Michigan Horticulture Fund FY2018 Final Report

August 28, 2019

Title: Root Knot Nematode in Ornamental *Hemerocallis* spp. (Daylilies) and *Astilbes* spp. Bare Root Production.

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Collaborator: Walter's Gardens in Zeeland, Michigan

Objectives:

1. Establish effective management strategies for plant-parasitic nematodes in bare-root *Hemerocallis* production beginning at field planting of plugs in year 1, including a combination of fumigation practices and nematicide applications with sustainable approaches such as manure/compost applications and cover crops

2. Evaluate the efficacy of new nematicide products in second- and/or third-year daylilies in the field.

3. Optimize efficiency of hot-water dipping, or alternatives, as a strategy for eliminating plant-parasitic nematode populations in bare-root daylilies and Astilbes rootstock prior to planting.

Progress Report for Each Objective

Objective 1.

Methods:

A replicated field trial was established on non-fumigated ground with first-year daylily plants, variety "Going Bananas". Plots were treated with three nematicides, a hot water dipping alternative that was lab-tested in 2017, three bio-nematicides, three compost blends, a soil steaming fumigation alternative, and a control. The products tested were Azaguard (BioSafe Systems), Indemnify (Bayer), Majestene (two formulations; Marrone Bio Innovations), TerraClean 5.0 (BioSafe Systems), and a product sourced from the company Advanced Ag. Morgan Composting Inc. of Sears, MI, supplied the compost products. Daylilies were planted on May 8, 2018. Each treatment was replicated six times and was compared to the same variety of daylilies planted in an adjacent plot in fumigated ground. Daylilies planted in fumigated ground were planted on the same day as non-fumigated and treated plots.

All 2018 soil samples have been processed and evaluated for nematode abundance (Table 1). Root samples taken mid-season 2018 have been stained and evaluated (Figure 1) and mean heights at harvest were compared (Figure 2). See below for results.

Table 1. Comparison of mean root knot nematode populations recovered from 100cc of soil collected in 2018 at initial (5/24), mid-season (7/24) and harvest (10/23). Plots treated with fumigation and Majestene 304 consistently had zero root knot nematodes within soil samples.

	Sample Date		
Treatment	Initial	Mid-Season	Harvest
Advanced Ag	0.00	0.00	1.50
Azaguard	0.17	0.00	0.25
Compost 1	0.17	0.00	1.00
Compost 2	1.83	0.00	0.75
Compost 3	0.83	0.17	0.50
Control	1.00	0.00	0.25
Fumigated	0.00	0.00	0.00
Indemnify	0.00	0.00	0.25
Majestene 304	0.00	0.00	0.00
Majestene 305	0.17	0.17	0.25
Root Dip	2.50	0.00	0.00
Soil Steaming	0.00	0.33	0.00
TerraClean 5.0	0.00	0.17	0.25

[1]No significant differences were detected Tukey HSD (α=.05)

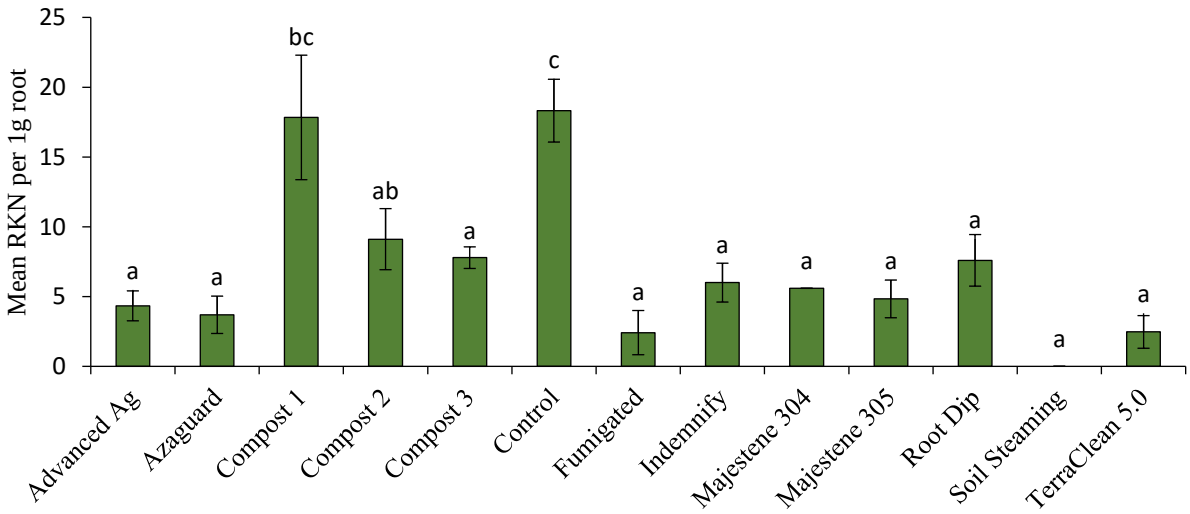

Figure 1. Mean root knot nematodes detected per gram of stained roots collected mid-season 2018. The control plots had significantly higher root knot nematodes than many treatments and the soil steaming consistently had 0 root knot nematodes per gram of root. Error bars represent standard error of the mean and treatments labeled with different letters are significantly different Tukey HSD (α = .05).

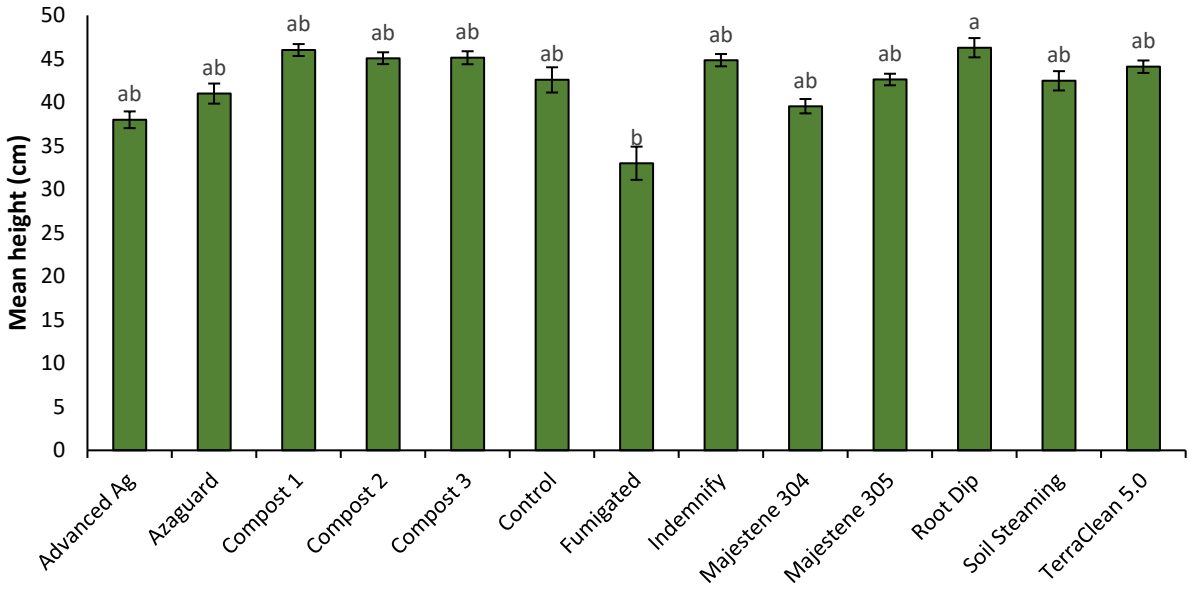

Figure 2. Mean plant height at harvest (10/23/18). Error bars represent standard error of the mean. Fumigated plant were substantially shorter than all other treatments and significantly shorter than the Indemnify root dip treatment (p=0.418). Treatments labeled with different letters are significantly different Tukey HSD (α = .05).

Objective 2

Methods:

A replicated field trial was established on second-year daylily plants, variety "Stella". Plots were treated with four products and a control. The products tested were Azaguard (BioSafe Systems), Indemnify (Bayer), Majestene (Marrone Bio Innovations), and Nimitz (Adama). Daylilies were treated on May 8, 2018. Each treatment was replicated six times. This plot was fumigated in 2017 prior to planting daylilies in this area. We will use results from this year (fumigated year 1 + nematicide treatments year 2) to compare to next year's results from our current non-fumigated trial (not fumigated, soil treatments year 1 + nematicide treatments year 2). At the end of the 2018 season (10/2018), mean plant height was determined by measuring 3 plants per plot. At harvest (04/2019), root samples were collected from three plants in each plot, stained and evaluated for root knot nematode presence. Total root weight was also collected at this time.

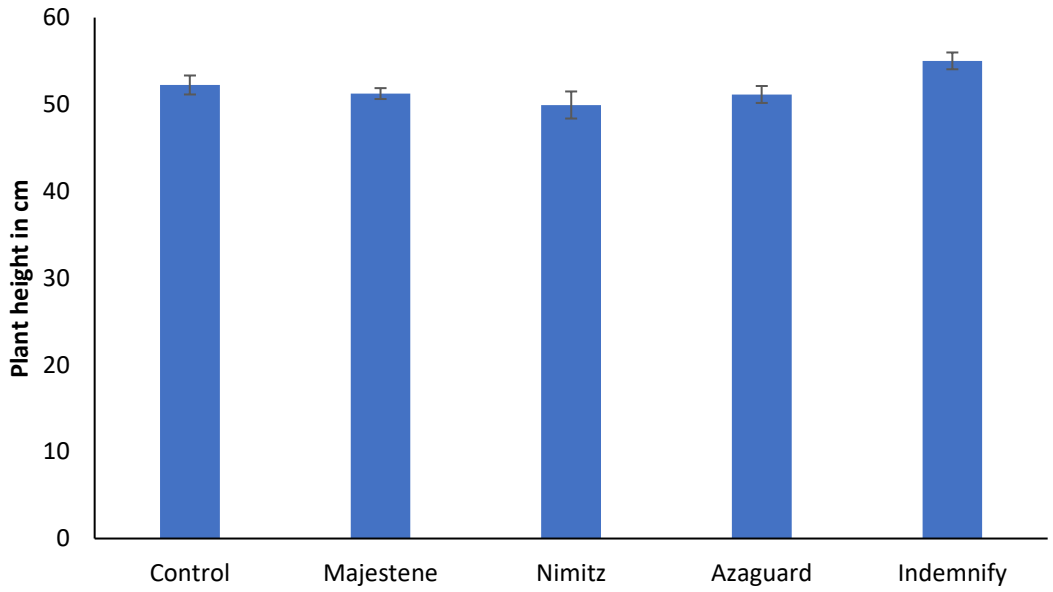

Figure 1. Mean plant height at end of 2018 season. Error bars represent standard error of the mean. No significant differences were detected Tukey HSD (α = .05), however Indemnify had the highest mean plant height compared to other treatments.

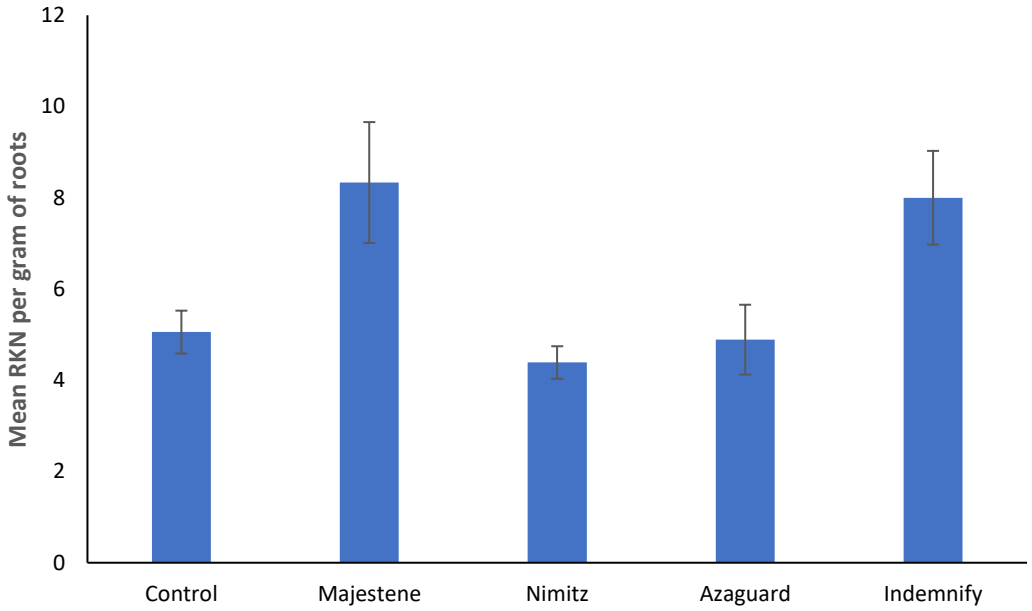

Figure 2. Mean root knot nematodes observed per gram of root collected at harvest (04/19/19). Error bars represent standard error of the mean. No significant differences were detected Tukey HSD (α = .05). Although not significant, Nimitz had the lowest rate of infection by root knot nematode.

Objective 3.

The daylily (*Hemerocallis*) portion of this objective is complete and was reported on in the progress report.

Methods:

Astilbes spp. rootstock was obtained from Walters Gardens in March of 2018. Roots were stored and 35°C for up to two weeks until use in testing. Prior to testing, a small selection of roots were sampled and stained to determine initial root knot nematode infestation. Staining revealed roots were not infested (zero root knot nematodes detected across all samples) and therefore intended treatments could not be applied. A replicated experiment was designed in which roots were inoculated with root knot nematodes to determine host status of *Astilbes* spp. Two concentrations of root knot nematodes were inoculated on two varieties of *Astilbes*, replicated five times per variety.

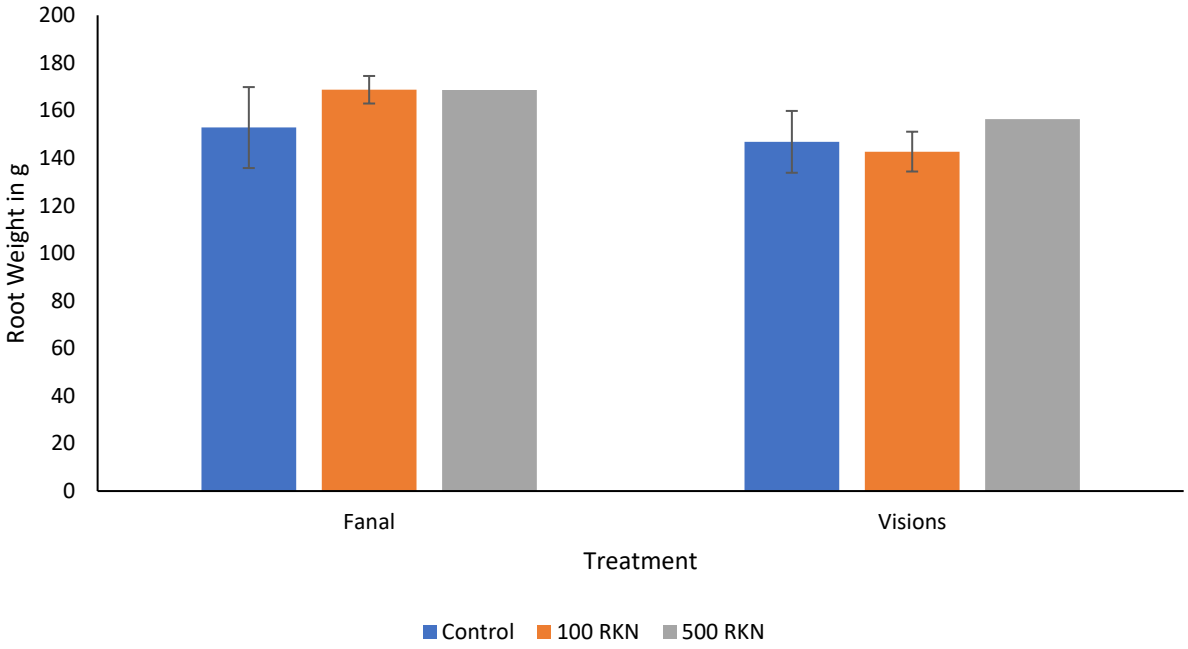

Figure 1. Comparison of final root weight for Fanal and Visions *Astilbes* varieties that were inoculated with 0 (control), 100 or 500 root knot nematodes at planting. No significant differences were detected Tukey HSD ($\alpha = .05$). Root weights were similar both between varieties and inoculation level suggesting root knot did not significantly impact the growth of the tested plants.

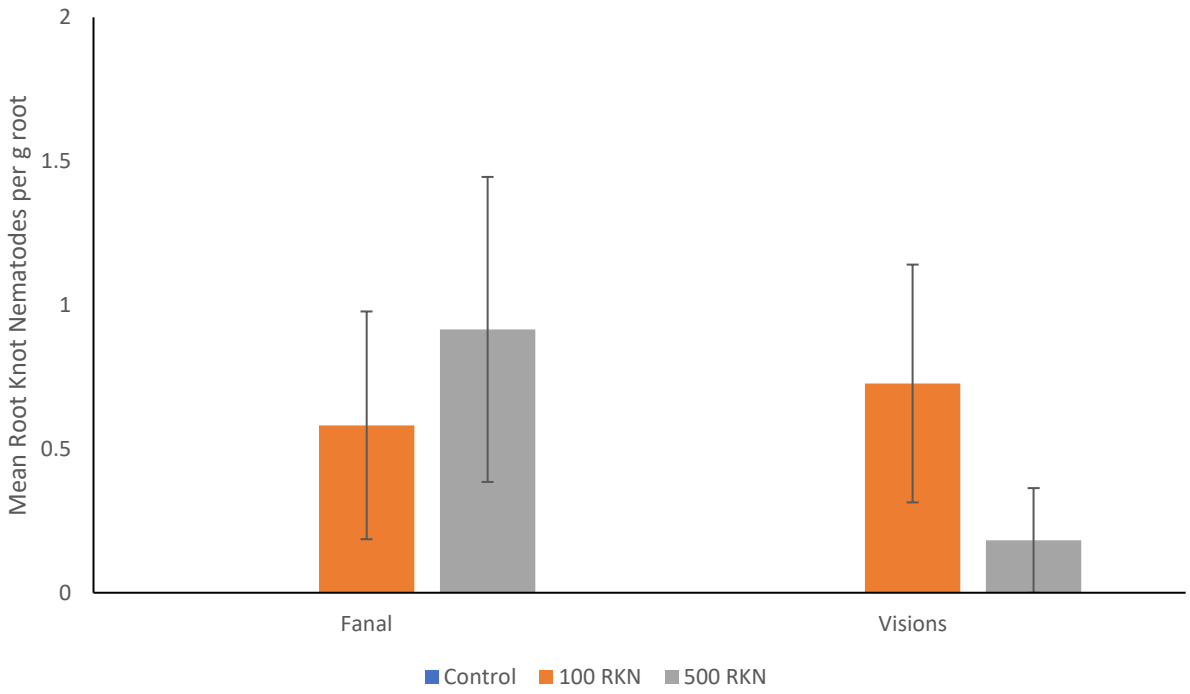

Figure 2. Final root knot nematode infection per gram of root for Fanal and Visions varieties and different inoculum levels. Significant differences were not detected Tukey HSD ($\alpha = .05$). The control (non-inoculated) plants did not have root knot nematode infection while both varieties did have some root knot nematode detection. From the data it appears that root knot nematodes will feed on *Astilbes* but it may not be an optimal host.

Financial Summary:

As of June 2019, the following funds have been utilized

Expenses:

Salaries: $9,834.04

The total funds obtained from MDARD Horticultural funds were $13,495.00 and since the last update $9,834.04 remained. This remaining fund was used for salaries to complete project objectives.

Comparison to Grant:

Funds and methods implemented are similar to what was proposed in the grant up to this point in time with a few minor modifications as follows.

We proposed using cover crops as a sustainable, alternative solution to root knot nematode control. However, after speaking with the manager of the ornamental operation we are collaborating with, we could not come up with a window of opportunity in which to apply a cover crop treatment that would both make sense to an ornamental producer and that would control nematode populations based on life cycle information.

Also, due to root knot nematode availability and difficulties in inoculating ornamental rootstock (rootstock is trimmed before shipment/standard hot water dipping, therefore there are no fine roots for the nematodes to infest), daylily plants used in greenhouse trials were not

inoculated prior to experimentation. The *Astilbes* spp. rootstock that was sent to us was not infested with root knot nematodes. Because of this, our experiment shifted from a nematode control experiment to a host-status inquiry.