Managing Insect Pests on School Grounds using Entomopathogenic Nematodes

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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

Lifecycle and mode of action

https://www.youtube.com/watch?v=wZ1LDXkyp6Y&list=PLB9tSz89_6_qBS8RRF0h5YzhyC31KJHoc
Entomopathogenic Nematodes

Common Biocontrol Species
- *Hetorhabditis bacteriophora*
  - White grubs
  - Crane flies
- *Steinernema feltiae*
  - White grubs
  - Billbugs
  - Crane flies
- *Steinernema carpocapsae*
  - Billbugs
  - Cutworms
  - Chinch bugs?

Different activity patterns
- Select species based on activity of target pest
Entomopathogenic Nematode Application

- 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

Products Currently Available:

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

- 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

- food web composition
- porosity
- soil type/mineralogy
- organic matter content
- water holding capacity

Management
Biocontrol of white grubs in school sports turf

Hobart and William Smith
- sand top-dressed regularly
- irrigated frequently

Geneva High School
- no amendment practices
- irrigated infrequently
soil mineralogy
within-site variability in soil conditions
traffic effects on soil

![Graph showing compaction levels across different sites and traffic conditions. The graph indicates variations in compaction (psi) across High and Low traffic conditions at HWS and Geneva sites.](image-url)
Methods
Methods
Methods
% Japanese beetle mortality

Traffic level

Site 1 – Hobart and William Smith
Site 2 – Geneva High School

Traffic level

% Japanese beetle mortality

- Control
- S. feltiae
- H. bacteriophora

Traffic level:
- High
- Low

% Japanese beetle mortality
Can soil conditions be optimized to improve biological control?

**Aerification**
- Toro Procore
- 5/8” tines x 2” deep

**Topdressing**
- Sand (1/4” Elam 60-20-20)
- Vermicompost + Sand (5#/1000ft²)

**Plug Removal**
Weevil densities 1 week post EPN treatment

- No top-dressing
- Sand
- Sand + VC

- Control
- S. feltiae
- S. carpocapsae

Threshold
Aerification and topdressing can enhance EPN control

% larval mortality

- Control
- S. carpocapsae
- S. feltiae

Graph showing the comparison of larval mortality under different treatments with error bars.
Can soil conditions be optimized to improve biological control?
Thank you!

**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

- 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 1st and 2nd instars
  - explore how soil physical and biological conditions impact EPNs