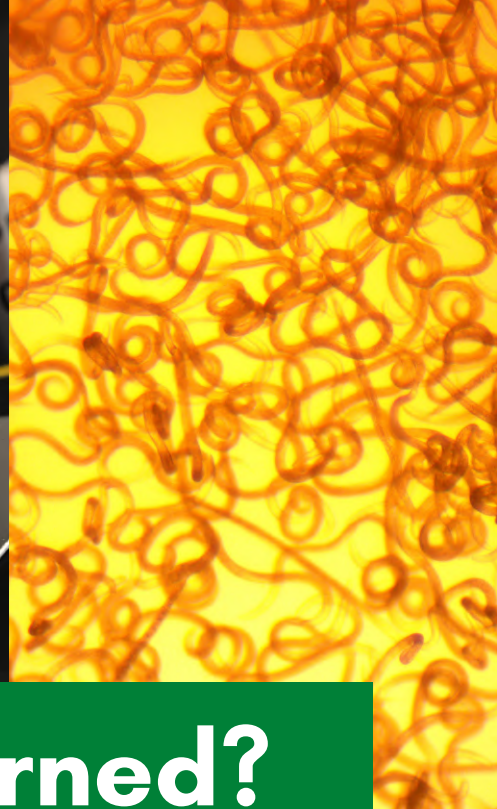
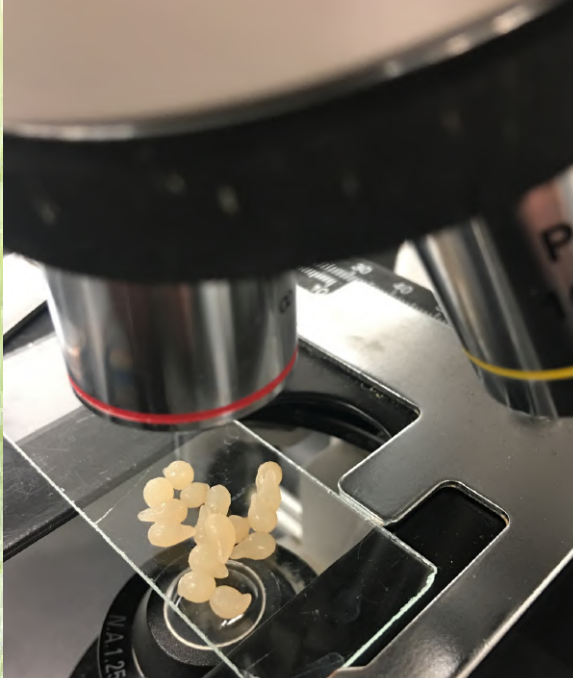


Evaluating The Biocontrol Pot Popper Pearls For Fungus Gnat Control

*2019 Muck Crops Research Station
greenhouse in the Holland Marsh, ON.*



what have we learned?

CROP: Celery (*Apium graveolens* L.), cv. TZ 6200
PESTS: Fungus Gnat, (*Bradysia* sp. (Winnertz))

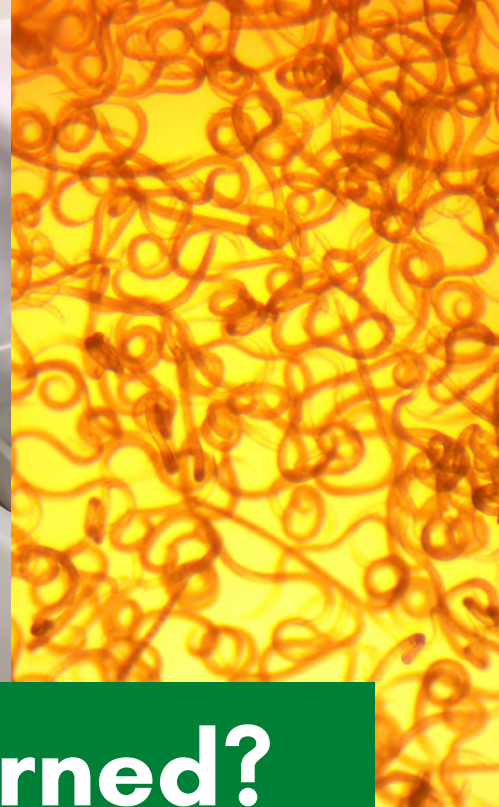
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TITLE: EVALUATING THE BIOCONTROL POT POPPER PEARLS FOR FUNGUS GNAT CONTROL 2019

MATERIALS: ENVIRONMENTAL FACTOR, INC. POT POPPER PEARLS (*Steninerema feltiae*), CITATION 75WP (cyromazine 75%)

CONCLUSIONS: This study indicates that the addition of nematodes in the Pot Popper Pearls at the high rated reduced the number of adult fungus gnats, and the low rate consistently increased plant growth. These beneficial nematodes could be an effective addition to an IPM program for vegetable transplants.





what have we learned?

METHODS: The trial was conducted in 2019 at the Muck Crops Research Station greenhouse in the Holland Marsh, Ontario. The experiment was designed to evaluate the efficacy of Environmental Factor, Inc. Pot Popper Pearls (*Steninerema feltiae*) to control fungus gnats (*Bradysia* sp.) in vegetable transplant production. The experimental unit was a 60cm x 60cm domed Headless – Soil Emergence Trap (BugDorm) containing one 288-cell plug tray of celery transplants. Treatments were of: Pot Popper Pearls at 10-15 (low), 16-30 (mid) and 60-70 (high) nematodes/pearl, untreated control (with fungus gnats), untreated control (no fungus gnats), and CITATION 75WP (commercial standard). There were four replications per treatment. Celery cv. TZ 6200, was seeded 1 seed/cell using a vacuum seeder into 288-cell plug trays filled with ASB soilless mix. Pot Popper Pearls of the corresponding treatments (low, mid, and high) were added at 1 pearl/cell on 27 September. All plug trays were watered to ensure high soil moisture to promote fungus gnat development and placed on an ebb and flow table covered with a thrips-mesh in the appropriate BugDorm enclosure. Each enclosure (excluding the untreated control with no fungus gnats) was infested with 20 adult fungus gnats on 3, 10, and 18 October, and with 25 larval fungus gnats on 31 October, allowing high population pressures to establish. Fungus gnats used for the infestations were collected from a nearby infested greenhouse on each the day of infestation. CITATION was applied at 0.13 g/L on 19, 26 November and 3 December at a rate of ~200 ml/tray using a watering can (OMAFRA Crop Protection Guide for Greenhouse Vegetables recommendations). Celery plants were grown for ~10 weeks (27 September – 10 December) on ebb and flow benches, watering occurred twice per week that included 20-20-20 fertilizer at 50 ppm). Adult fungus gnat emergence was monitored weekly from 12 November to 10 December for a 48-hour period using 4.5cm x 5.5cm one-sided yellow sticky cards that were placed in each enclosure ~3cm above the canopy. Adult fungus gnats caught on sticky cards were counted at the end of each 48-hour period and included the observation of visible flying adults in each BugDorm. Total population counts of adult fungus gnats were combined over the 5 weeks of collection. On 10 December trays were removed from the enclosures and 20 plants/tray were assessed for the following criteria: plant height, fresh weight of tops and roots. Ten plugs/tray were assessed for the number of fungus gnat larva per plug. Six plugs/tray were taken from each of the Pot Popper Pearl treatments and nematodes were extracted from the soil using the Baermann pan method and nematodes numbers counted and recorded.

Data were analyzed using an ANOVA general linear model using RStudio (RStudio Team, Boston, MA, version 3.5.2) to determine the effect of treatment on mean plant height, mean fresh weight of tops, mean fresh weight of roots, mean number of fungus gnat larva per plug, and mean number of nematodes per plug. The total population counts of adult fungus gnats were analyzed using an ANOVA general linear model log transformed with a negative binomial distribution using RStudio (RStudio Team, Boston, MA, version 3.5.2) to determine the effect of treatment on total cumulative adult fungus gnat population. Mean separation was obtained using a Tukey's HSD test with $p = 0.05$ level of significance.

RESULTS: as presented in Tables 1 & 2

DISCUSSION: Celery grown in plug trays with Pot Popper Pearls at the high rate had fewer adult fungus gnats than the untreated control but did not differ from Pot Popper Pearl at the lower rates or trays treated with CITATION (Table 1). There were no significant differences in fungus gnat larva per plug among treatments when assessed at the end of the trial, on 10 December (Table 1). Higher numbers of nematodes were extracted from the celery plugs from all three Pot Popper Pearl treatments than those applied in the Pearls. The increase in nematodes suggests that nematode populations were able to establish in the celery plugs. The number of nematodes was significantly higher in the mid and high rates compared to the low rate (Table 1). Celery plants that received the low rate of Pot Poppers were taller and had higher root and shoot weights than both controls (fungus gnats and no fungus gnats) and plants were taller than the plants treated with the CITATION (Table 2). Plants that received the high rate of Pot Poppers were also taller than the those that were treated with CITATION. Fresh weight of the shoots was also higher in plants receiving the middle rate of nematodes. Root fresh weight was significantly higher in all treatments when compared to the control with fungus gnats (Table 2). These results demonstrate that fungus gnat larva can significantly reduce the mass of plant roots from feeding. The differences in plant height and fresh top weight (Table 2) could be the result of differences in fungus gnat populations but might also be related to where the trays were placed on the benches in the greenhouse. A repetition of this study would be beneficial to show the consistency of the results.

Table 1. Total cumulative adult fungus gnats per treatment in celery transplants treated with Pot Poppers Pearls, 2019

Treatments	Cumulative adult fungus gnats per 48 hr.		Fungus gnat larva per plug 10 Dec		Nematodes per plug 10 Dec	
	Mean	SE	Mean	SE	Mean	SE
Control (no fungus gnats)	0 a ¹		0 ns ²		NA	
Control (fungus gnats)	143 c	±44.9	6	±5.5	NA	
Pot Popper Pearls – Low	79 bc	±9.9	7	±3.0	65 a	±22.0
Pot Popper Pearls – Mid	103 bc	±33.7	13	±5.8	285 b	±65.8
Pot Popper Pearls – High	46 b	±19.6	9	±4.4	296 b	±82.9
CITATION	67 bc	±15.6	0	±0.0	NA	

Cumulative number of adults in a 48-hour period, averaged from 12 November until 10 December, 2019, and fungus gnat larva per plug and nematodes per plug assessed on December 10, 2019.

¹ Different letters within columns denote significantly different groups according to Tukey's HSD ($\alpha=0.05$).

² ns indicates all numbers in the column are not significantly different at $\alpha = 0.05$ according to Tukey's HSD test.

Table 2. Mean (±SE) plant height, fresh weight of tops and roots of celery transplants treated with Pot Popper Pearls for the control of fungus gnats grown University of Guelph, 2019.

Treatments	Plant height/plug (cm)		Top fresh weight/plug (g)		Root fresh weight/plug (g)	
	Mean ¹	SE	Mean ¹	SE	Mean ¹	SE
Control (no fungus gnats)	13 d	±0.9	0.7 c	±0.06	0.29 b	±0.03
Control (fungus gnats)	16 bcd	±0.4	0.9 c	±0.05	0.14 c	±0.02
Pot Popper Pearls – Low	21 a	±1.0	1.7 a	±0.14	0.44 a	±0.05
Pot Popper Pearls – Mid	18 abc	±1.6	1.5 ab	±0.22	0.30 b	±0.02
Pot Popper Pearls – High	19 ab	±0.7	1.1 bcd	±0.10	0.41 ab	±0.04
CITATION	15 cd	±0.5	1.0 bc	±0.08	0.35 ab	±0.04

¹ Different letters within columns denote significantly different groups according to Tukey's HSD ($\alpha=0.05$).

Funding for this project was provided by ENVIRONMENTAL FACTOR, INC.