ADVANCES ON THE MANAGEMENT OF THE SPOTTED WING DROSOPHILA (*Drosophila suzukii*) WITH ENTOMOPATHOGENIC NEMATODES (EPNs)

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INTRODUCTION

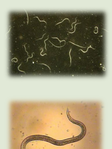
Until 2010, Michigan's blueberry IPM program was a sustainable system that targeted the main blueberry pest complex (Cranberry and Cherry Fruitworms, Blueberry Maggot and Japanese Beetle). After the arrival of Spotted Wing Drosophila (SWD), insecticide applications increased to more than 10 per season, and pest management expenses went from $75/acre to $456/acre in 2014 (MSU-AABI 2016). In response, the MSUE Blueberry IPM Program started on-farm trials to assess the performance of entomopathogenic nematodes (EPNs) and soil dweller (SD) predatory insects in commercial fields

OBJECTIVES

1) To incorporate EPNs and SD into current IPM programs for the control of SWD.
2) To reduce insecticide applications and associated expenses by at least 50%.
3) To reduce fruit losses and help small blueberry farms and industry to produce sustainably and cost effectively

BIOLOGICAL CONTROL FOR SWD MANAGEMENT

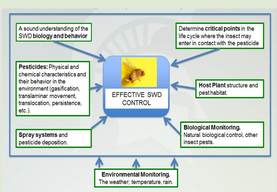
Biological control agents (BCAs) are a great alternative to chemical insecticides, but the economic threshold for pest damage in blueberries is "zero" and this becomes a limiting factor to the use of BCAs alone. However, the incorporation of BCAs under a ***Systems Approach***, could increase pest mortality and help reduce the negative risks of relying on chemical control alone, which results in high costs for the environment and farmers, workers and Consumers exposure, And development of pest resistance.



EPN – Nemasys *(Steinernema feltiae)*

Atheta-System (Dalotia coriaria)

Hypoaspis-System (Stratiolaelaps scimitus)



A Systems Approach to manage SWD

METHODS

Crew preparing EPNs

Application of EPNs drenched to soil/plant base

Selection of BCAs:

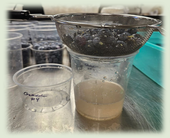
Selection of the EPN *Steinernema feltiae,* was based on efficacy results obtained from preliminary laboratory tests. Among three commercial EPN species tested (*S. feltiae, S. carpocapsae and Heterorhabditis bacteriophora), S. feltiae* caused the highest mortality of SWD larvae and pupae (78% and 65% respectively). *Dalotia coriaria* (previously known as *Atheta coriaria*) and *Stratiolaelaps scimitus* (p. known as *Hypoaspis miles*) were included as soil dwellers. These BCAs can also prey on thrips and other diptera, allowing introductions prior to the arrival of SWD.

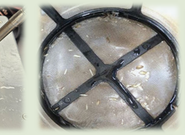
SWD Adult counts :

The arrival and population dynamics of adult SWD were monitored weekly using traps baited with a PHEROCON® SWD lure (*TRÉCÉ*).

SWD Larvae + Eggs counts

At harvest, six 1-pound fruit samples were taken at random from each treatment. Each sample was submerged in a saline solution for 30 minutes, the water was sieved using a coffee filter and all larvae + eggs were collected and counted.





Rates and application of BCAs:

Biological Control Agents	Type	2023 Rate	# App	2024 Rate	# App
Steinernema feltiae (Nemasys)	EPN	1 billion/ac	3	500 million /ac	2
Dalotia coriaria (Atheta- System)	SD	0.1/sqft	1	0.05/sqft	1
Stratiolaelaps scimitus (Hypoaspis-System)	SD	10/sqft	1	5/sqft	1

Farms selected in 2023-2024

BAUTISTA FARMS (Commercial, Conventional Grower)
Variety Keepsake
T1: Chemical control : 1 application Lannate + 4 applications Mustang Maxx
T2: EPNs ; T3: EPNs + SD; T4: SD

NYE FARMS (Organic, Pesticide free Grower)
Variety Jersey
T1 Control: Untreated, T2: EPNs; T3: EPNs + SD

ACKNOWLEDGEMENTS

- Plant Products/Biobest Group for the field collaboration and donation of BCAs.
- The Michigan Blueberry Commission for the support to this IPM program.
- Pedro Bautista and David and Sandy Nye for allowing us to use their blueberry farms.
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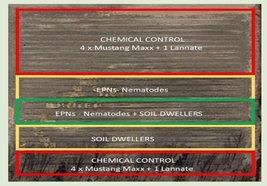
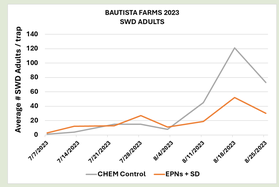
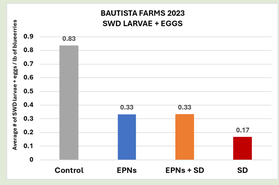
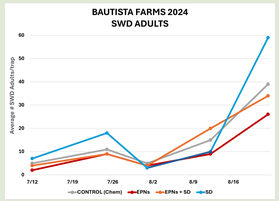
RESULTS

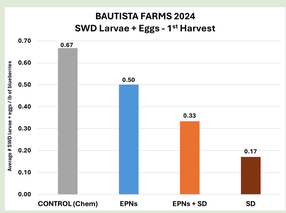
Conventional Farm, var. Keepsake



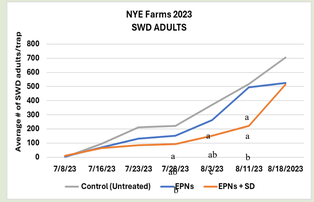




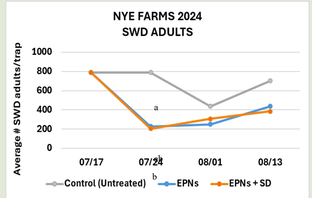




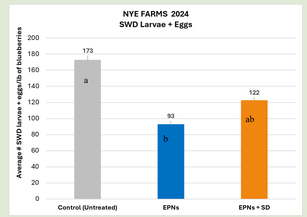
Organic Farm, var. Jersey



Transformation (Log10 (X+1)). ANOVA 7/28 p-value 0.01302. Tukey HSD Control vs. EPNs+SD: 0.01087; 8/03 p-value 0.001012. Tukey HSD Control vs. EPNs p-value:0.0008403, EPNs vs EPNs + SD p-value: 0.01038; 8/11 p-value 0.0345 Tukey HSD Control vs.EPNs+ SD: 0.0503.



Transformation (Log10). ANOVA *p-value* 0.04384. 07/24 Tukey HSD Control vs. EPNs + SD p-value: 0.05082



Reciprocal transformation (1/X). ANOVA p-value 0.04802. Tukey HSD Test. Control vs. EPNs. *p-value* 0.04118

CONCLUSIONS

- *Application of EPNs (Steinernema feltiae)*, alone or in combination with SD (the soil dwellers *Dalotia coriaria* + *Stratiolaelaps scimitus)* effectively reduced SWD adult population and fruit larval infestations.

At NYE Farms (organic) SWD adult populations got reduced between 40-60%.
At BAUTISTA Farms (conventional) the reduction was 41.5%.

Larval infestations at harvest were reduced by 30-50%, at NYE Farms, whereas at BAUTISTA Farms the decrease was between 50-80%.

- In 2023 (High Rate) the addition of beneficials (EPNs and SD) reduced the end population of SWD adults. This could be a useful tool to reduce the source of infestation for the following season.
- All BCAs used are native and could have the potential to overwinter and continue reproducing in successive seasons.

- This systems approach, reduced insecticide applications by at least 50% while improving control, and could therefore be an economically viable and sustainable alternative for Michigan's blueberry growers.