



Northern New York Agricultural Development Program 2016 Project Report

Impact of Alfalfa Snout Beetle Biocontrol Nematodes On Corn Rootworm During Corn Rotation

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Background:

The application of biocontrol nematodes to combat alfalfa snout beetle has been shown to be effective in reducing the impact of alfalfa snout beetle on alfalfa stands. In addition, related research in Northern NY has shown that not only do the populations of biocontrol nematodes persist in the field when the field is rotated to corn, but in many cases actually increase during corn years 2-4. Since corn years 2-4 are the years when corn rootworm larvae are feeding on corn roots, it is suspected that the biocontrol nematodes are reproducing in the corn rootworm larvae.

Northern NY farmers have raised the question about the effectiveness of these resident biocontrol nematodes in controlling corn rootworm. Their interest is focused on whether or not the impact of these biocontrol nematodes are significant enough to eliminate the need for BT-rootworm corn or soil insecticide on conventional varieties. In a similar study conducted during the field seasons of 2014-2016 at Musgrave Research Farm, Aurora, NY, biocontrol nematodes limited root feeding damage and the results were nearly identical to the level of root protection with the best BT-CRW corn variety.

2016 was the first year of a multi-year study in Northern NY focused on answering the question regarding the effectiveness of resident biocontrol nematodes for controlling corn rootworm. For

accurate scientific results, this experiment needs to be conducted in multiple fields across the region in fields where biocontrol nematode populations have been established in alfalfa during preceding years. However, these experiments also need multiple nematode untreated areas in the field to accurately measure the impact of these biocontrol nematodes on corn rootworm larvae.

In the first year of this study, biocontrol nematodes were established in 1st year corn following sod along with areas left free of nematodes for untreated check or control plots. Following discussions with Cornell Cooperative Extension personnel and producers who farmed the previous biocontrol nematode demonstration sites, we discovered three of the producers were not ready to rotate to corn in 2016. The fourth site, located in Franklin County, was rendered useless for this study when the farmer decided to plow the field across the experimental sites and contaminated the untreated control sites with established biocontrol nematodes in the adjacent plots. We were then left with the only option of initiating a new site in Jefferson County.

Methods and Results:

In 2016, the initial set of field plots were established at Morning Star Farm in Jefferson County. The site was established in a 132-acre field (N 43.8612, W -76.1252) owned and operated by Dave Magos, Adams, NY. Plot design included eight 0.5-acre blocks. Four blocks were treated with nematodes and the other four blocks remained untreated (Appendix: Figure 1). Plots were not assayed prior to nematode establishment on May 17, 2016, however, in areas without a history of nematode application, experience has shown a low probability of a resident population.

Bio-control Nematodes

Using the multi-species approach developed with laboratory and field trials on NNY farms funded long-term by the farmer-driven Northern New York Agricultural Development Program, two native NY strains of bio-control entomopathogenic nematodes (EPNs): (*Steinernema carpocapsae* and *Steinernema feltiae*) were reared for this corn rootworm trial site. EPN infective juveniles (IJ) were applied at a rate of 75 million per species per treated block. Each treated block received a two-species combination, the total number of IJs per treated block were 150 million. A total of 600 million nematodes were reared for the Magos farm trial site.

Application of Nematodes

On the date of application, infective juveniles were washed from rearing containers and strained twice through screens before being added to the 2-50 gallon spray tanks inside the truck (Appendix: Figure 2, 3). Nematodes were applied at a water rate of 46 gpa using a spray boom fitted with 0010 fertilizer steam nozzles (screens removed).

Biocontrol Nematode Establishment Assay

Soil cores were collected from the treated plots only to verify a successful inoculation on July 19, 2016, 60 days post-nematode application. A total of 50 samples were randomly collected from each treated 0.5-acre block. Each sample was removed from the soil and split into upper 2” and 3-6” portions to bioassay for nematode presence. Soil cores were returned to the laboratory and bioassayed using a standard technique with wax moth larvae as an indicator for the presence of biocontrol nematodes in the sample. The level of nematodes in each sample is used as an

indicator to the presence of host insects within the area of the field. Subsequent nematode sampling verified nematode establishment in the field plots.

Table 1. Percentage of positive samples in 2016 EPN establishment, Biocontrol Nematodes Trial, NNY.

Magos CRW 2016	Days Post Inoc	# Soil Samples	% Sc Positive Samples	% Positive Sf Samples
Treatment Block I	60	50	4	26
Treatment Block II	60	50	2	28
Treatment Block III	60	50	2	16
Treatment Block IV	60	50	0	26

Wireworm Assay

During the spring and fall of 2016, a field assay to determine the presence of wireworms (*Lumonius spp*), based on observations from farm owner Dave Magos, was conducted simultaneously with field visits for the CRW trial as wireworms can cause significant damage in established cornfields through increased weed pressure, reduction in stand, yields, and profits. Wireworms are the larval stage of click beetles, and feed throughout this larval stage on germinating seeds and young seedlings.

Spring Assessment

On May 25, 2016, the first assessment for wireworm populations was conducted using the modified solar bait method. Within each treated and untreated block, ten locations were chosen for sampling to determine presence of wireworms in the field. At each location, a hole was dug using a golf-hole cutter 3-5 inches deep, GPS point recorded (Appendix: Figure 4), and flagged.

In each hole, a bait trap of corn seed was placed, soil returned and covered with a plastic cup to aid in warming the soil for seed germination (Appendix: Figure 5, 6). Removal of the bait trap corn seed from the hole was conducted 8-days later on June 2, 2016; hole and soil surrounding corn seed was evaluated for presence of wireworms (Appendix: Figure 7). The spring assessment for wireworms found no wireworm larvae in any of the site plots. Since wireworms were reported as observed prior to this study, let's explain or suggest why none were found in 2016.

Fall Assessment

The second assessment for wireworm presence was conducted on October 12, 2016, using the GPS locations from the spring assessment. Protocols were similar to those performed in the spring with the only exception being the corn seed bait was allowed to germinate for 12 days. On October 24, 2016, bait trap corn seed was removed and evaluated for the presence of wireworms. Fall assessment for wireworms was also negative.

Conclusions/Outcomes/Impacts:

With the past successes of farmers who have adopted the biocontrol nematode program to control alfalfa snout beetle (documented in 9 counties in New York State) on their farms in Northern NY, the opportunity to provide protection against corn rootworm seemed a logical next step as resident biocontrol nematodes populations in many cases have increased during corn years 2-4. Ideally, this study needs to be conducted in multiple fields across the NNY region in fields where biocontrol nematodes have been established in alfalfa during proceeding years.

However, to accurately measure the impact of biocontrol nematodes on corn rootworm larvae, untreated areas must also be present. To date, only one site located in NNY has met the criteria for the study as the producers of the established demonstration plots have yet to rotate into corn.

This 2016 trial was the first year of a 3-4 year study; measurable benefits of nematodes on corn rootworm are not expected until year 2 as rootworm adults laid eggs in the corn plot during the summer of 2016. In a similar study conducted at the Musgrave Research Farm, Aurora, NY, biocontrol nematodes limited root feeding damage and the results were nearly identical to the level of root protection with the best BT-CRW corn variety.

In year one of the NNY trial, biocontrol nematodes were established within the designated treated plots providing the resident population to measure any impact on corn rootworm larvae. Additionally, a wireworm trial was conducted within the test plots to determine if any population was present at the site. Results from the wireworm assay were negative for presence of wireworm larvae.

Results from the two current corn rootworm study sites (Adams and Aurora, NY) will be shared with the agribusiness community of NNY during winter cycles beginning in 2017. Additional sites may be established-introduced into the study in 2017 across NY if funding is attained. It is important to remember however that without the support of prior research in NNY on alfalfa snout beetle, the study to evaluate eliminating the need for BT-rootworm corn or soil insecticides on conventional varieties would not be possible.

Outreach:

- Grower Meeting: DeBeer Seeds & Spraying; Charlie's Seed & Spray, March 31, 2016, Brushton-Moira American Legion, Moira, NY
- Commercial Applicator Meeting: April 6, 2016, Watertown, NY
- Corn Conference: January 22-26, 2017, Wichita, KS
- NNY Crop Congress East: February 1, 2017, Miner Institute, Chazy, NY
- NNY Crop Congress West: February 2, 2017, CCE, Canton, NY
- NNY Winter Forage Forum: February 7, 2017, Lowville Farmers CO-OP, Lowville, NY

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

Dec 2016	Morning Ag Clips	Research Aids Young NNY Ag Entrepreneur
12-13-16	Holstein World	NNYADP ASB Entrepreneur
12-13-16	Dairy Business	NNYADP ASB Entrepreneur
12-13-16	Pinterest	NNYADP ASB Entrepreneur
12-14-16	Morning Ag Clips	NNYADP ASB Entrepreneur
12-15-16	Cornell Field Crops Blog	NNYADP ASB Entrepreneur
12-19-16	Focus on Farming	NNYADP ASB Entrepreneur
12-19-16	Time Warner Cable News	NNYADP ASB Entrepreneur
12-22-16	New York Ag Connection	NNYADP ASB Entrepreneur
12-22-16	US Ag Network	NNYADP ASB Entrepreneur
12-29-16	Facebook: Progressive Forage	NNYADP ASB Entrepreneur
12-29-16	Progressive Forage	NNYADP ASB Entrepreneur
12-29-16	agnewsfeed.com	NNYADP ASB Entrepreneur
01-05-17	Dairy Agenda Today	NNYADP ASB Entrepreneur
02-02-17	Morning Ag Clips	Solution for One Farm Pest in NNY May Help Another
02-07-17	American Agriculturist	NNYADP CRW Research

02-06-17	Country Folks	NNYADP CRW Research
02-05-17	Plattsburgh Press Republican	NNYADP CRW Research
02-04-17	Batavia Daily News	NNYADP CRW Research
02-04-17	Malone Telegram	NNYADP CRW Research
02-04-17	Carthage Republican Tribune	NNYADP CRW Research
02-04-17	Lowville Journal	NNYADP CRW Research
02-04-17	Massena-Potsdam Courier	NNYADP CRW Research
02-04-17	Ogdensburg Journal	NNYADP CRW Research
02-04-17	Watertown Daily Times	NNYADP CRW Research
02-04-17	Oswego News	NNYADP CRW Research
02-03-17	Time Warner Cable News	NNYADP CRW Research
02-03-17	Morning Ag Clips	NNYADP CRW Research
02-02-17	Farming	NNYADP CRW Research
02-01-17	Dairy Business	NNYADP CRW Research
02-01-17	Holstein World	NNYADP CRW Research
01-31-17	Cornell Field Crops Blog	NNYADP CRW Research
01-31-17	Cornell Field Crops Blog	NNYADP at Crop Congresses
01-31-17	North Country Now	NNYADP at Crop Congresses
01-27-17	New York Ag Connection	NNYADP at Crop Congresses
01-26-17	Morning Ag Clips	NNYADP at Crop Congresses
01-25-17	Empire State Farming	NNYADP at Crop Congresses
01-25-17	Dairy Agenda Today	NNYADP at Crop Congresses
01-24-17	Dairy Business Facebook	NNYADP at Crop Congresses
01-24-17	Dairy Business/Holstein World	NNYADP at Crop Congresses
01-24-17	newcliq.com	NNYADP at Crop Congresses
01-24-17	American Towns: Chazy	NNYADP at Crop Congresses
01-24-17	American Towns: Canton	NNYADP at Crop Congresses
01-24-17	Time Warner Cable News Blog	NNYADP at Crop Congresses
01-24-17	Batavia Daily News	NNYADP at Crop Congresses
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01-24-17	Carthage Republican Tribune	NNYADP at Crop Congresses
01-24-17	Massena Potsdam Courier	NNYADP at Crop Congresses
01-24-17	Oswego News	NNYADP at Crop Congresses
01-24-17	Ogdensburg Journal	NNYADP at Crop Congresses
01-24-17	Watertown Daily Times	NNYADP at Crop Congresses

Next Steps:

For 2017 the Shields' Lab will continue its efforts in the next phase of the corn rootworm study at the Magos farm study site. Prior to corn rootworm larval hatch (mid-late May), all plot areas will be sampled for biocontrol nematodes to document the expected overwintering populations in the treated plots and the lack of nematodes in the untreated plots. Plot areas will be re-sampled in the fall after harvest to document the level of biocontrol nematodes entering the winter.

The impact of biocontrol nematodes on the corn rootworm larval populations in each plot area will be measured in three different ways: 1) Within each plot, two 10 x 10 screen houses will be erected in each corn variety (BT, Non-BT) to capture the number of CRW beetles emerging from each 10 x 10 area. Beetles will be collected 2x per week, counted, sexed and recorded. Beetle emergence is expected to begin around July 15 and continue until late August; 2) After larval feeding is finished (early August), a specified number of plants will be dug, washed and the root feeding damage rated using the Iowa 0-3 scale; and 3) Before harvest, sections of each plot area will be rated for lodging as a result of CRW feeding damage.

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