

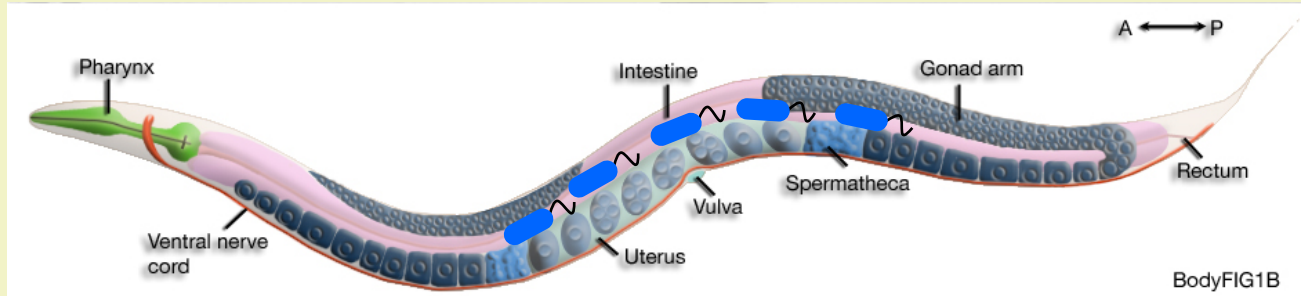
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# Managing Insect Pests on School Grounds using Entomopathogenic Nematodes

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**Cornell University**  
**NYSAES, Geneva, NY**

# Entomopathogenic Nematodes

- Currently the most efficacious biocontrol option available for turf
- Microscopic soil invertebrates (~0.1 – 2mm)
- Existing populations can be extensive in soil  
over 80% of all animal life on earth
- Endosymbiotic bacteria critical to biocontrol potential

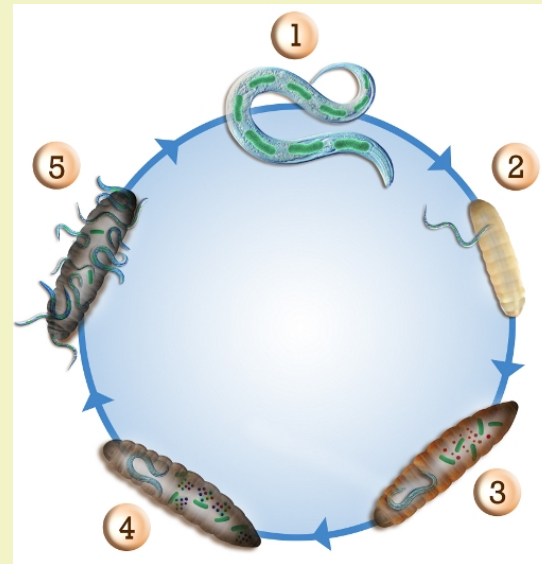


# Entomopathogenic Nematodes

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## Lifecycle and mode of action

[https://www.youtube.com/watch?v=wZ1LDXkyp6Y&list=PLB9tSz89\\_6\\_qBS8RRF0h5YzhyC31KJHoc](https://www.youtube.com/watch?v=wZ1LDXkyp6Y&list=PLB9tSz89_6_qBS8RRF0h5YzhyC31KJHoc)



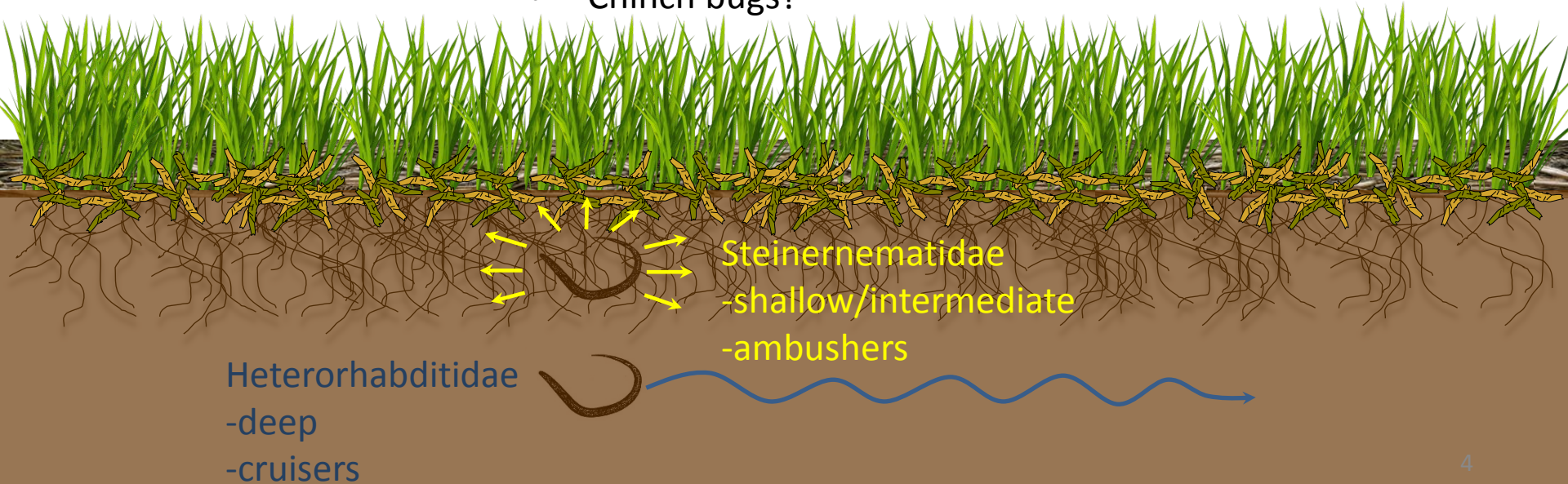
# Entomopathogenic Nematodes

## Common Biocontrol Species

- *Heterorhabditis bacteriophora*
  - White grubs
  - Crane flies
- *Steinernema feltiae*
  - White grubs
- *Steinernema carpocapsae*
  - Billbugs
  - Crane flies

## Different activity patterns

- Select species based on activity of target pest
  - *Steinernema carpocapsae*
    - Billbugs
    - Cutworms
    - Chinch bugs?



# Entomopathogenic Nematode Application

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- Can be applied using most equipment
- Watering can – hand and vehicle mount spray rigs
- Drip – fan nozzle combo
  - low pressure (<300psi)
  - >50 mesh screens
- Cornell recommends 1 billion/ acre
- Watering-in is critical (1/4 inch post application)
- UV sensitive – apply while overcast
  - Apply while insects are young
    - White grubs - Late spring/early summer
    - Crane flies – spring or fall depending on species



# Entomopathogenic Nematodes

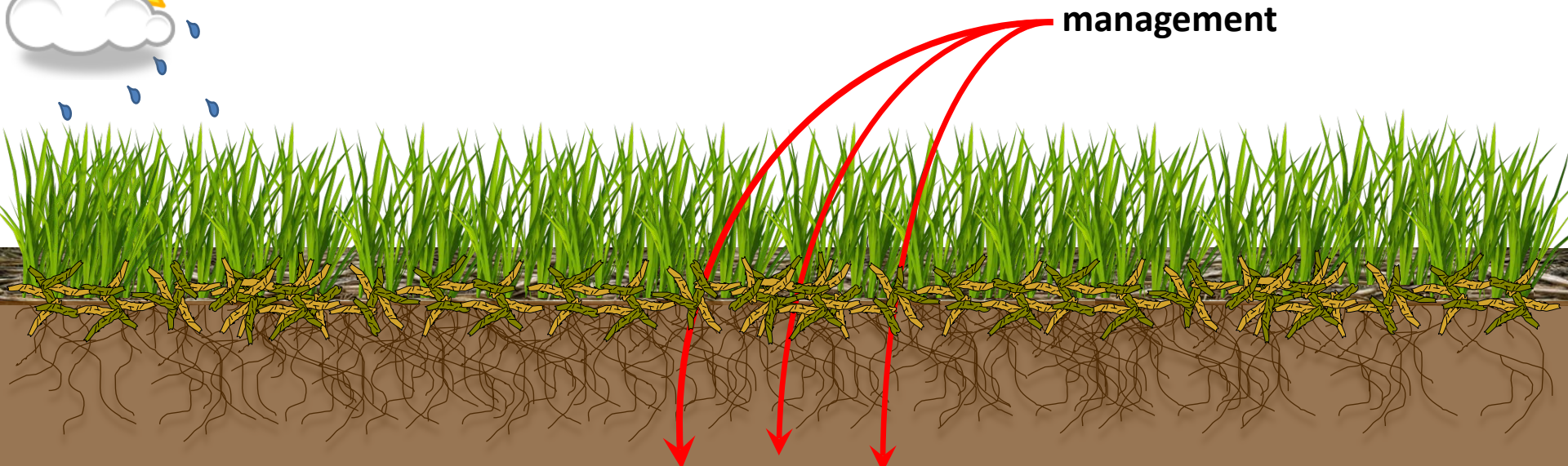
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## Products Currently Available:

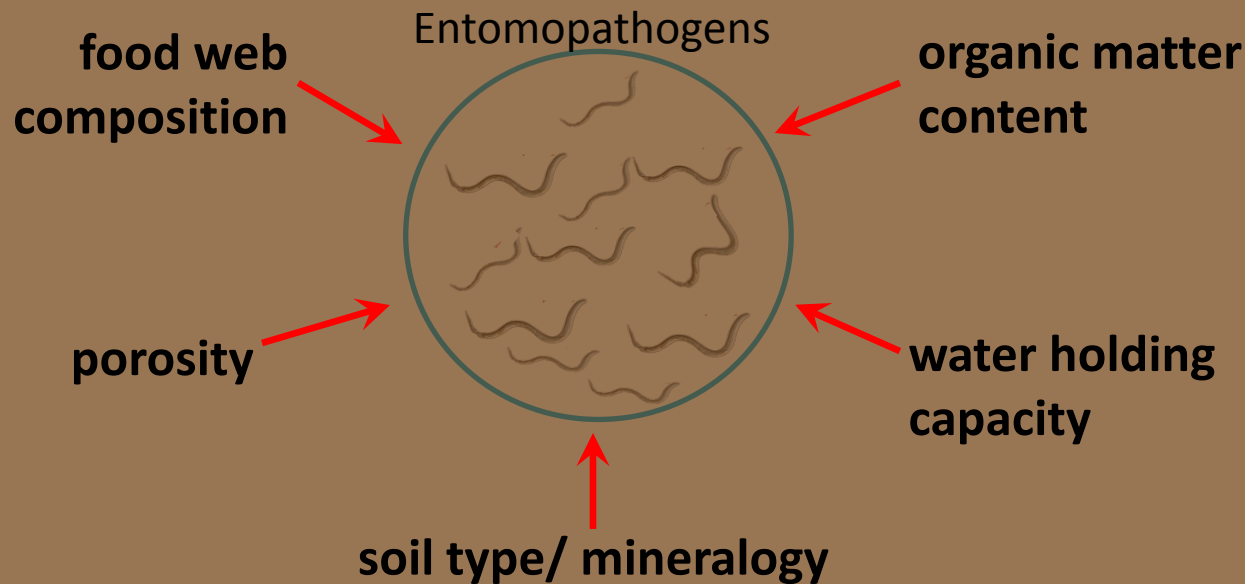
Company	website	product	~ price per billion (1 acre)
Koppert	<a href="http://www.koppert.com">www.koppert.com</a>	Capsanem/ Terranem-NAm	\$400-500
BASF	<a href="http://www.betterplants.basf.us">www.betterplants.basf.us</a>	Nemasys G	\$300
BioLogic	<a href="http://www.biologicco.com">www.biologicco.com</a>	Ecomask/ Heteromask	\$1500-1800
Arbico Organics	<a href="http://www.arbico-organics.com">www.arbico-organics.com</a>	NemAttack/ NemaSeek	\$500

- Shelf life ~1 month when left unopened
- Refrigerate immediately upon delivery
- Evaluate product to confirm presence of active nematodes!!!

# *Biotic and abiotic constraints on soil entomopathogens*



**management**



# Biocontrol of white grubs in school sports turf

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## Hobart and William Smith

- sand top-dressed regularly
- irrigated frequently

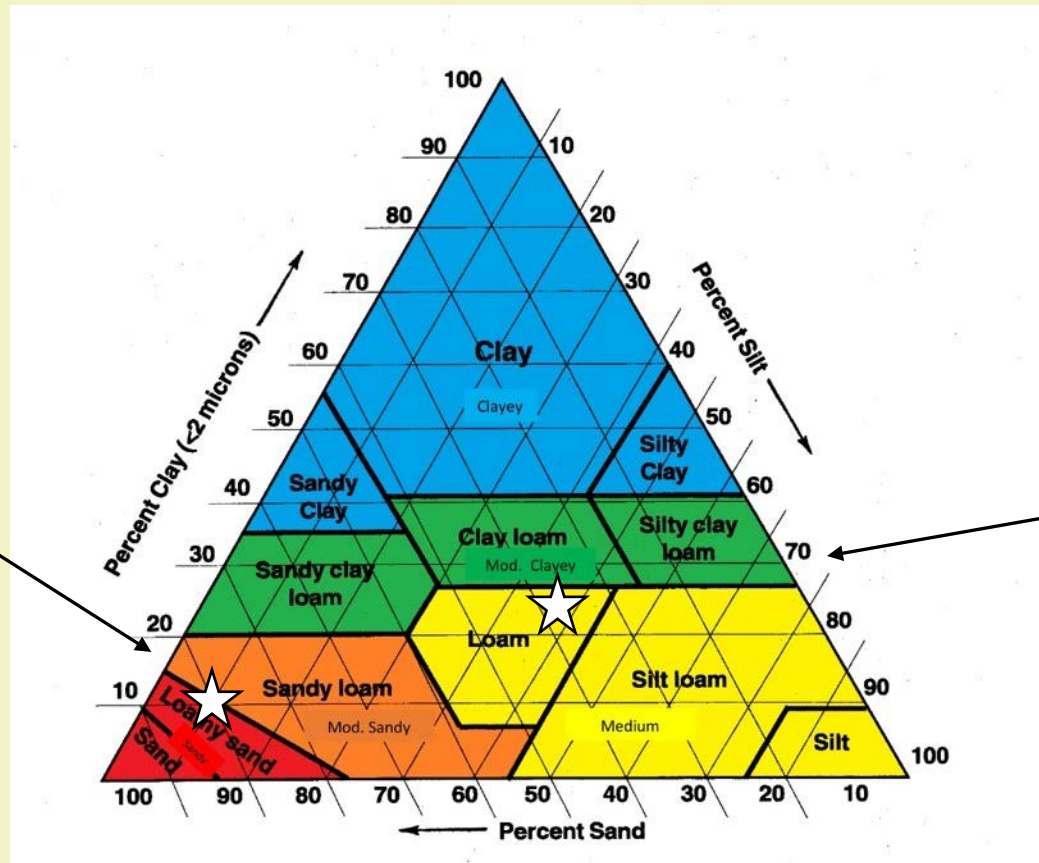
## Geneva High School

- no amendment practices
- irrigated infrequently



# soil mineralogy

HWS



Geneva

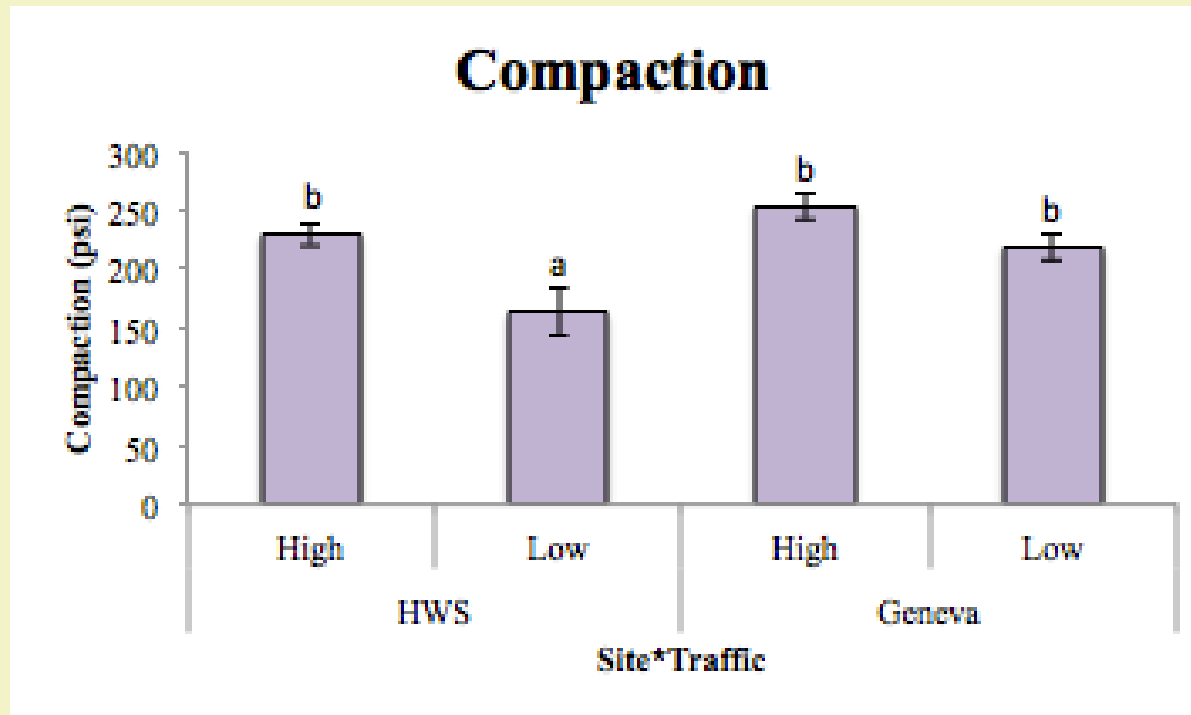
# within-site variability in soil conditions

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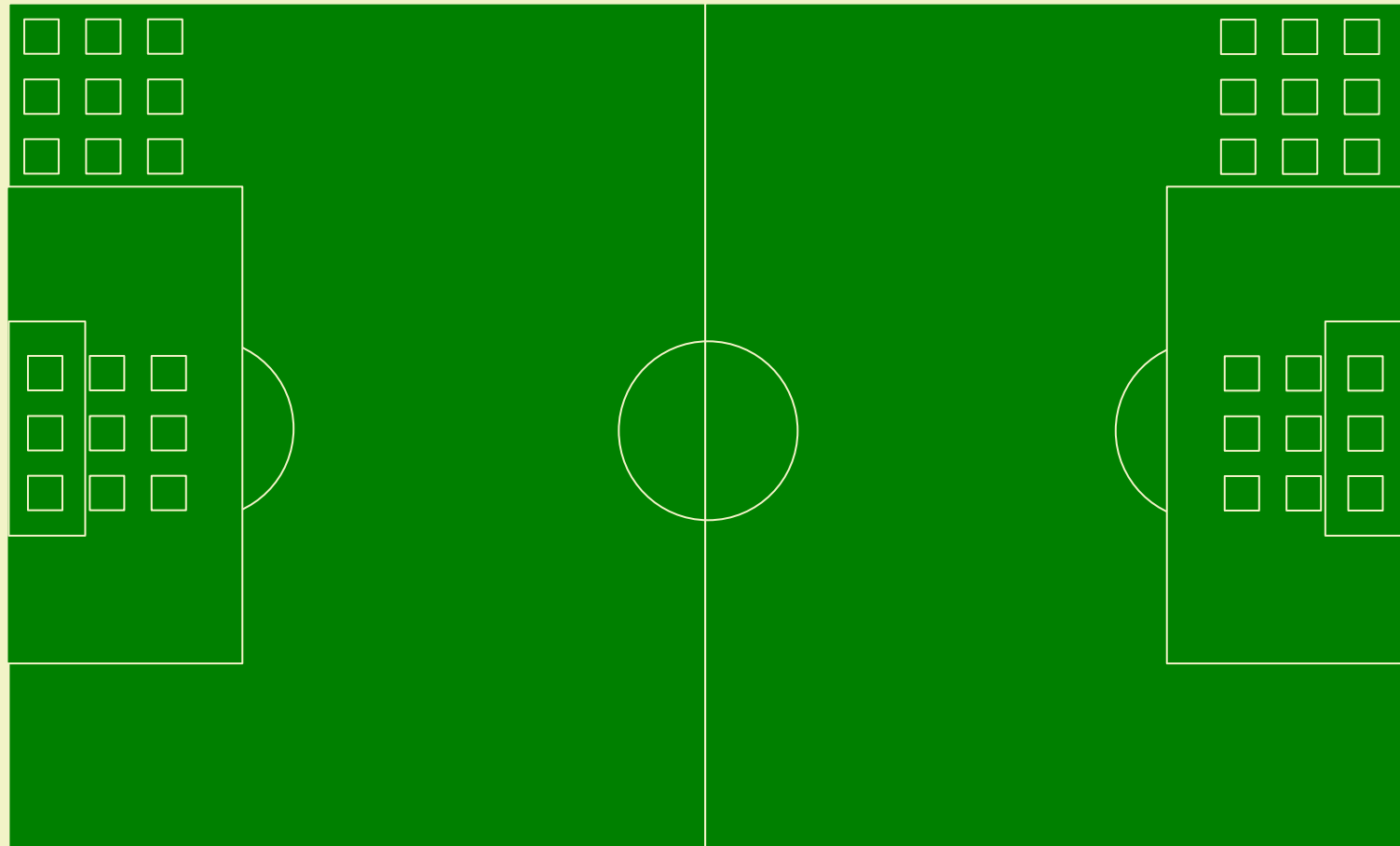
# traffic effects on soil

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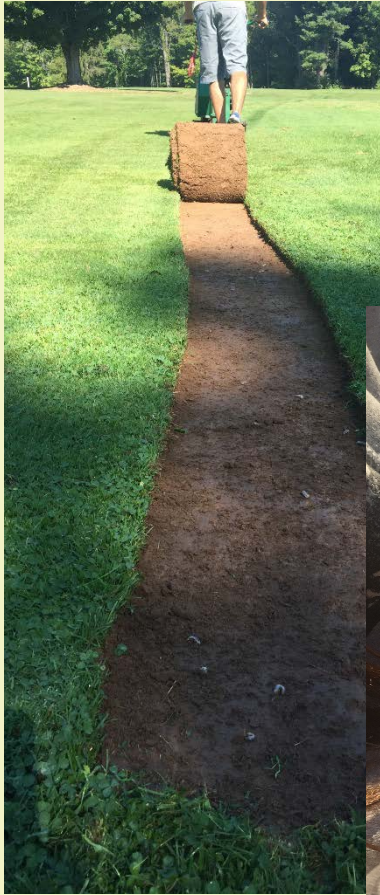
# Methods

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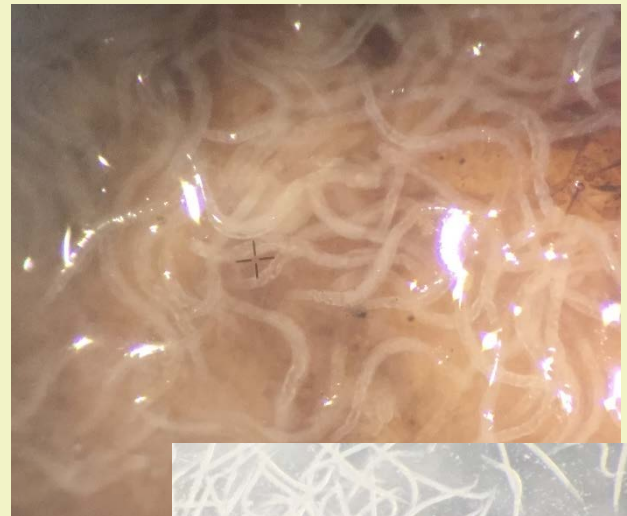
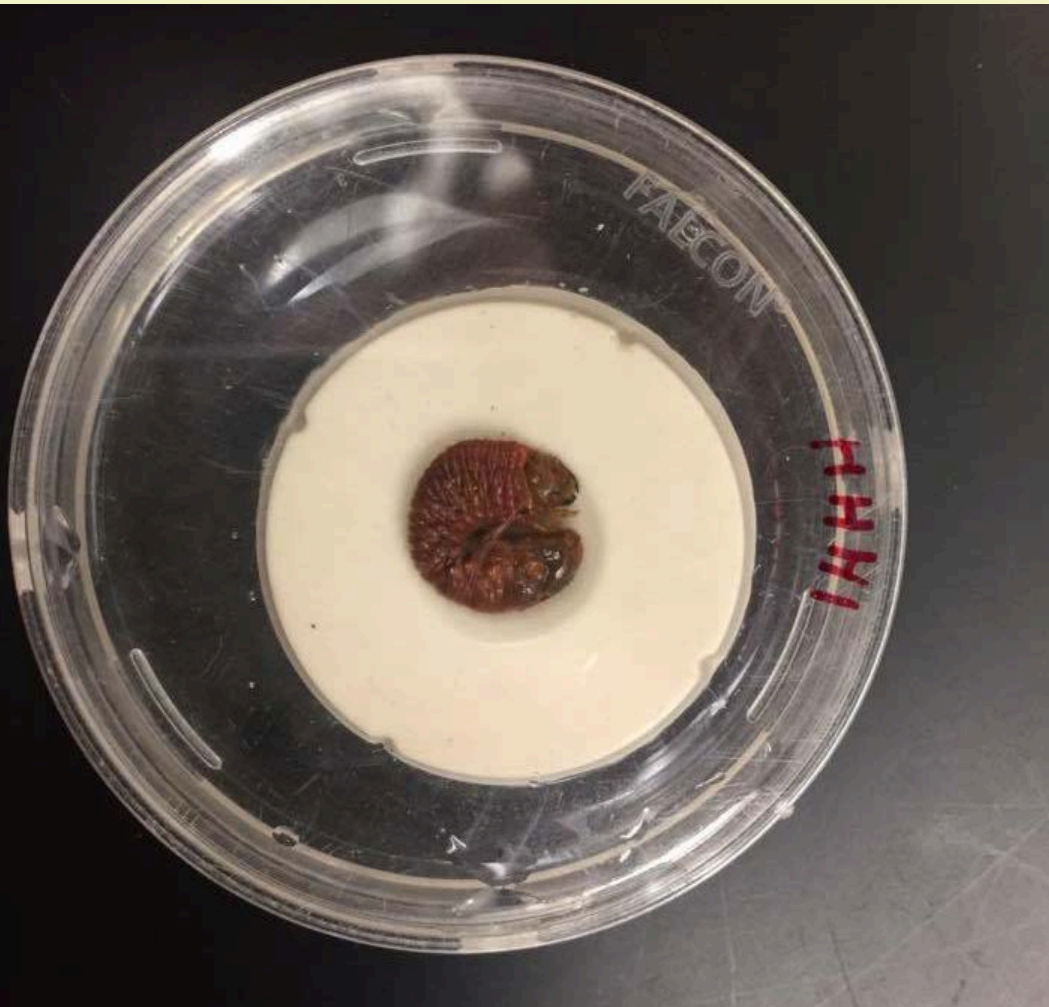
# Methods

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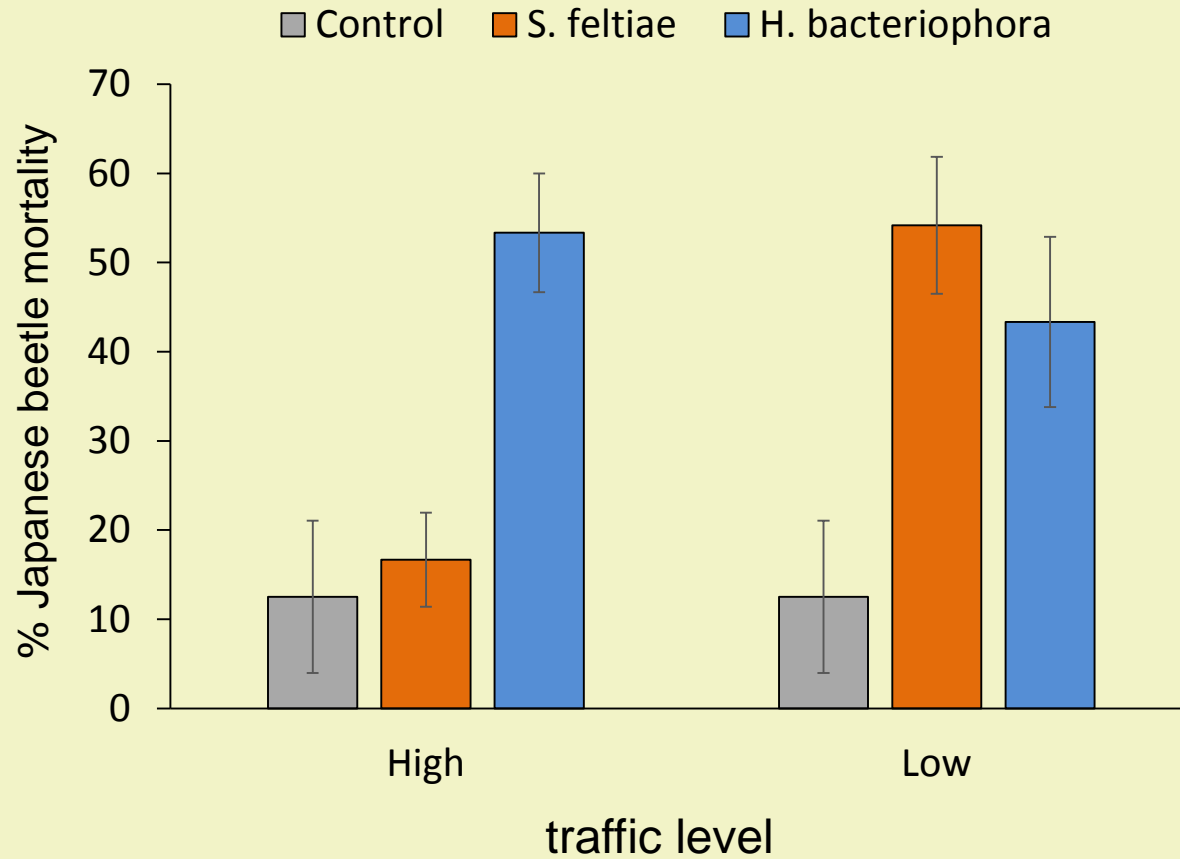
# Methods

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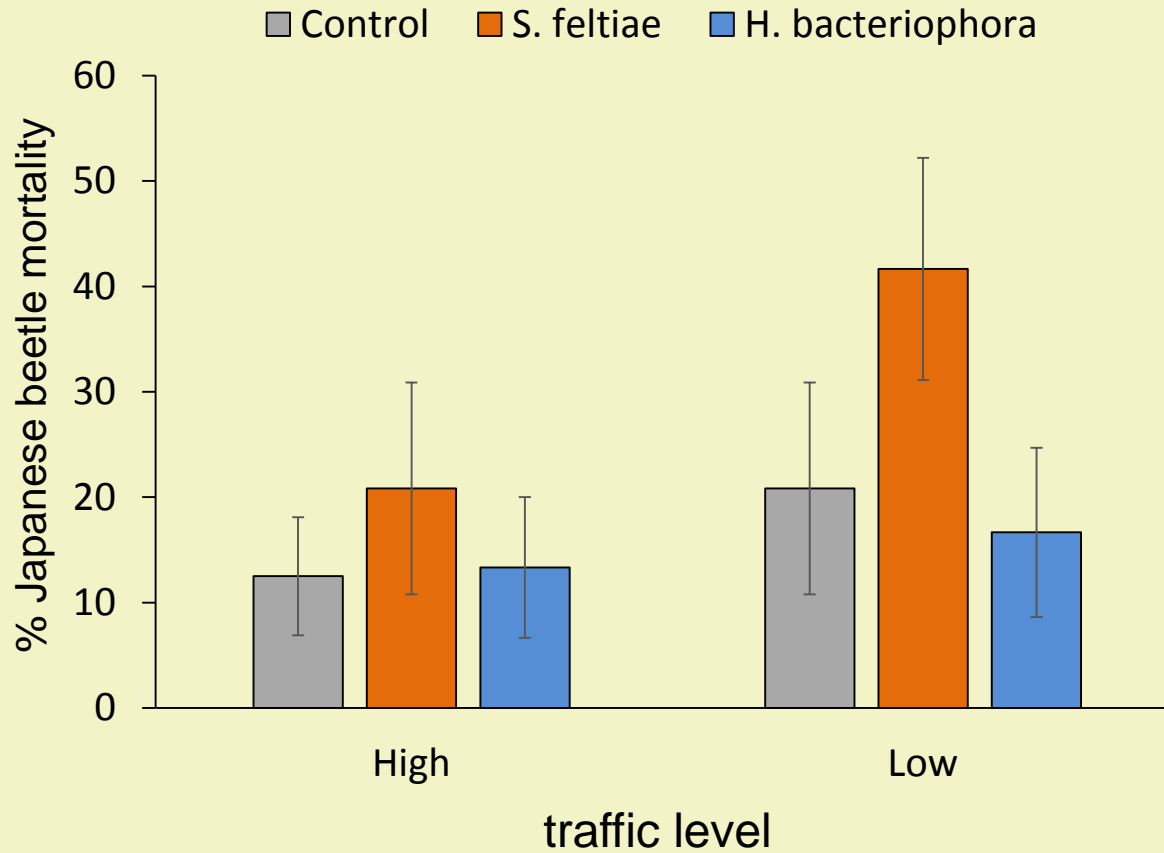
# Site 1 - Hobart and William Smith

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# Site 2 – Geneva High School

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# *Can soil conditions be optimized to improve biological control?*

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## Aerification

- Toro Procore
- 5/8" tines x 2" deep



## plug removal



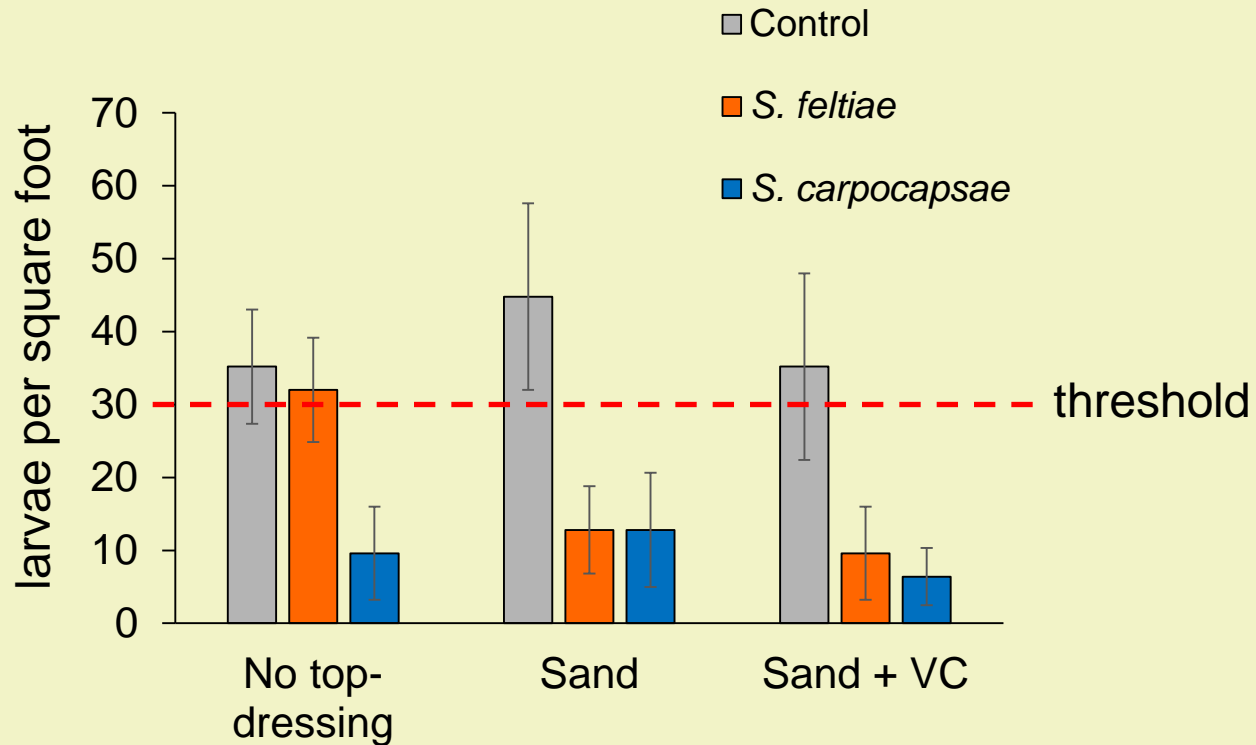
## topdressing

- Sand (1/4" Elam 60-20-20)
- Vermicompost + Sand (5#/1000ft<sup>2</sup>)



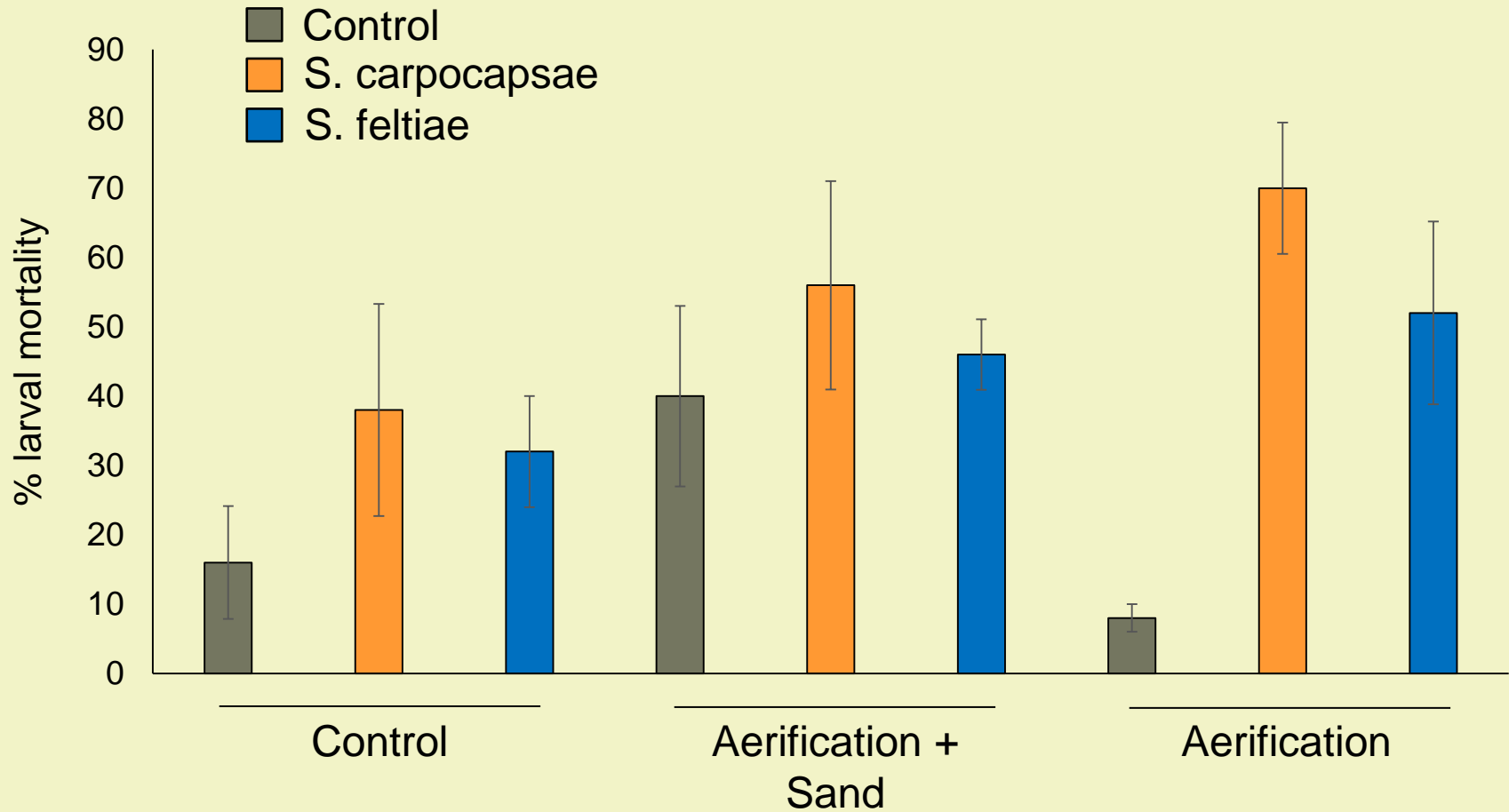
# Weevil densities 1 week post EPN treatment

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# Aerification and topdressing can enhance EPN control

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# *Can soil conditions be optimized to improve biological control?*

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# Thank you!



@Cornell\_SAEL

## Wickings lab

- Martin Ward
- Huijie Gan
- Maxwell Helmberger
- Natalie Bray
- Katie Sortino
- Abby Wentworth

## Cooperators

- Batavia Turf
- Sky High Turf Farms
- Hobart and William Smith Colleges
- Geneva High School



# Conclusions

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- EPNs show promise as a curative practice for controlling Japanese beetle on school sports fields
  - up to 50% control
- soil type, management, and traffic have major effects on EPNs
- future work:
  - evaluate control of 1<sup>st</sup> and 2<sup>nd</sup> instars
  - explore how soil physical and biological conditions impact EPNs