MDARD Horticulture Fund Fiscal Year 2022 Final Report

Title: Evaluating the Impact and Management of Plant-Parasitic Nematodes on *Hemerocallis* spp. (Daylily) Field Production

Principal Investigator: Marisol Quintanilla-Tornel
E-mail: marisol@msu.edu
Department: Entomology
Mail Address:
Marisol Quintanilla, Ph.D.
Michigan State University
288 Farm Lane, Room 26B
East Lansing, MI 48824
Email: marisol@msu.edu
Office phone: 517-884-2058
Team Members: Amanda Howland, Emilie Cole, and Heidi Lindberg
Collaborator: Walters Gardens in Zeeland, Michigan

Objectives

Objective 1: Utilize the top six treatments from the field trial conducted at Walters Gardens, Zeeland, MI, from 2018-2020 that resulted in the highest control of root-knot nematode populations and increased plant growth to conduct a two-year greenhouse trial. The greenhouse trial is testing the effect of these treatments on root-knot nematode inoculated daylily plants to see if the results observed in field are consistent in other environments.

Objective 2: Evaluate the host status and impact of stubby-root nematodes (*Trichodorus* spp.) and pin nematodes (*Paratylenchus* spp.) on daylily production. Understanding the impact of these nematodes on daylilies can tell us if these nematodes, in addition to root-knot nematodes, need to be controlled in daylily production fields and how strong a focus needs to be on managing these nematodes.

Progress Report for Each Objective

Objective 1.

A greenhouse trial was started in spring of 2021 at Michigan State University's Plant Greenhouses in East Lansing. Bare-rooted daylily plants, var. 'Going Bananas,' was received from Walters Gardens and planted on May 4, 2021 and planted into a 1:1 mix of pasteurized greenhouse soil and pure sand in one gallon-sized pots. They were inoculated on May 17, 2021 with 9,000 root-knot nematode eggs/pot. The treatments were applied on June 3, 2021, two weeks after being inoculated to give time for root-knot nematode establishment within each pot. Treatments were reapplied on June 3, 2022. Each treatment has six replicates and the plants are arranged in a randomized block design in the greenhouse. Treatments include:

1) Majestene MBI-304
2) A high carbon compost (from Morgan Composting Inc., Sears, MI)
3) Indemnify (fluopyram) Root Dip
4) TerraClean 5.0 (hydrogen peroxide)
5) AzaGuard (Neem oil)
6) Bravo WeatherStik fungicide (to evaluate any effect on nematodes)

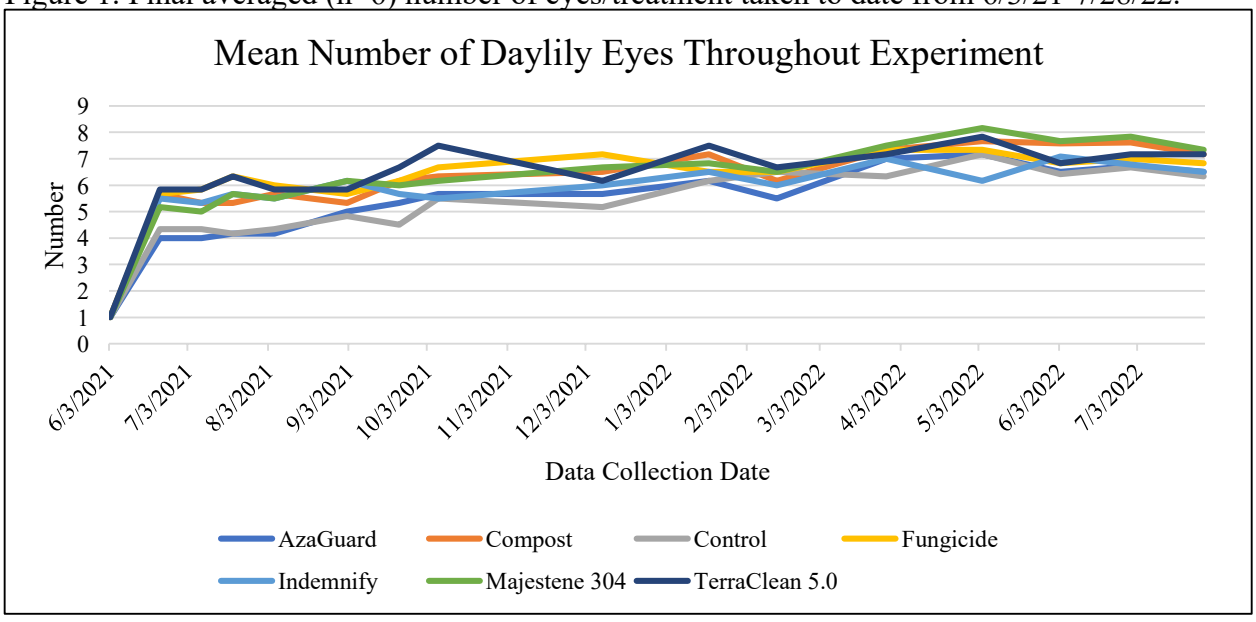
7) Control

Plants are kept at a 16h:8h light:dark photoperiod at 26°C and fertilized weekly (Peters' Professional 20-10-20 N-P-K fertilizer). Plant quality parameters, such as plant height (cm), two diameters taken N-S and E-W for growth index (GI) calculations (cm), number of eyes, number of flower buds, and number of scapes, are taken monthly starting when the treatments were applied on June 3, 2021. Based on the plant's growth measurements, a growth index will be calculated at the termination of the experiment. This greenhouse trial will continue until October 2022 to mirror the two-year field season of daylily plants.

Table 1. Mean plant growth measurements (n=6) for the duration of the trial (6/3/21-7/28/22). Data are taken monthly.

Treatment	Growth Index	No. of Scapes	No. of Buds	No. of Eyes
Control	57.45	1.89	2.53	5.50
Majestene 304	57.61	2.12	2.23	5.56
Compost	55.75	1.94	2.73	6.47
Indemnify	58.67	1.52	1.86	6.51
TerraClean 5.0	57.09	1.94	2.83	6.11
AzaGuard	58.62	1.89	2.27	6.53
Bravo Fungicide	56.10	1.73	2.73	6.67

Figure 1. Final averaged (n=6) number of eyes/treatment taken to date from 6/3/21-7/28/22.



Conclusion:

In summary, the treatment that is currently performing the best in terms of plant growth measurements is Indemnify with the highest growth index. The treatment that has the most eyes/plant (or yield calculation) is the Bravo fungicide, followed closely by AzaGuard and

Indemnify. The treatment that is performing the worst overall is the control plants with the least amount of eyes/plant. We do not know the effect each treatment has on root-knot nematodes until the experiment will end in October of this year.

Objective 2.

A replicated, daylily greenhouse trial was established in May of 2021 to establish the host status and damage potential of *Paratylenchus* spp., or pin nematodes, on daylily plants at Michigan State University's Plant Greenhouses, East Lansing. Individual bare-rooted daylily plants, var. 'Going Bananas,' from Walters Gardens nursery were potted on May 4, 2021 into a 1:1 mix of pasteurized greenhouse soil and pure sand in one gallon-sized pots. The newly potted plants were inoculated on May 21, 2021 with differing inoculation rates of *Paratylenchus* spp. The inoculum rates were 0 nematodes/plant (control), 500 nematodes/plant, 1,000 nematodes/plant, and 3,000 nematodes/plant. Plants were then arranged in a RBD in the greenhouse.

Similar to the experiment above, the plants were kept at a 16h:8h light:dark photoperiod at 26℃ and fertilized weekly (Peters' Professional 20-10-20 N-P-K fertilizer). Plant quality parameters, such as plant height (cm), two diameters taken N-S and E-W for growth index (GI) calculations (cm), number of eyes, number of flower buds, and number of scapes, are taken monthly.

The experiment was terminated on September 23, 2021, giving the pin nematodes four generations. At the end of the experiment, plant shoot and root weights (cm), crown width (cm), final plant height (cm), two diameters taken N-S and E-W (cm), grade/yield data (Table 2), number of eyes, number of buds, and number of scapes were taken (Figure 1). Final pin nematode populations were determined by extracting nematodes from the soil according to standard centrifugal-flotation methods (Barker et al. 1969). Based on the final population levels, we calculated a reproduction factor (RF) value; RF= final nematode population/initial nematode population. A RF value > 1 indicates that the plant is a good host while a RF value < 1 indicates a poor host.

Results from this experiment show that final pin population levels significantly differed ($p < 0.001$) with the inoculation rate of 1,000 resulting in the highest population level (Table 2). The RF values ranged from 0.00 to 0.90 indicating that *Hemerocallis* spp. are not in fact a good host to pin nematodes. The mean shoot and root fresh rates, yield, crown width, and growth index did not significantly differ ($p \geq 0.05$) and the control pots did not result in the highest measurements, further confirming daylily is a poor host. Additionally, the number of scapes, flower buds, and eyes did not significantly differ by inoculation rate, but the control did have the highest mean number of eyes. To confirm these results, we are replicating this experiment now. We just planted new bare-rooted daylily plants, var. 'Going Bananas,' from Walters Gardens nursery, into one gallon-sized pots with a 1:1 mix of pasteurized greenhouse soil and pure sand. We will inoculate them with the same inoculation rates of *Paratylenchus* spp. as listed above on August 29, 2022. This experiment will go four months and will be terminated as described above in late December 2022.

Part of the objective was also to test the host status of *Trichodorus* spp., or stubby-root nematodes, on daylily plants but due to culturing issues we were unable set up a similar experiment as the pin nematodes. We are still working on figuring out how to successfully culture their populations.

Table 2. Final averaged (n=8) fresh shoot and root weight (g), Grade 1 (yield), crown width (cm), the growth index, final pin population level, and the RF value of each inoculation rate taken at the termination of the pin nematode experiment on Sept. 23, 2021. Means followed by the same letter are not significantly different according to Tukey's test ($p < 0.005$).

Inoculation Rate	Shoot Weight (g)	Root Weight (g)	Grade 1 (Yield)	Crown Width	Growth Index	Final Pin Population	RF Value
0	54.13 a	345.13 a	2.38 a	10.00 a	58.16 a	0.00 a	0.00 a
500	59.50 a	417.00 a	2.83 a	11.08 a	57.75 a	50.51 ab	0.10 a
1,000	56.38 a	328.25 a	2.13 a	9.75 a	58.53 a	89.90 b	0.90 a
3,000	64.50 a	311.50 a	2.50 a	11.25 a	64.38 a	37.90 ab	0.13 a

Figure 2. Final averaged (n=8) growth parameters taken at the termination of the pin nematode experiment on Sept. 23, 2021.

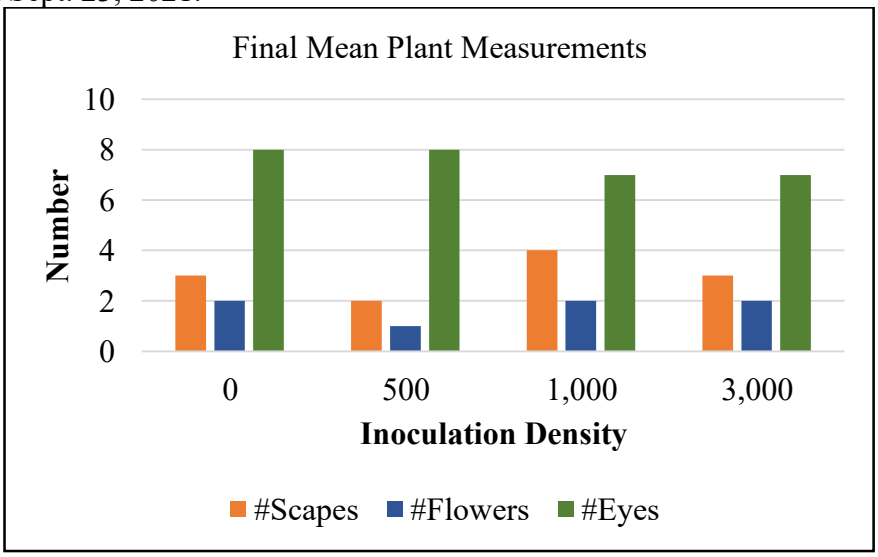
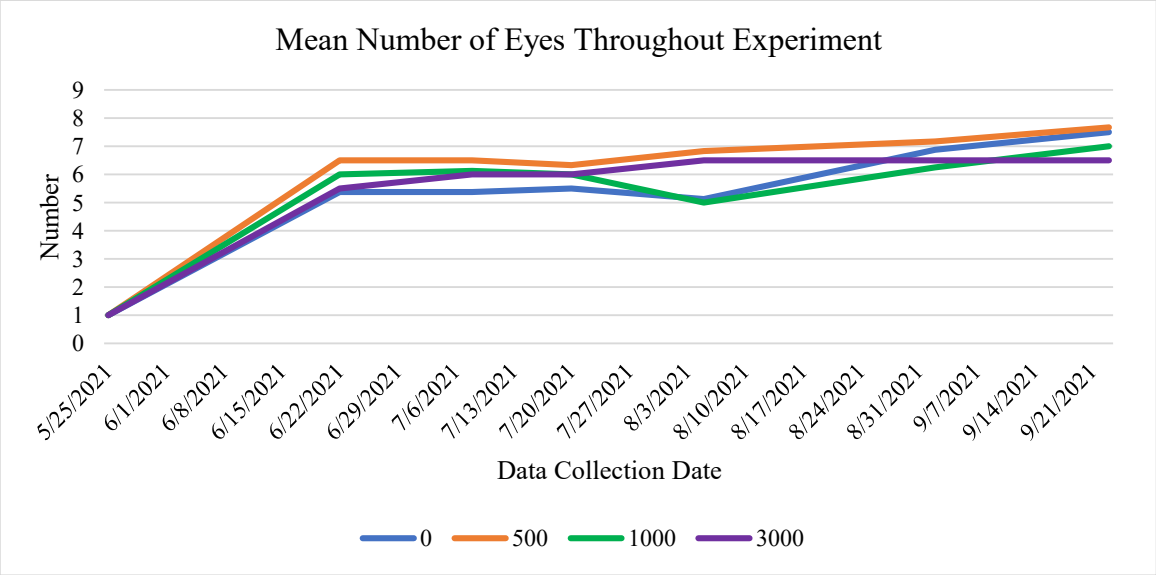


Figure 3. Final averaged (n=8) number of eyes/inoculation rate (0, 500, 1000, and 3000 pin nematodes/pot) of the pin nematode experiment throughout the summer in 2021.



Conclusion:

The results of the first year of this trial indicate that daylily is a poor host to pin nematodes with no effect on yield or growth measurements. If this data continues when the experiment is replicated next year, then this novel information will be great news for the ornamental industry showing that pin nematodes do not need to be included in any nematode management plans.

Financial Summary:

Here is the financial summary. We had a total reward of $19,023.00 and have spent $19,101.49, resulting in an overdraft of $78.49. However, MSU's CGA will process a cost adjustment to remove the overdraft before their final billing to MDARD. Therefore, the correct final expense amount should equal the budget at $19,023.00.

Description	Budget	Spent	Remaining
Salaries	$13,338	$12.919.5	$418.46
Travel	$57	$162.64	$-105.64
Supplies	$300	$331.09	$-31.09
Publications	$500	$0	$500
Other Direct Costs	$4,828	$5,688.22	$-860.22
Total			$-78.49