



Northern NY Agricultural Development Program 2016-2017 Project Report

Evaluation of the Efficacy of Bt Corn for the Control of Western Bean Cutworm in NNY: Part A

Ear Damage Evaluation and Mycotoxin Screening of Corn Silage Hybrids: NNY Trials: Part B

Part A

Project Leader(s):

Cornell University Cooperative Extension North Country Regional Ag Team Field Crop Specialists:

- Mike Hunter, 315-788-8450, meh27@cornell.edu
- Kitty O'Neil, 315-854-1218, kao32@cornell.edu

Collaborator(s):

- Elson Shields, Entomology Department, Cornell University, 4144 Comstock Hall, Ithaca, NY 14853
- Gary C. Bergstrom, Department of Plant Pathology and Plant-Microbe Biology, Cornell University, 334 Plant Science Building, Ithaca, NY 14853-5904
- Jaime Cummings, Research Support Specialist, Department of Plant Pathology and Plant-Microbe Biology, Cornell University, Ithaca, NY
- Kenneth Wise, NYS IPM Program, 2715 U.S. 44, Millbrook, NY 12545

Cooperating Producers:

- Logue Farms Inc., Franklin County
- Thunder Lane Dairy, Lewis County

Background:

Part A of this report evaluates Western Bean Cutworm control management by the use of Bt corn; Part B follows with an evaluation of WBC-related corn ear damage and the opportunity for mycotoxin development.

Western Bean Cutworm (WBC; *Striacosta albicosta*) is a new pest of field and sweet corn and dry beans in the Eastern United States. The WBC larva feed on the ears of field and sweet corn and the pods and seeds of dry beans. WBC has established itself as a significant pest in the Western United States and is an increasing concern for corn growers in the Eastern United States as an emerging threat to corn yield and quality.

Low numbers of WBC were first detected in New York State in 2009. In 2010, the NYS Integrated Pest Management program implemented an extensive monitoring network used to survey the presence and/or populations of WBC in New York. A network of collaborators continue to document increases in the number of WBC moths caught in locations statewide.

Northern New York continues to record the highest WBC traps counts in the state. In 2017, there were 99 WBC traps located throughout New York State. Twenty seven WBC traps were monitored weekly in corn fields in NNY (Jefferson, Lewis, St. Lawrence, Franklin, Clinton, Essex counties).

Northern NY traps caught a record number of WBC moths in 2017. The 27 WBC traps in NNY caught 23,658 total moths, averaging 876 moths per trap. To illustrate how much of a Western Bean Cutworm “hotspot” we are in NNY, the other 72 WBC traps located throughout NYS caught a total of 12,052 moths, averaging 167 moths per trap.

Current management strategies available for the control of WBC in corn are the use of foliar insecticides or selecting transgenic corn hybrids with appropriate Bt traits. Foliar insecticide treatments are effective but can be difficult to time correctly. Two Bt events, Cry 1F and Vip 3A have been reported to have activity on WBC. There is a growing concern from corn growers and agribusinesses in Northern New York that the WBC feeding on corn ears can lead to increased mycotoxin levels. There have also been reports from Michigan, Indiana, Ohio and Ontario, Canada, suggesting incomplete control of WBC with the Bt corn trait containing the Cry 1F protein.

Methods:

This project involved establishing two large scale replicated corn trials planted on farms in Lewis and Franklin counties. Comparisons of different Bt corn traits for the control of Western Bean Cutworm and identification of ear molds on WBC damaged corn ears were made, and corn grain samples from the different treatments were tested for the presence of mycotoxins. Each trial was replicated four times and evaluated four different corn hybrids with different Bt traits: Cry1F + Vip 3A, Vip 3A, Cry 1F, Cry 1A.05 + 2Ab2. Sampling was done at the end of season just prior to corn harvest.

Results:

Based on the 2016 on-farm research findings in NNY, it was determined that incomplete control of WBC control from the Cry 1F trait was confirmed in New York corn fields. The 2017 results from the two sites (Table 1 and 2) were not statistically different. Perhaps there was not enough WBC damage in any treatments to show any defined differences. The reduced amount of Western Bean Cutworm presence in the corn at these sites was likely due to the fact that the corn was planted in mid June and reached the

pretassel stage (the stage of growth that is most attractive for WBC egg laying) after the recorded peak flight of the WBC moths.

Damage comparison in Bt Corn Trials for WBC Control in NNY in 2017. Left: Table 1. Castorland, Lewis County trial site; right: Table 2. Moira, Franklin County trial site.

Type of Bt(s)	WBC Damaged Ears %
Cry1F + Vip 3A	0 a
Vip 3A	2.00 a
Cry 1F	3.75 a
Cry 1A.05 + 2Ab2	2.75 a

WBC Trap Count: 1914
Planted June 12, 2017

Type of Bt(s)	WBC Damaged Ears %
Cry1F + Vip 3A	0 a
Vip 3A	0 a
Cry 1F	6.25 a
Cry 1A.05 + 2Ab2	5.75 a

WBC Trap Count: 626
Planted June 13, 2017

Mycotoxin Testing: None Detected

The results of the WBC and mycotoxin screening project associated with the research described herein revealed large differences in the number of hybrids damaged by WBC, but surprisingly few hybrids tested positive for measurable mycotoxins. For more details, see Part B of this report: Ear Damage Evaluation and Mycotoxin Screening of Corn Silage Hybrid Trials in NNY (this report is also posted separately at www.mnyagdev.org).

One of the concerns corn growers have is that the kernel feeding damage from the WBC larva presents an opportunity for favorable pathogen growth. If the environmental conditions are right, this could lead to mycotoxins developing in the damaged grain. We collected corn grain samples from each treatment in the individual trials and sent them to Dairy One for a mycotoxin panel screening. There was much less WBC damage and fewer corn diseases than we experienced in 2016. While we had a much wetter than normal growing season, there were no mycotoxins detected in corn grain samples from this on-farm research project.

The feeding damage of the Western Bean Cutworm larva is typically limited to ear tip kernel feeding. While this trial was not designed to evaluate yield losses attributed to the Western Bean Cutworm, we do not feel that corn yields were affected by WBC feeding damage found at either of these locations.

Conclusions/Outcomes/Impacts:

Incomplete control of WBC from the Cry 1F trait was seen in NNY corn fields in 2017 with no statistical differences between the two trial sites. We will replicate this study in 2018 in NNY to confirm that Cry 1F no longer effectively controls WBC.

Outreach:

The results from these on-farm research trials are being disseminated to corn growers, crop consultants, agribusinesses, and extension field crops staff members throughout

New York State. To date, it has been presented at the Northwest New York Cornell Cooperative Extension Corn Congress in Batavia and Waterloo, the North Country Crop Congress in Lowville and the W.H. Miner Agricultural Research Institute Crop Congress in Chazy. It will also be presented at CaroVail grower meetings in Greenwich, Fort Plain, Niverville, Cazenovia, and Auburn, Rudd's Spray Service grower meeting in Adams Center and Hallett Spraying grower meeting in Depeyster.

Next Steps:

We will continue this project in 2018 to further evaluate the control of WBC with Bt corn hybrids under a different set of growing conditions and WBC populations. We will plant two trials not planted in 2017 due to wet growing conditions at the time of planting.

Acknowledgments:

The Northern New York Agricultural Development Program provided financial support for this project. We acknowledge the following individuals for assisting with the weekly WBC trap monitoring efforts in NNY: Joe Lawrence (Cornell University PRO Dairy Program), Mike Kiechle (Garden of Eden Farm, Jefferson County), Harry Fefee (CCE Franklin County), Billy Bullock (CCE St. Lawrence County).

Reports and/or articles in which results of project have been published.

For more information:

- Mike Hunter, Regional Field Crops Specialist, Cornell University Cooperative Extension Northern New York Regional Ag Team, 203 North Hamilton Street, Watertown, NY 13601; meh27@cornell.edu; 315-788-8450
- Kitty O'Neil, Regional Field Crops Specialist, Cornell University Cooperative Extension Northern New York Regional Ag Team, 2043B State Hwy 68, Canton, NY 13617; kao32@cornell.edu; 315-379-9192

Ear Damage Evaluation and Mycotoxin Screening of Corn Silage Hybrids: NNY Trials: Part B

Part B

Project Leader(s):

Cornell University Cooperative Extension North Country Regional Ag Team Field Crop Specialists:

- Mike Hunter, 315-788-8450, meh27@cornell.edu
- Kitty O'Neil, 315-854-1218, kao32@cornell.edu

Collaborator(s):

- **Joe Lawrence**, PRO-DAIRY, Cornell University, c/o 5274 Outer Stowe St., Lowville, NY 13367
- **Margaret Smith**, Plant Breeding and Genetics, Cornell University, Ithaca, NY 14853

- **Elson Shields**, Entomology Department, 4144 Comstock Hall, Cornell University, Ithaca, NY 14853
- **Gary C. Bergstrom**, Department of Plant Pathology and Plant-Microbe Biology, Cornell University, 334 Plant Science Building, Ithaca, NY 14853-5904
- **Jaime Cummings**, Research Support Specialist, Department of Plant Pathology and Plant-Microbe Biology, Cornell University, Ithaca, NY
- Kenneth Wise, NYS IPM Program, 2715 U.S. 44, Millbrook, NY 12545

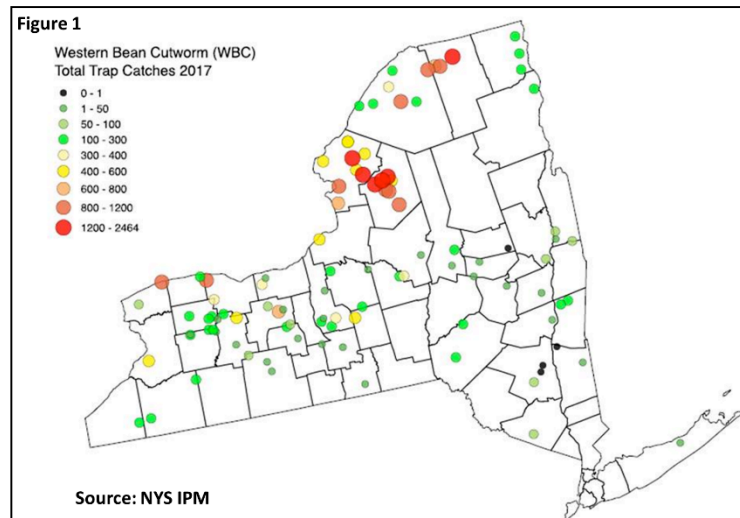
Cooperating Producers:

- Greenwood Dairy, St. Lawrence County

Background:

The presence of Western Bean Cutworm (WBC) in New York corn fields continues to expand as shown in the WBC Pheromone Trap Network coordinated by the NYS Integrated Pest Management (IPM) program, though the insect's apparent population varies significantly across the state (Figure 1).

Where WBC populations are high, the corresponding ear damage from WBC feeding can leave wounded corn ears more susceptible to pathogen development, but a clear relationship between ear damage and mycotoxin development has not been documented. A number of mold species may develop on corn ears and relatively few of these produce mycotoxins. Principal concern in New York is with the mycotoxins deoxynivalenol (DON or vomitoxin) and zearalenone, both produced by the fungus *Fusarium graminearum*.



While WBC damage to corn ears can be significant and may have detrimental effects on corn grain yield and quality, the economic impact on corn silage is less understood. For corn silage growers, understanding whether or not this pest significantly impacts the yield or quality of the forage is critical to their decision making for managing this pest.

Methods:

The Commercial Corn Silage Testing program conducted by Cornell University in collaboration with the University of Vermont and the Northeast dairy industry offers a good opportunity to evaluate numerous hybrids for ear damage from WBC and mycotoxins. In 2017, 49 corn hybrids were selected and planted in a replicated plot in St. Lawrence County in Northern New York. The plot was scouted prior to harvest for WBC

feeding damage to the ears. Composite samples, of whole plant silage, for each hybrid were taken at harvest and submitted to the Dairy One forage laboratory for a mycotoxin screening package which included aflatoxins B1, B2, G1, G2, vomitoxin, 3-acetyl DON, 15-acetyl DON, zearalenone, and T2 toxin.

Results:

The results of the WBC and mycotoxin screening project revealed large differences in the number of hybrids damaged by WBC, but surprisingly few hybrids tested positive for measurable mycotoxins (Table 1).

		Madrid, NY
WBC Trap Counts (seasonal total)		356
# Hybrids		49
# Hybrids with WBC Damage		32 (65.3%)
Hybrids Positive for Mycotoxins DON or zearalenone	Total Hybrids	19 (38.8%)
	NO WBC Damage	6
	WBC Damage Present	13

The most prevalent species of mycotoxin-producing mold found in the screening was *Fusarium graminearum* which can also infect corn ears through the silk channels at the time of pollination during favorable weather conditions and result in contamination of the grain and silage with the mycotoxins DON, 3-ADON, 15-ADON, or zearalenone. A review of the 2017 weather data at this trial site showed wet conditions conducive to this type of infection. As expected for New York, no aflatoxins were detected

Conclusions/Outcomes/Impacts:

While there are numerous ways in which molds can establish themselves in forages, this study reflects a common challenge researchers face while attempting to document the conditions where mycotoxin development is likely, thus recognizing that the results reported here are specific to the 2017 growing season, which was conducive for silk channel infections. A different relationship between WBC damage and mycotoxin development may be found during a growing season less conducive to silk channel infections.

These results from one year of data do not provide strong evidence that WBC damage is a significant concern for corn silage growers who are worried about mycotoxins in their silage. It is also important to note that these results do not reflect what may occur in corn harvested for grain as the time between silage harvest and grain harvest offers additional opportunities for infection and growth.

Outreach:

The results from this on-farm research trial are being disseminated to corn growers, crop consultants, agribusinesses, and extension field crops staff members throughout New

York State. To date, the data from this project has been included in presentations at the Northwest New York Cornell Cooperative Extension Corn Congresses in Batavia and Waterloo, the North Country Crop Congress, the W.H. Miner Agricultural Research Institute Crop Congress, Hallett Spraying grower meeting, Lowville Farmers Co-op Forage Forum, Cayuga County Pesticide Meeting, Delaware County CCE Meeting, SCNY CCE Winter Crop Meeting, Oneida County Crop Congress, Channel Seed Dealer Training, Cornell Seed Conference, Certified Crop Advisor Training, Cornell Field Crop Dealer Meeting, and the Cornell Nutrition Conference.

Next Steps:

Multiyear studies, including years of varying weather conditions, are required for further evaluating these risks and providing recommendations.

Acknowledgments:

The Northern New York Agricultural Development Program provided financial support for this project.

Reports and/or articles in which results of this project have been published.

For More Information:

- Joe Lawrence, Dairy Forage Systems Specialist, PRO-DAIRY, Cornell University, 5274 Outer Stowe St., Lowville, NY 13367; jrl57@cornell.edu; (315)3765-270
- Mike Hunter, Regional Field Crops Specislist, Cornell University Cooperative Extension Northern New York Regional Ag Team, 203 North Hamilton Street, Watertown, NY 13601; meh27@cornell.edu; 315-788-8450
- Kitty O’Neil, Regional Field Crops Specislist, Cornell University Cooperative Extension Northern New York Regional Ag Team, 2043B State Hwy 68, Canton, NY 13617; kao32@cornell.edu; 315-379-9192