Examining the Impact of Corn Rootworm on Silage Corn

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Introduction

Western corn rootworm (*Diabrotica virgifera virgifera*; WCR) and northern corn rootworm (*Diabrotica barberi*; NCR) larvae are the most significant insect pests of corn across the Midwest region. In areas that must feed livestock, especially dairy cattle, continuous corn production is common and the incidence of corn rootworm larvae affecting yield is high. Additionally, corn severely impacted by weather events (hail, drought, etc.) is commonly harvested for silage as a rescue practice. The economic injury level and yield losses associated with root injury are well understood for grain corn. However, these relationships have not been investigated for silage corn production since the early 1990s. Since then, the evaluation criteria for corn rootworm larval injury have changed, corn hybrids with Bt proteins for corn rootworm management have become available, and corn rootworm populations have become resistant to these hybrids. Plus, market conditions and production costs have changed significantly. This research aims to understand the impact of corn rootworm on silage quality and quantity metrics and determine the economic injury level for silage corn.

Materials and Methods

The Southeast Research and Demonstration Farm (SERF) was one of two locations where this research was conducted in 2024. At SERF, four corn hybrids were planted in four-row strips and replicated four times (16 total plots). The four corn hybrids were Wyffels brand (Table 1) and varied by primary use (grain or dual-purpose) and presence of Bt traits for corn rootworm.

The field was visited twice during the summer to evaluate root injury and collect silage quality samples. On August 8, 20 whole plants were extracted from each treatment to assess root injury using the Iowa State University 0-3 Node Injury Scale (NIS). Roots were soaked overnight, thoroughly cleaned, and evaluated by trained individuals. On September 10, 20 plants were cut from each treatment, approximately six inches above the soil line to simulate silage harvest, removed from the field, weighed, and then chopped using a woodchipper. Silage quality samples were collected in gallon Ziploc bags and sent to Dairyland Labs for analysis using the NIR NASEM-Complete package.

Data were first analyzed using analysis of variance (ANOVA) in SAS 9.4 to test for differences in NIS score, weight, and all silage quality metrics across locations and hybrids. Then, a linear regression analysis was used to test for linear correlations between NIS score and any silage quality metric. Further analyses will be conducted to assess non-linear relationships. Results presented are from the SERF location only, unless otherwise stated.

Results and Discussion

Corn rootworm larval injury assessed on the ISU 0-3 Node Injury Scale was highly variable across treatments (0.02 – 2.85 NIS; Table 1, Figure 1). Node injury scores were significantly higher in the non-Bt hybrids than the Bt hybrids ($P = 0.0002$). Root protection

was not significantly different for the two types of corn hybrids (grain vs. silage).
When looking at the silage quality test results, moisture and lignin content of the silage hybrids were significantly higher than grain hybrids (P = 0.0006 and 0.0465, respectively), and NDFD30 was significantly lower in the silage hybrids (P = 0.0024).

When the regression analysis was run with both locations together, the only silage quality metric that showed a linear relationship with larval root injury was soluble protein content (as a percent of crude protein; P = 0.0065, R^2 = 0.2912). However, this relationship was driven largely by results from the Kirkwood location, but results from SERF suggest that root injury may explain some of the variation in soluble protein content (P = 0.0983, R^2 = 0.1831; Figure 2).
This research will be continued at the ISU SERF in 2025, and further work will focus on understanding how corn rootworm impacts on silage quality might affect feed rations, especially for dairy cattle.

Acknowledgments

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Table 1. Mean Node Injury Scores (NIS), moisture content (%), lignin content (% NDFom), and NDFD30 (% NDFom) for the four corn hybrids.

Hybrid	Type	Bt	NIS ± SEM	Moisture ± SEM	Lignin ± SEM	NDFD30 ± SEM
Wyffels 3576	Grain	None	1.08 ± 0.21b	38.13 ± 2.08c	10.28 ± 1.00a	42.33 ± 0.91ab
Wyffels 3579	Grain	Yes	0.08 ± 0.02a	39.87 ± 1.66bc	10.72 ± 1.08a	44.85 ± 1.27a
Wyffels 7876	Silage	None	0.79 ± 0.11b	49.61 ± 1.16a	11.76 ± 1.05a	37.25 ± 1.21b
Wyffels 7878	Silage	Yes	0.18 ± 0.07a	46.04 ± 0.69ab	11.89 ± 1.01a	36.90 ± 2.06b

Mean separation letters show differences between hybrids within a column. Least significant differences were determined with the LSMEANS statement in SAS 9.4 using type*bt as the variable and P < 0.05 for significance.

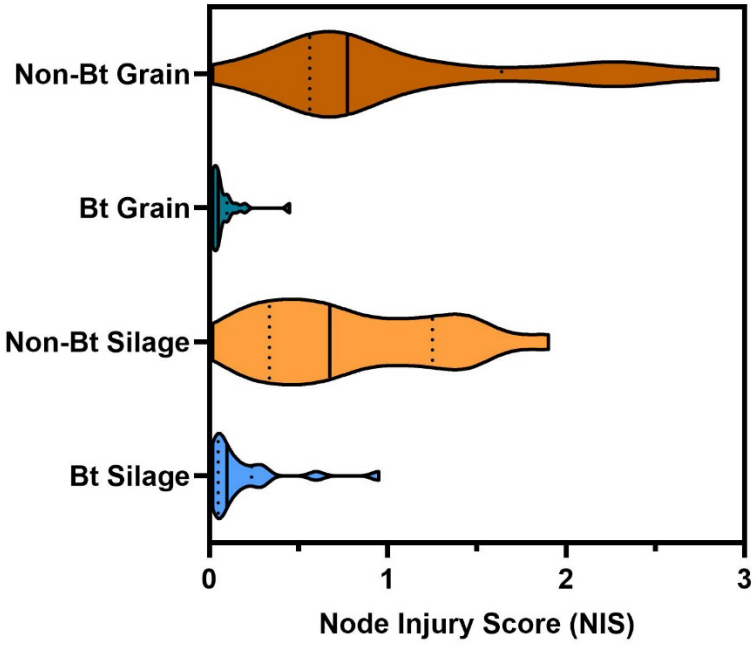

Figure 1. Larval root injury ratings (Node Injury Score) for the four corn hybrids at SERF. This shows the range, median, and quartiles of the raw data (20 plants per treatment).

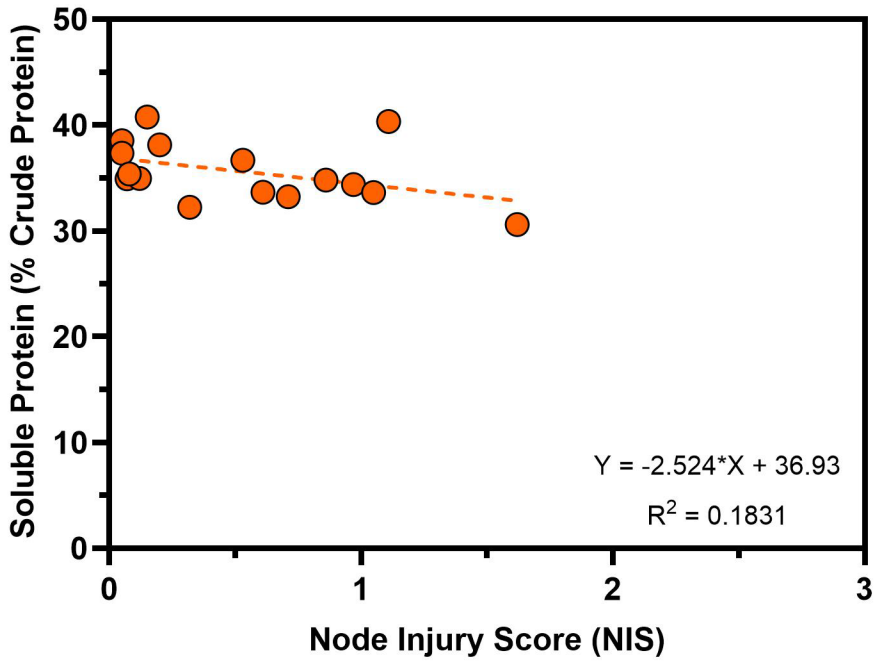

Figure 2. Scatter plot of soluble protein content and mean node injury score at SERF with the linear regression equation and goodness of fit test.