Final report for 2010 NYS IPM Program
Research and Development

Title: Determining the impact of cover crops on nematode population within the project – "Prioritizing cover crops for improving root-health and yield of vegetables in the Northeast."

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Abstract (no more than100 words): A project has already been funded from another source to assess the impact of eight cover crops on root diseases of vegetables and soil health. We will enhance this project by including pathogenic and free-living nematode assessments in soils where the cover crops grown. Results of the nematode assay will be included in the overall cover crop ratings that will be completed in 2011, included in a fact sheet to be prepared and in the Cornell Vegetable Guidelines, and presented at grower meetings.

Background and Justification: From 1995-2005 a vegetable crop and pest management systems trial was conducted at NYSAES Geneva on 4, 2-acre fields and funded by USDA-SARE, USDA-RAMP and NYS IPM. Over time the 4 fields - managed using 2 IPM systems, a conventional system and an organic system - began to show clear differences in soil health, particularly in the area of root rot severity (root-health ratings). The site was maintained and tested for soil health differences from 2006-2008 at which time a NE IPM project titled "Prioritizing cover crops for improving root-health and yield of vegetables in the Northeast" was funded (in cooperation with CT and PA) to conduct a replicated large plot test of the impact of eight different cover crops on soil health in each of the 4 fields. From four different starting points of root rot disease pressure, all eight cover crops are being tested to see which might increase root rot pathogens and damage or which ones might reduce them.

Excerpt from NE IPM funded project: "The overall goal of this project is to provide vegetables growers with additional information that they can use to select the appropriate cover crops when specifically trying to reduce root disease pressure or develop a cropping sequence that limits the build-up of root pathogens in addition to improving other soil health physical, biological and chemical properties."

Cover crops (clover, tillage radish, hairy vetch/rye, oat, wheat, buckwheat, sudex, and canola, along with a fallow control) were established at the site in fall 2008 and the trial has proceeded through 2009 with cover crops and sweet corn grown in the plots according to the trial plan. There are 108 plots (27 per field) in the trial. Snap beans cv. 'Caprice' was planted in all plots in 2010 in order to observe root rot and nematode damage on a susceptible vegetable crop.

Although NE IPM funded the project, funding was reduced from the proposed amount by approximately 20% necessitating the elimination of some planned tests and data collection. One type of data that was eliminated from the NY site of the project was an assessment in each cover crop plot of pathogenic and free-living nematode populations. A limited amount of funding from another source was used to conduct initial pathogenic nematode population trials in spring 2009. The funds provided by the NYS IPM Program allowed us to determine whether plant-parasitic and free-living nematode populations increased or decreased as a result of growing the various cover crops during the 2009 – 2011 season. The latter information on nematode populations will

be added to the soil health and root health measurements that we are generating for each cover crop in the trial.

Objectives:
1. Assess the impact of several types and varieties of cover crops adapted to the Northeast on the populations and damage of plant-parasitic nematodes and also free-living nematodes in replicated field research trials.
2. Include ratings cover crop suppression or population increase for nematodes in the Cornell Guidelines and in the fact sheet to be prepared at the end of the NE IPM project.

Procedures:
Objective 1: Composite soil samples were collected from each of the 108 plots in the 4 fields at NYSAES according to the prescribed methods of the Cornell Soil Health Program (http://soilhealth.cals.cornell.edu). A portion of each soil sample was processed for nematode analysis. Plant-parasitic and free-living nematodes were extracted using established the "Pie-Pan" method (a modification of the "Baerman Funnel" method) and identified and enumerated under a microscope at 40X.

Objective 2: The 2010 results of the nematode analyses were compared to those obtained in 2009 to determine if the cover crops suppressed or exacerbated pathogenic nematode populations. The 8 cover crops and the fallow treatments were re-established in late August 2010 in the same plots for another cycle of evaluations. The accumulated nematode results will be included in the 2011/12 Cornell Guidelines for Vegetables as well as in the preparation of fact sheet on the impact of cover crops on nematode populations and potential crop damage by prevalent plant-parasitic nematodes.

Results and Discussion:

Due to differences in the previous management of the four fields (Conventional, Organic, Present IPM and Future IPM Systems) and also to the establishment of the replicated 9 cover crop treatments in fall of 2008 in each field (system), it is not surprisingly to find the variability in the densities of plant-parasitic [principally root-knot (*Meloidogyne hapla*) and lesion (*Pratylenchus penetrans*)] and free-living nematodes (Table 1). Overall, the populations of the lesion nematode were highest in the Future IPM production system, which undoubtedly due to the frequent use of grain and forage crops in this production system for enhancing soil quality. Grain and forage crops are known to be good hosts to the lesion nematode. However, it was very surprising to detect almost no lesion nematode in any plots of the various cover crops in the Organic production System, suggesting the development of a suppressive soil. In contrast, populations of the root-knot nematode were highest in plots of the present IPM and the Organic Production Systems as compared to those of the Future IPM and the Conventional Systems (Table 1). Populations of total free-living (beneficial) nematodes were surprisingly the lowest and highest in the Organic and Present IPM Systems, respectively.

Regardless of the production system, the cover crop treatments also greatly influenced the populations of plant-parasitic nematodes, as evident when comparing the 2010 and the 2009 results (Table 2). All grain crops and also rapeseed reduced the population of root-knot

nematode, whereas red clover, radish, and rye/vetch increased the populations. However, all cover crops treatments increased the populations of the lesion nematode, but specially sudex, oats, wheat, and rye/vetch as well as the check (fallow) treatment. Several weed species grew in the latter treatment, which a number of them are known to be hosts to the lesion as well as other plant-parasitic nematodes. Similarly, populations of the free-living nematodes were also affected differentially by the cover crop treatments included in the trial. Rye/vetch, oat, wheat and sudex appear to generally support higher number of these nematodes.

The root-knot and lesion nematodes are widespread and damaging plant-parasitic nematodes to most vegetables grown in New York and the northeast region. Also, free-living nematodes are important component of the microbial communities of healthy soils and are major players in various soil processes including nutrient recycling. The results obtained this project will contribute to the selection of appropriate cover crop to design a sustainable production system that improve soil health level and suppress nematodes and other crop pests.

Figure 1. Strips of a few cover crops in one of the Production systems used in the cover crop trials, fall 2010.

Table 1: Population Density of the Lesion (Pratylencius penetran), Root-Knot (Meloidogyne hapla), other Plant- Parasitic, and Free- Living Nematodes in the Cover Crop Plots inastablished in the Four Production System Fields, 2010.

Present IPM system (26)

	# Nematodes/ 100cc Soil			
Cover Crop	**Root-knot**	**Lesion**	**Others**	**Free-living**
Rapeseed	20.0	0.0	0.0	2160.0
Radish	73.3	0.0	0.0	1720.0
Buckwheat	6.7	13.3	0.0	1820.0
Sudex	20.0	40.0	20.0	2540.0
Wheat	13.3	33.3	13.3	1946.7
Oat	33.3	40.0	13.3	2353.3
Clover	80.0	20.0	6.7	1193.3
Rey/Vetch	113.3	6.7	6.7	2826.7
Check	10.0	0.0	0.0	1010.0
LSD 0.5	*49.7*	*64.7*	*20.9*	*2054.4*

Future IPM System (33)

Rapeseed	40.0	113.3	180.0	1740.0
Radish	20.0	26.7	93.3	900.0
Buckwheat	0.0	40.0	40.0	1326.7
Sudex	0.0	86.7	300.0	1273.3
Wheat	0.0	113.3	253.3	2573.3
Oat	0.0	113.3	93.3	1766.7
Clover	60.0	73.3	40.0	1400.0
Rey/Vetch	86.7	100.0	93.3	2266.7
Check	13.3	120.0	53.3	1893.3
LSD 0.5	*49.8*	*88.8*	*201.9*	*803.0*

Organic IPM System (37)

Rapeseed	26.7	0.0	6.7	580.0
Radish	33.3	0.0	0.0	1166.7
Buckwheat	13.3	0.0	0.0	766.7
Sudex	0.0	6.7	13.3	1013.3
Wheat	33.3	0.0	0.0	1180.0
Oat	13.3	0.0	0.0	1193.3
Clover	20.0	0.0	6.7	806.7
Rey/Vetch	40.0	0.0	0.0	2086.7
Check	13.3	0.0	6.7	906.7
LSD 0.5	*35.3*	*6.7*	*13.3*	*615.2*

Conventional IPM System (38)

Rapeseed	6.7	46.7	20.0	1133.3
Radish	0.0	60.0	6.7	760.0
Buckwheat	0.0	6.7	6.7	686.7
Sudex	6.7	113.3	0.0	873.3
Wheat	13.3	40.0	0.0	1433.3
Oat	40.0	0.0	13.3	1706.7
Clover	6.7	6.7	100.0	1473.3
Rey/Vetch	13.3	6.7	6.7	1066.7
Check	13.3	66.7	0.0	873.3
LSD 0.5	*30.3*	*120.5*	*54.0*	*798.5*

Table 2: Effect of Cover Crop on Population of the Root-knot (Meloidogyne hapla) and Lesion (Pratylencius penetran) Nematodes in the 4 Production System Fields.

	Nematodes/ 100 cc Soil		
Cover Crop	**2009**	**2010**	**Increase/ Decrease**
Root-Knot			
Sudex	86.00	26.67	-59.33
Buckwheat	79.00	20.00	-59.00
Wheat	100.00	60.00	-40.00
Oats	120.00	86.67	-33.33
Rapeseed	107.00	93.33	-13.67
Check, fallow	60.00	50.00	-10.00
Clover, red	153.00	166.67	13.67
Radish	40.00	126.67	86.67
Rye/ Vetch	87.00	253.33	166.33
Lesion			
Clover, red	94	100.00	6.00
Radish	80	86.67	6.67
Buckwheat	47	60.00	13.00
Rapeseed	146	160.00	14.00
Rye/ Vetch	66	113.33	47.33
Wheat	120	186.67	66.67
Oats	60	153.33	93.33
Check, fallow	34	186.67	152.67
Sudex	93	246.67	153.67