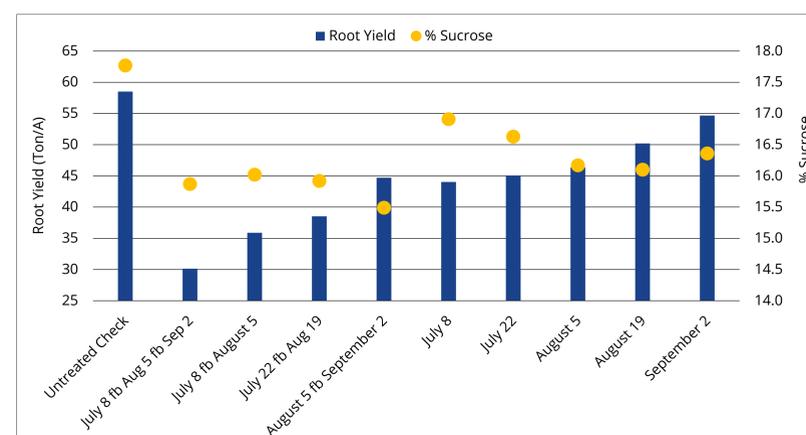


Figure 2. Canopy loss affecting root yield and percent sucrose.

Root yield and percent sucrose (Figure 2). Plots defoliated on 7/8 fb. 8/5 fb. 9/2 had the lowest root yields (30.1 ton/A). Plots defoliated once on 9/2 (last defoliation treatment) had the highest yields (54.7 ton/A) of all treatments, excluding the untreated control which yielded 58.5 ton/A.

Discussion & Summary

- Defoliation caused persistent canopy loss and ground coverage never recovered to levels of control plots.
- Early season canopy loss (starting 7/8) had stronger effects on root yield, than on sucrose content.
- Late season canopy loss (1.5 months pre harvest) strongly affects sucrose content.
- Multiple defoliation events especially early in the season have detrimental effects on yield and sucrose content.
- Strong correlation between canopy loss and higher internal beet root temperature.

Overall, this study shows that a healthy canopy is crucial for root yield and sucrose content as well as protecting the beet root from sun exposure and overheating.



Photo 2. a) Sugar beet plants defoliated on September 2nd, b) analyzed with Canopeo application.