



Cornell University  
College of Agriculture and Life Sciences  
Department of Entomology

# Rearing & Applying Biocontrol Nematodes To Control Alfalfa Snout Beetle

2016

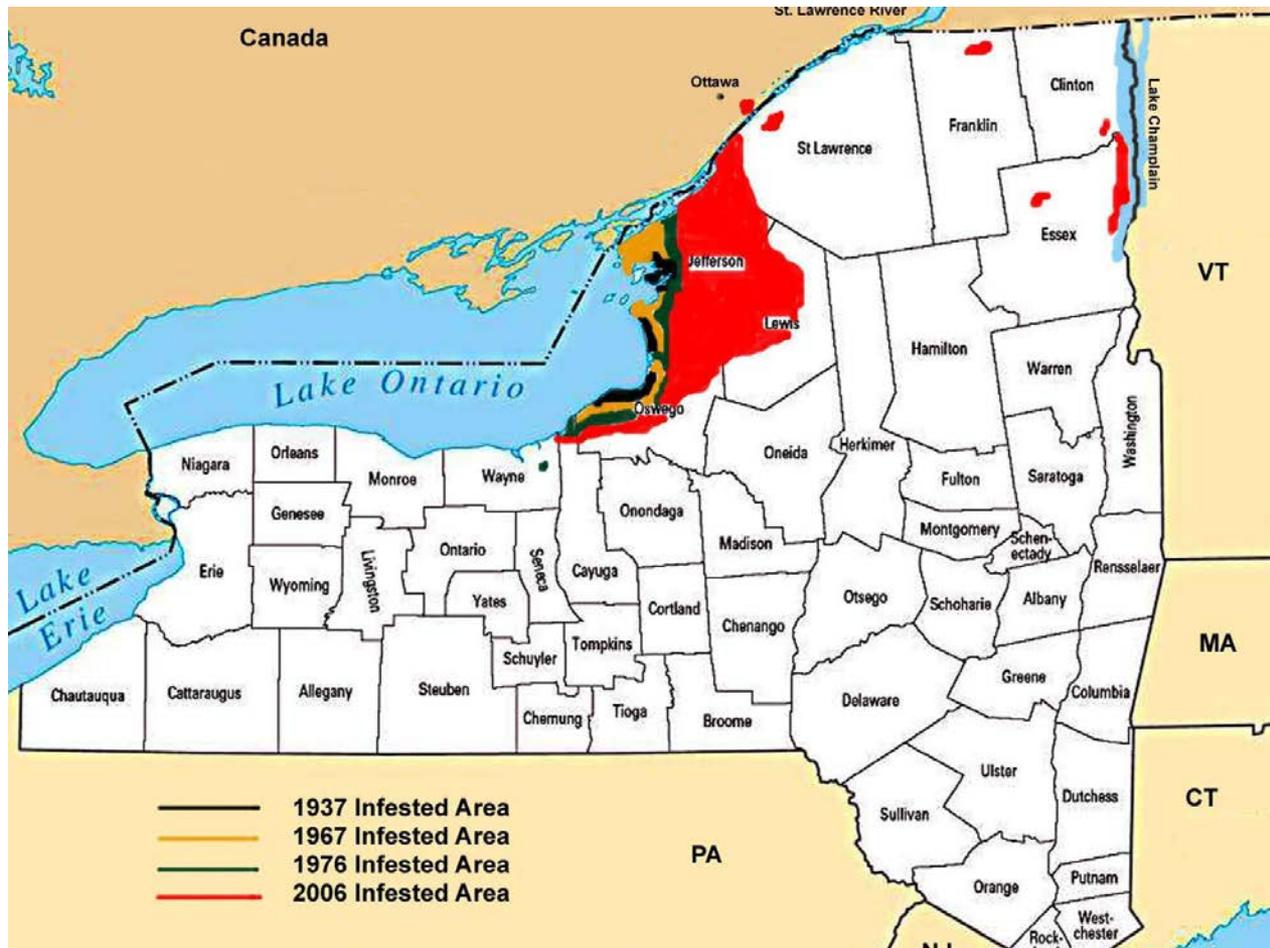
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# Alfalfa Snout Beetle (ASB)

# Background

- In NY, 500,000 acres of agricultural land is estimated to be infested.
- This severe pest is currently restricted to nine counties in NY and a small portion of Ontario, Canada.
- Once established, ASB can destroy entire alfalfa stands in one growing season.
- Adult ASB feed on red and white clovers, broad-leaved dock, wild carrot, wild strawberries, blackberries, dogwood, other legumes and weeds.
- Costs for producing milk rises between 22-25% due to rising feed costs to purchase protein supplement, added replanting costs, and lower yields.



## ASB Infested Area

This severe pest is currently restricted to nine counties in NY and a small portion of Ontario, Canada.

# Signs of Infestation

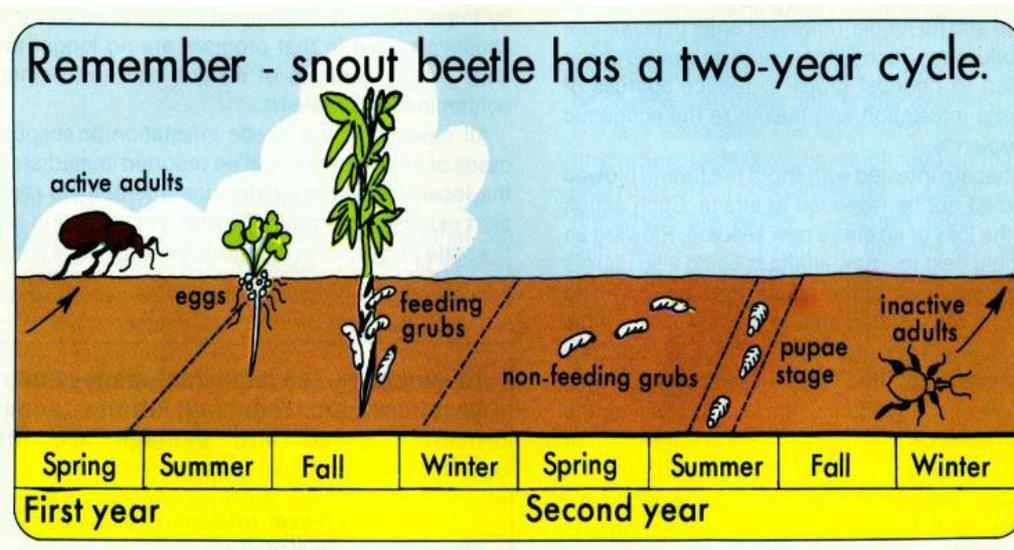
- Winter Kill
- Plant Upheaval
- Stand Loss
- Leaf Feeding



# Life Cycle of ASB

## Year 1

- May: Adults emerge and feed on alfalfa and clover foliage for three weeks to build up fat reserves for egg laying.
- May-June: Adults enter a non-feeding dispersal phase, laying eggs at the base of host plants. One adult can lay up to 500 eggs.
- June-November: Larvae feed on alfalfa plant roots, the most heavily damaged plants begin to die in August. Remaining plant death occurs in September-October. In November larvae burrow deep into the soil for a full year, they become adults the following summer.



## Year 2

- April-May: Stand loss is noticed, fields are patchy or barren. Open areas quickly fill in with weeds and grass.
- June-August: Larvae remain in hibernation, 18-24" deep in the soil, finish developing and turn into adults.

## Year 3

- April-May: ASB that began in Year 1 now emerge in alfalfa fields as adults.

# Biological Control

# Entomopathogenic Nematodes

- Cornell University, in collaboration with NY Farm Viability Institute and Northern NY Agricultural Development Program, has developed a low-cost bio-control procedure to reduce current infestation levels and to help prevent further spread of the insect.
- Biological control is accomplished by inoculating fields with entomopathogenic nematodes (EPNs).
- Biological control using EPNs is currently the only effective and readily available method of ASB management.
- Close soil contact makes ASB susceptible to attack by EPNs which are insect attacking nematodes. The nematodes staged release from host insects is called infective juveniles (IJs).

# Entomopathogenic Nematodes

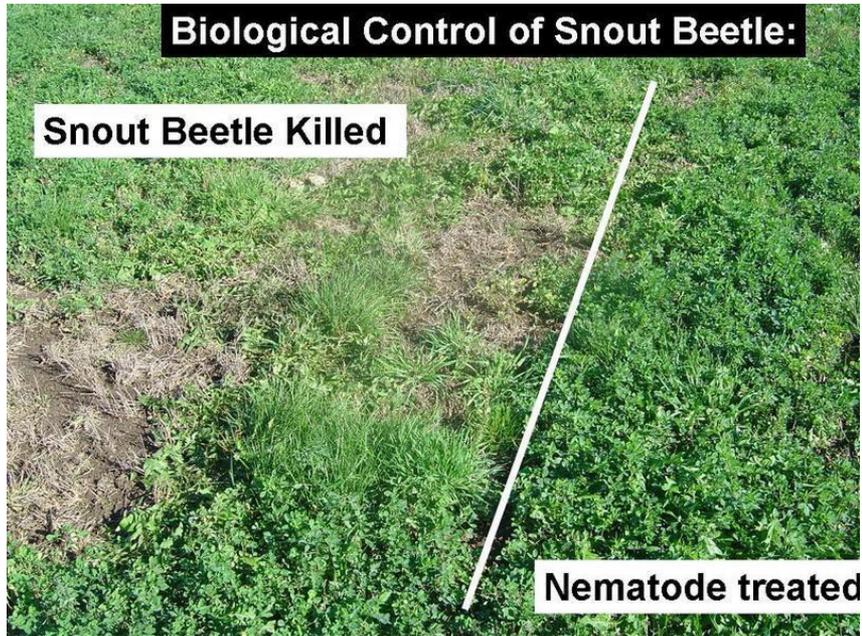
- Long-term biological control appears to be a feasible management strategy and studies indicate that EPNs can persist in soils for a number of years.
- Alfalfa snout beetles are exposed to EPNs at different stages of their life cycle and at various depths within the soil profile.
- Long-term management strategies turned to using a multi-species EPN approach. It requires 3-5 years to totally inoculate a farm with nematodes and reduce ASB populations to a manageable level.
- Results showed significant impact of using the multi-species approach in areas of heavy ASB infestations.
- It is also important to rotate alfalfa, corn, and soybeans, if possible to control or prevent infestations.

# On-Farm Rearing

# Recommendations

- Producers who have alfalfa fields in their seeding year, or 1<sup>st</sup> production year for the best economic impact.
- Producers with established alfalfa fields, the nematodes will establish and attack ASB but, will not assist with stand retention of the alfalfa stand.
- Individuals interested in rearing bio-control nematodes as a business
- Kids may enjoy being involved
  - FFA and 4-H members can help

# Benefits



- Protect your crop with a safe, environmentally friendly biological control that is native to the area.
- The nematodes will recycle in the field for years given sufficient hosts; research has shown corn & soybeans provide sufficient hosts to maintain EPN populations.

# Rearing the Nematodes

# Timeline

<b>Timeline to Successfully Rear and Apply Your Own Nematodes</b>	
<b>Before you begin:</b> 1) <b>Determine number of acres</b> to treat with nematodes and harvest date 2) <b>Establish a location</b> to store rearing cups that is dark and can remain between 70° and 75° F for several weeks 3) <b>Communicate with Shields Lab</b> at Cornell University for starter cups (607.591.1493)	
<b>17-21 days before harvest</b>	4) <b>Order starter cups</b> from Shields Lab 5) <b>Order wax worm cups</b> from a bait supplier
<b>1-3 days before harvest</b>	Starter cups and wax worm cups for field use will arrive
<b>24-48 hours after harvest</b>	Inoculate field cups using nematodes from starter cups. Store between 70° and 75°F
<b>3 days after inoculation</b>	Should see 90-100% death of wax worms in field cups
<b>12-14 days after inoculation</b>	Should see emergence of infective juvenile nematodes from field cups
<b>3-7 days after emergence</b>	Wax worms can be washed to collect nematodes for field release in alfalfa

# Supplies Needed To Rear Nematodes

- **Wax worms** (wax moth larvae) – Starter cups and field cups contain about 250 wax worms each.
- **Fine mesh screen** to rinse cups through.
- **Dishpan** to collect nematodes
- **Non-chlorinated water**
- **Coffee Scoop** – Apx. 1oz. in size

# Getting Started

- Cornell will provide starter cups to generate EPNs.
- Order the starter cups & wax worm cups 17-21 days before the planned harvest.
  - It is best to order wax worm cups in large orders so producers may collaborate to order together.
- Keep wax worm cups from bait supplier at 40-50° F until the nematodes are applied. Starter cups from Shields' Lab should remain at 70° to 75°F until nematode begin emerging from larvae cadavers, nematodes will appear as a yellow-film on edges of the cups and lid.



**Nematodes Emerging**

# On the day the field is cut...

- To infect the wax worm cups, empty the contents from your designated starter cup (labeled Sc or Sf) into your mesh screen and gently flush using the non-chlorinated water all nematodes from the sawdust into dishpan until you have accumulated apx. 1 gal of water.
- Inoculate cups by removing lids on wax worm cups and stirring the nematode water solution gently to prevent nematode settling, then dip coffee scoop into nematode water solution.
- Pour contents of one coffee scoop (apx. 1 oz-15,000 nematodes) over the live worm cups trying to moisten the entire surface of each cup.
- Cover the tubs and label with the species and date of inoculation
- Clean mesh screen, dish pan, and coffee scoop with alcohol or Clorox and rinse thoroughly to avoid cross contamination.

# Storage

- Dark space
- 70°-75°F
  - Do not let get them get too hot because they will die
- A basement is usually good
- Do not store in boxes---they hold in heat
- They begin to smell, so do not put them in a highly used area

# 3 -7 days later...

- Check for 90-100% infection.
- It should look like this:



← Sf



Sc →

- If this has not happened, the inoculation was not successful. You can wait for more nematodes to emerge and retry 2-4 days after the first wash.
- After 7-days, add small amounts of moisture with spray bottle, continue checking moisture in cups until yellow-fil develops.

# At 12-14 days...

- There should be evidence of infective juveniles on the lids and sides of the tub.
- They will often form clumps, like on the left side of this tub.
- If these are visible, the tub can be used for field application.
- Nematodes emerging from the field cups should be used within 3-days for bio-control application.



# Field application

# Materials

- **Large container** to collect nematodes from the field cups for field application (e.g., 20 gallon garbage can OR 5 gallon bucket).
- **Mesh Screens(20 to 40 mesh)** to prevent wax worms and sawdust from falling into the nematode solution. Wash cans are available for use from the Shields Lab.
- **Spray rig** – You can build your own or contact a local extension agent to inquire if one is available. If using one that has been used for any other pesticides, etc., be sure to rinse thoroughly before using for nematode application.
- **Remove all screens and filters from spray rig before use.**



# Application Timing

- Bio-control nematodes are applied to the soil surface and require some shading from sunlight until they enter the soil
- Applications made to an alfalfa field 2-3 weeks after harvest allows about 6" of regrowth which shades the soil surface
- Applications should be made late in the day (after 6pm) or during cloudy and/or rainy days to minimize nematode death from intense UV sunlight

# Nematode Preparation For Application

- 1) Bio-control nematodes must be removed from the sawdust/wood chips found within the wax worm cups
- 2) Attach modified trash can lids with mesh screen and flashing to 20-gallon trash can (coarse and fine mesh lids are included in set)
- 3) Dump contents of multiple wax worm cups onto the coarse wire screen and wash nematodes through into can with a large volume of non-chlorinated water



4) The collected nematode solution needs to be poured through a second filter screen (fine) to remove finer debris which will clog nozzles



5) After the second screening, the solution containing nematodes is ready to be dumped into the spray tank for application



# Sprayer Requirements

- Any commercial pesticide sprayer can be modified to apply nematodes
- All screens and filters have to be removed to allow nematode to pass through them
- Sprayers need to be cleaned in similar manner as required when changing pesticides for applications
- Non-chlorinated water must be used to fill the sprayer
- Standard pressure (40-60 psi) are best for nematode survival
- Sprayers need to apply a minimum of 50 gallons per acre (total from nozzles)
- Only a portion of the nozzles are used during an application so the actual application rate of water is less
- Ask the Shields Lab for the “Spray Guide for Application of Biocontrol Nematodes for Control of ASB” or find the link on the website

# Sprayer Options

- Make sure there are no screens or filters.
- Wash sprayer with ammonium and water to clean out any chemical residues.



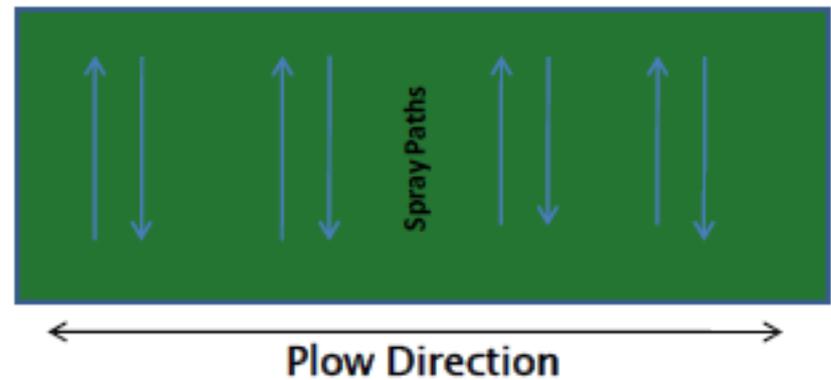
3-point hitch sprayer used by Mike Kiechle, Jefferson County



Gary Sullivan, Lewis County, sprays with a gravity feed sprayer made from PVC pipe.

# Application of Nematodes

- Nematodes move throughout the soil and to adjacent areas on their own
- Plowing and other farm activities that move the soil around also spread nematodes throughout the farm
- Applying nematodes in strips perpendicular to or against the grain of the plow direction allows spread to non-inoculated areas by plowing of soil
- Application of nematodes requires driving the entire field but does not require that nematodes be applied out of every nozzle
- By blocking 2 of every 3 nozzles, nematodes are applied out of the 3<sup>rd</sup> nozzle only treating 1/3 of the field at 1/3 of the nematode rate
- Within a year, the nematodes increase in population by attacking and reproducing in soil insects and moving into open areas in between application strips



## Contact Information

Bait Suppliers	Cornell Cooperative Extension Agents	Cornell Shields Lab
<b>Best Bet Inc.</b> <a href="mailto:bestbetinc@aol.com">bestbetinc@aol.com</a> 1-218-659-4202	Jefferson/Lewis Counties Michael Hunter <a href="mailto:Meh27@cornell.edu">Meh27@cornell.edu</a> 1-315-778-8602	Tony Testa Cornell Entomology Department <a href="mailto:At28@cornell.edu">At28@cornell.edu</a> 1-607-591-1493
<b>Speedy Worm</b> <a href="http://speedyworm.com">http://speedyworm.com</a> <a href="mailto:sales@speedyworm.com">sales@speedyworm.com</a> 1-320-762-8247	St. Lawrence/Franklin/Clinton/Essex Counties Kitty O'Neil <a href="mailto:Kao32@cornell.edu">Kao32@cornell.edu</a> 1-315-854-1218	Elson Shields Cornell Entomology Department <a href="mailto:Es28@cornell.edu">Es28@cornell.edu</a> 1-607-279-1849
<b>Grubco</b> <a href="http://grubco.com">http://grubco.com</a> 1-800-222-3563		