

Northern NY Agricultural Development Program 2010 Project Report

Biological Control of Alfalfa Snout Beetle: Nematode Persistence Across Rotations

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Lewis C County: Jerome Demko, Bernie Gohlert, Mark Karelus, Gary Sullivan, Merle Yancey

St. Lawrence County: Mark Akins, Jim Armstrong, Peter Braun, David Fisher, Steven McKnight, "Skip" Putney

Franklin County: Real Choinere, Carolyn McNamara/Dick Eakins, Jason Fox, David Moore, Eugene Poirier, Peter Poupore

Background:

Alfalfa snout beetle continues to be the major factor limiting alfalfa stand life within the snout beetle infested region of NY that includes all six counties in NNY. Snout beetle related stand loss is often mistakenly identified as winterkill because the majority of plant death occurs after the growing season during the fall and early winter. Research focused on the use of biological control to suppress snout beetle was initiated in 1990. Progress toward managing this insect has progressed a long way with the continued support of the Northern New York Agricultural Development Program (NNYADP).

Between 1995 and 2005, research was focused on nematode efficacy against snout beetle, nematode strain persistence, application techniques compatible with large-scale agriculture, and the utility of nematode species mixes. A trip to Hungary, one of the native homes of snout beetle indicated research was focused in the correct direction because snout beetle was being held at sub economic levels by the same three species of nematodes being utilized in NNY research. A snout beetle population collapse on the Peck Farm and soil survey indicating the spread of entomopathogenic nematodes across the farm, strongly suggested that the use of nematodes as a biocontrol program against snout beetle had area wide potential. Discussions identified that the cost of nematode

rearing and application were high cost areas needing optimizing for adoption by alfalfa producers.

Funding for research to develop a low labor “farmer friendly” nematode rearing method was provided by NNYADP and the New York Farm Viability Institute (NYFVI). Since the entomopathogenic nematodes used as the biological control for snout beetle are adapted to NNY, a farm or field only needs to be inoculated once for the establishment of the nematodes in the field. Two methods were developed, first a process to rear nematodes on the farm and second, a method of application compatible with on-farm equipment to inoculate multiple fields on each farm. Inoculation of multiple fields allows farmers to more rapidly spread the biocontrol nematodes throughout their fields for faster control of snout beetle. Beginning in 2006 and continuing through the 2010 field season, 25 billion nematodes were reared for field application to approximately 100 ASB infested fields located in six NNY counties using this new method. Successful nematode application and establishment was achieved in all fields using a modified commercial pesticide boom mounted on a pickup truck.

During the 2009 field season and continuing in 2010, a goal of the project was to develop the necessary components which would allow the ASB-biocontrol nematodes to be inoculated into fields throughout infested region by farmers themselves or by commercial applicators. To achieve this goal, two interns worked with CCE agents in three NNY counties and were successful in having 11 different producers’ rear 5 billion nematodes which were used in establishing biocontrol nematodes on 24 ASB infested fields.

Funding by NYFVI to promote “On Farm” rearing of nematodes by producers/family members, 4-H-FFA groups and assist with producer applications was a priority for 2010 and 2011. This funding addressed the priority in NNY to move this technology to the farm/field across the region. Funding however was pulled back in 2010 so our attention and focus turned toward answering the following question; “What types of field situations give the best chances of success for nematode establishment and long-term ASB control?”. To answer this question, we sampled a subset of the 100 fields where nematodes were established in the past three years. These fields were broken down into three rotational categories distributed across six county infested region in NNY.

Methods & Results:

Thirty-six fields were selected from the pool of 100 fields inoculated with entomopathogenic nematodes (2007-2009), to represent the following rotational categories. Fields in each category were geographically distributed across the ASB infested area in NNY. Within each field, two of the four inoculated areas were selected for collecting soil samples which were returned to the lab and bioassayed for the presence of entomopathogenic nematodes. GPS coordinates were recorded for each field site inoculated with nematodes and the soil samples were taken down the center of each inoculated area. A total of 50 samples were collected in each area resulting in 100 samples collected per field. The sample area of each field will be repeatedly sampled for three years to construct a continuous record of nematode presence in the field regardless of the crop rotation in the field. At the end of this project, some fields will have a 6 year record history (inoculated in 2007) of nematode presence/relative population where others will have a 4-year history (inoculated in 2009).

In April of 2010, we contacted producers who had participated in the On-Farm Rearing Program beginning in 2007 to find out what their plans were for fields previously inoculated with nematodes for 2010. This information allowed us to create a sampling group for each category that we would follow during the 2010 field season. Field samples were collected between June 9 and September 22.

Fields rotated to corn prior to 2010.

After talking with our producers’ we determined there were 7 fields, in four counties that would be in a rotation other than alfalfa for at least a 2nd year post establishment of entomopathogenic nematodes during the 2010 growing season. All fields have been previously sampled to confirm persisting populations of nematodes.

Jefferson County had one producer, Shelmidine, whose field was originally inoculated in 2008 and was rotated to corn in 2009. In 2010, the producer went back to a rotation of a grass/alfalfa mix and this was the only field in our study that followed this rotation pattern (others remained in at least a 2 year corn rotation). In Lewis County, there were 4 fields that were in a 2nd year of a corn rotation. Three of the fields were inoculated in 2007 and the fourth inoculated in 2008. The Karelus site, had nematodes applied using a hand boom and was going into year 3 of a corn rotation. The Gohlert sites were split between fields inoculated using the hand boom and truck application method. The Demko fields were all applied in 2008 using the truck application method. St. Lawrence County had one producer site operated by Skip Putney whose field was inoculated in 2007 using hand boom and was in its’ second year of a corn rotation in 2010. The species combination at this site was ‘Oswego’ and *Steinernema feltiae* ‘NY04’. A single field in Franklin County (Poupore) used a combination of ‘NY001’ and ‘NY04’ and was applied using the truck method in 2008. The following table shows the percentage of positive samples found at each site since nematode establishment:

Producer	Application Year	‘NY001’ Positive Samples	‘Oswego’ Positive Samples
Shelmidine	2008	7-30%	6-10%
Karelus	2007	8-17%	1-5%
Gohlert (HB)	2007	7-35%	3-5%
Gohlert (T)	2007	10-33%	0-3%
Demko	2008	3-43%	2-24%
		‘NY04’ Positive Samples	‘Oswego’ Positive Samples
Putney	2007	12-68%	0-6%
		‘NY001’ Positive Samples	‘NY04’ Positive Samples
Poupore	2008	5-18%	8-32%

Fields rotated to corn in 2010.

There were a total of 14 fields that met the criteria of fields rotated into corn for the first time in 2010. Fields inoculated prior to 2009 were separated by nematode species combination based on the county where the producer was located. All fields inoculated in 2009 used the ‘NY001’ and ‘NY04’ combination. All fields inoculated from 2008-2009 used the truck application method.

Jefferson County had 6 fields with four different producers who went to a corn rotation in 2010 for the first time:

Producer	Application Year	‘NY001’ Positive Samples	‘Oswego’ Positive Samples
Hansen	2008	10-16%	5-16%
Kiechle	2008	14-19%	6-11%
Porter	2009	2-31%	8-16%
Shelmidine	2007	7-32%	1%
		‘NY001’ Positive Samples	‘NY04’ Positive Samples
Shelmidine	2009	5-16%	23%
Shelmidine	2009	9-29%	16-31%

Lewis County had 2 fields, each with a different producer that went into a corn rotation in 2010:

Producer	Application Year	‘NY001’ Positive Samples	‘Oswego’ Positive Samples
Yancey	2008	14-22%	0-4%
		‘NY001’ Positive Samples	‘NY04’ Positive Samples
Gohlert	2009	30-38%	3-6%

St. Lawrence County had 1 producer who had two fields go into a corn rotation in 2010:

Producer	Application Year	‘NY04’ Positive Samples	‘Oswego’ Positive Samples
McKnight	2008	5-34%	0-5%

Franklin County found 4 different producers whose fields were rotated to corn in 2010:

Producer	Application Year	‘NY001’ Positive Samples	‘NY04’ Positive Samples
Choiniere	2008	6-19%	6-36%
Eakins	2008	10-14%	5-12%
Moore	2008	8-16%	11-30%
		‘NY001’ Positive Samples	‘NY04’ Positive Samples
Fox	2009	0-5%	7-17%

Fields remaining in alfalfa/grass for 2010.

The cross section of fields remaining in continuous alfalfa/grass mix consisted of 15 fields with 12 different producers' located in four counties. Fields varied by nematode application method (hand boom vs. truck) and species combinations (2008 by county – 2009 uniform species combinations) resulting in a greater set of fields to compare throughout the study:

Producer	Application Year	'NY001' Positive Samples	'Oswego' Positive Samples
Haldeman	2008	9-55%	5-16%

Producer	Application Year	'NY001' Positive Samples	'Oswego' Positive Samples
Demko	2008	9-31%	6-14%
Gohlert	2008	34%	6%

Producer	Application Year	'NY04' Positive Samples	'Oswego' Positive Samples
Akins (HB)	2007	12-38%	2-12%
Akins (T)	2007	22%	3%
Putney (T)	2007	3-19%	2%
Armstrong	2008	8-43%	1%
Braun	2008	21-36%	3%

Producer	Application Year	'NY001' Positive Samples	'NY04' Positive Samples
Eakins (HB)	2007	3-18%	10-25%
Eakins (T)	2007	10-14%	4-12%
Poirier (HB)	2007	3-17%	4-34%
Choiniere	2008	5-19%	5-35%
Moore	2008	5-26%	4-22%
Poirier	2008	6-13%	10-29%
Fox	2009	2-10%	12-20%

Conclusions/Outcomes/Impacts:

Soil bioassay results in 2010 across rotation indicate that we still have 100% persistence in the 36 fields used in this study. However, only one year of sampling and a subset of the infested snout beetle fields inoculated with entomopathogenic nematodes do not give us any definite answers. The continued sampling of these groups as well as incorporating additional fields as they are rotated into corn will increase our knowledge on the type of field situations that will give the best chance for long-term ASB control. At the conclusion on this 3-year study, we will make estimates about nematode persistence across corn rotation and suggestions about the frequency of nematode re-inoculation.

Outreach:

2010 NNY meetings:

NNYADP –West committee –Jan 25, 2010 @ Watertown, NY

NNYADP – East committee – Feb 3, 2010 @ Plattsburg, NY

Next Steps:

Continue examining nematode persistence across corn rotation with funding assistance from hatch in 2011.

Acknowledgements:

We thank the Northern New York Agricultural Development Project farmer-leaders for their continued support in 2010 despite difficult financial times within the state.

Newspaper and online articles:

An interview conducted in NNY by local newspaper reporter on our efforts to use biocontrol nematodes to control alfalfa snout beetle was picked up and hit several media outlets beginning in November 2010. Below is a partial list of links to this article:

Ebionews.com

<http://www.ebionews.com/news-center/research-frontiers/ag-bio-a-bio-agriculture/29954-inexpensive-on-farm-method-controls-invasive-beetle.html>

Missouri Ag Connection

<http://www.missouriagconnection.com/story-national.php?id=2374&yr=2010>

My Science

http://www.myscience.cc/en/wire/inexpensive_on_farm_method_controls_invasive_beetle-2010-cornell

PhysOrg.com

<http://www.physorg.com/news/2010-11-inexpensive-on-farm-method-invasive-beetle.html>

Science

<http://www.scimag.com/PrinterFriendly.aspx?id=33804&url=http%3A%2F%2Fwww.scimag.com%2Fnews-inexpensive-on-farm-method-controls-invasive-beet-112910.aspx>

New York Ag Connection

<http://www.newyorkagconnection.com/story-state.php?id=939&yr=2010>

North Country Now: <http://northcountrynow.com/business/alfalfa-growers-madrid-and-elsewhere-north-country-raising-nematodes-fight-invasive-beetle->

A separate article was published in the January 2011 edition on American Agriculturist:

<http://magissues.farmprogress.com/AMA/AM01Jan11/ama028.pdf>

Person(s) to contact for more information (including farmers who have participated):

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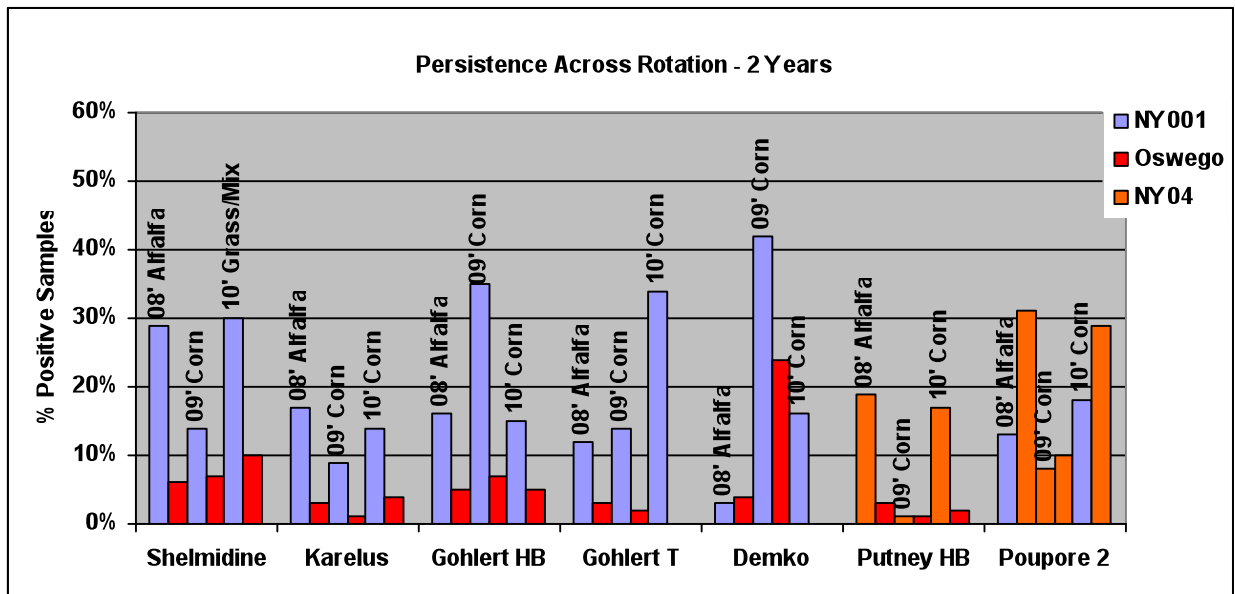
Photos:



Figure 1: Sampling for persisting nematodes in field rotated to corn in 2010



Figure 2: Adult alfalfa snout beetle on the move



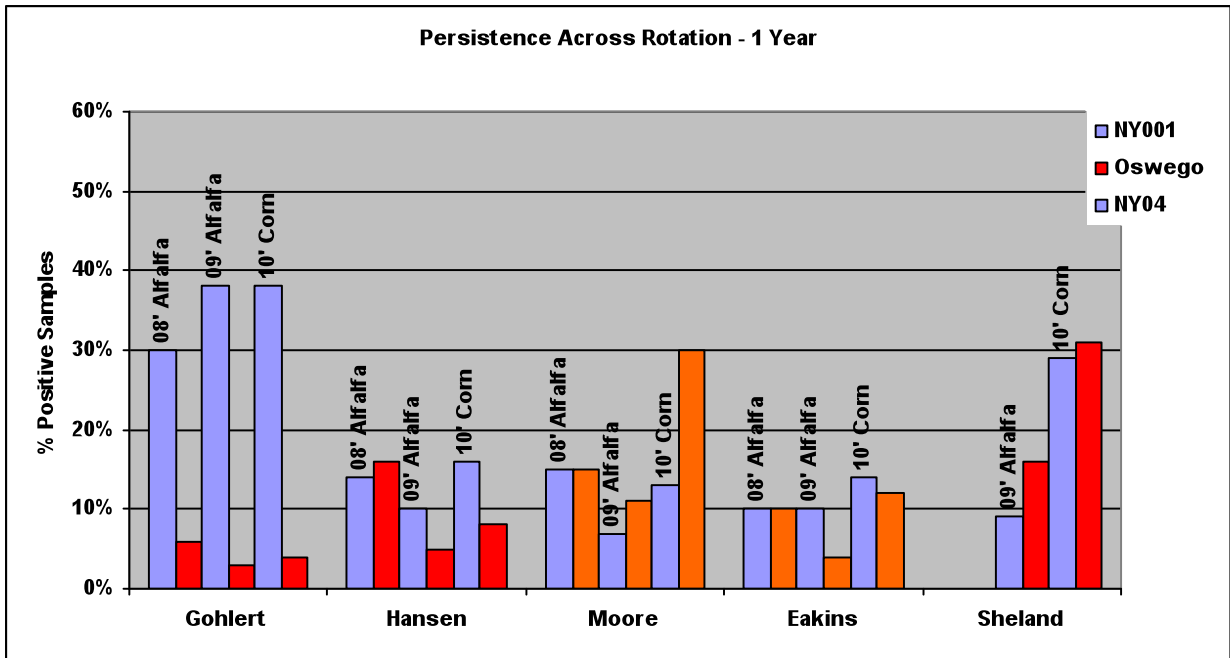


Figure 4: Infested ASB fields inoculated with nematodes rotated to corn in 2010

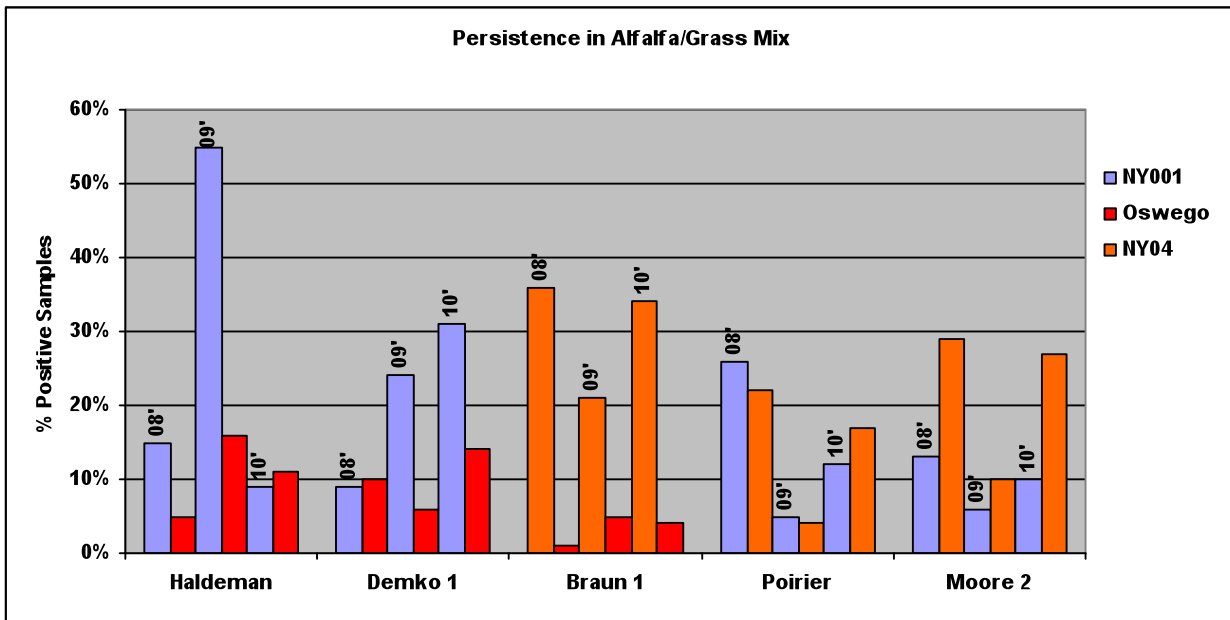


Figure 5: Infested ASB fields inoculated with nematodes persisting in continuous alfalfa/grass mixture