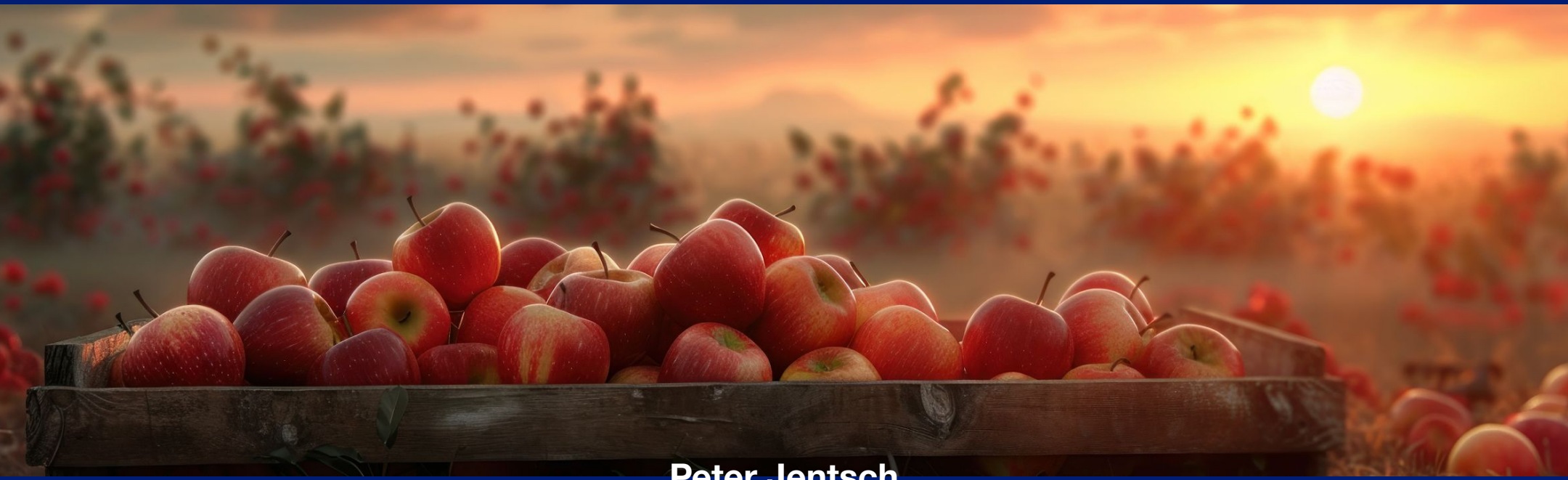
Shifting Priorities and Challenges of Pome Fruit Pest Management



Peter Jentsch

2024 New England Vegetable and Fruit Conference and Trade Show
December 17th , 2023

11:30am - 10:00am

When Rouge Waves Hit Sailing

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When Rouge Waves Hit Pome Fruit

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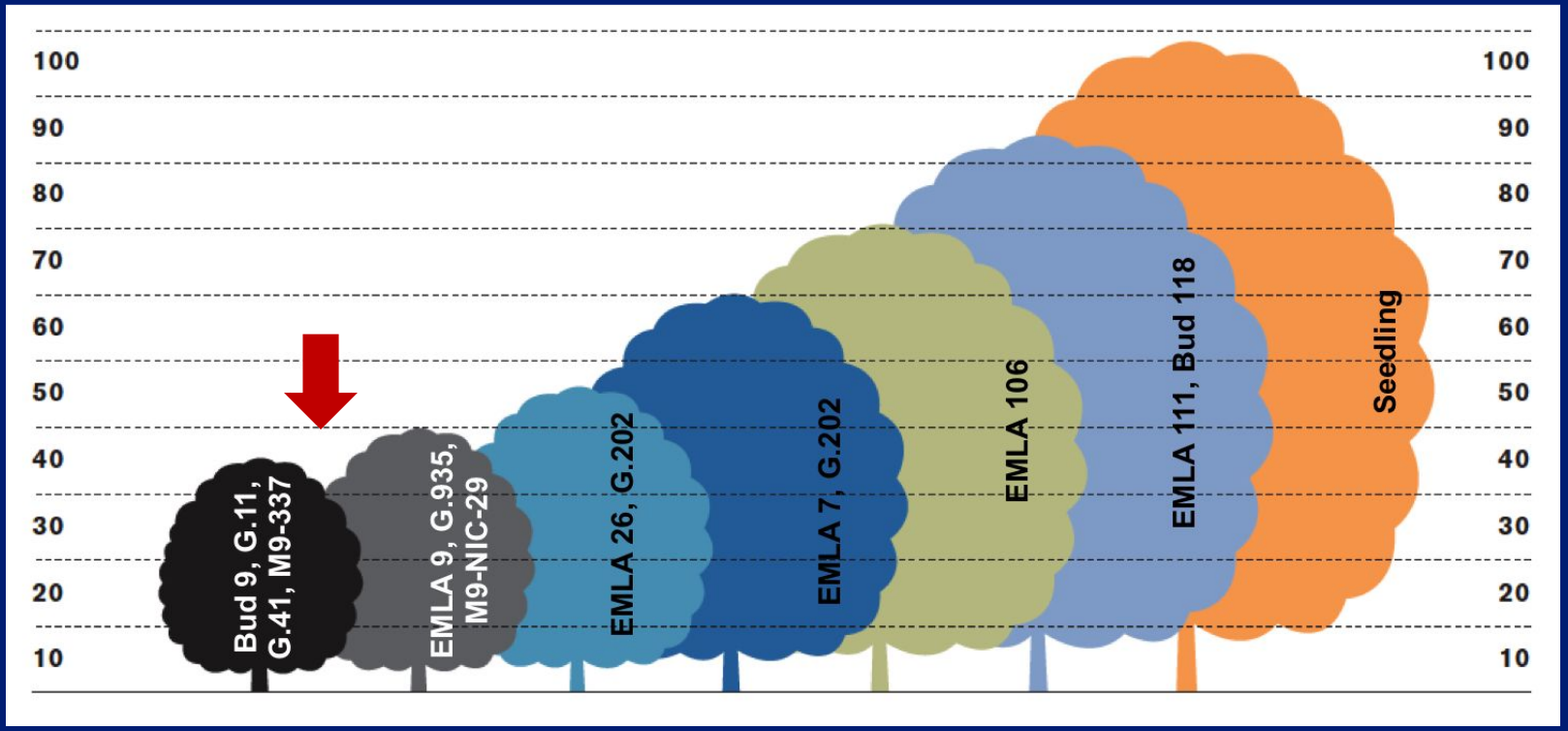
Tall Spindle System : Tree Architecture

- Utilizes A Weak Highly Dwarfing Rootstock
- Requiring Adequate Support Systems For High Density
- Produce High Volume, Large Fruit With Excellent Color



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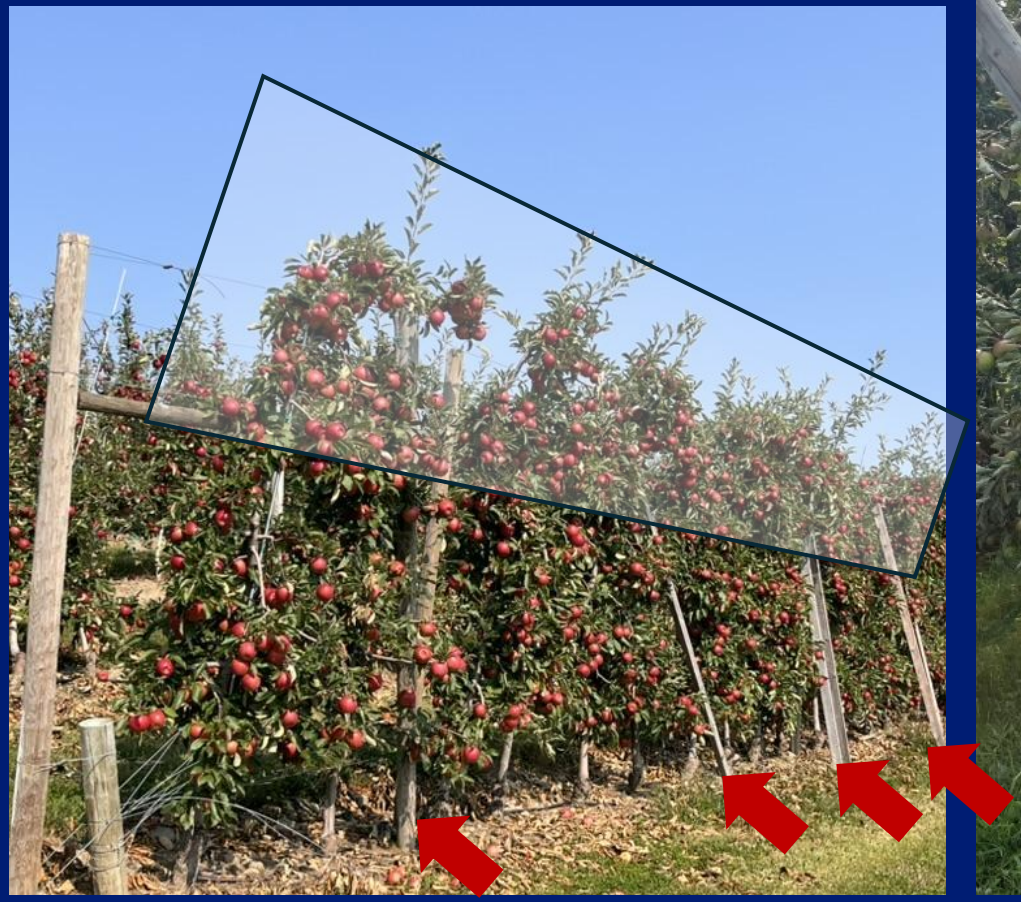
When Rouge Waves Hit Pome Fruit



H-Brace System

- Heavy Crop Load Exceeding Design
- Overcropped upper canopy
- Requiring additional support

H-Brace System

- Strong Wind Causing Extreme Leverage
- Insufficient pressure treated in-rows support posts
- Insufficient post sizing for crop and wind

Apple Orchard Support Systems

- Trellis Systems Design: Inadequate For Canopy Crop Load (Upper Canopy)
- Weak Anchorage: Post Diameter Insufficient
- In-row Post: Diameter Too Far Apart
- Undersized & Poor Pressure Treated Posts: Frequently Snap At Base.
- Improperly Tensioned Wires
- Heavy Rainfall: Soft Ground & Heavy Wind
- Sandy Or Wet Soils Higher Failure Rates Than Clay Or Dry

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Sudden Apple Decline

Tree nutritional levels must be kept at optimum for reducing the risk of cold injury to fruit trees. Carbohydrates, nitrogen, potassium, boron, copper, zinc, and manganese are all involved.

Mineral Nutrition as a Factor In Cold Tolerance Of Apple Trees
James R. Schupp, Lailiang Cheng, Warren C. Stiles, Ed Stover, and Kevin Iungerman

NEW YORK FRUIT QUARTERLY • VOLUME 9 NUMBER 3 • 2001

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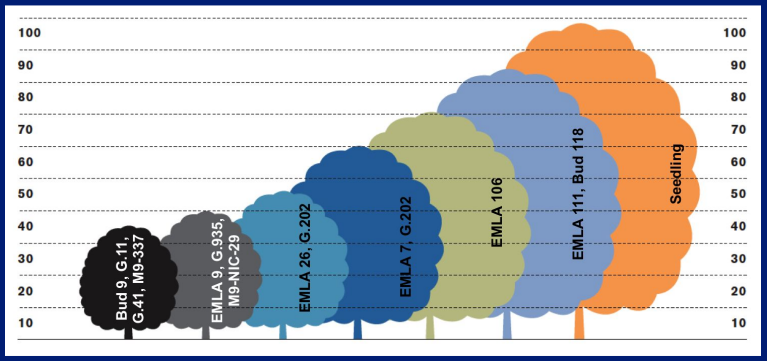
‘M.9 Series: Pajam 2, T-337 & Nic 29

- **Susceptibility** to fire blight (M9 series).
- **McArtney, Steve & Obermiller, J.** (2011). In low temperature event in **2008-09**

  found **M.9 Pajam 2 and T337 expressed visible and severe trunk injury**



McArtney, Steve & Obermiller, J.. (2011). Effect of Dwarfing Rootstocks on Low Temperature Tolerance of 'Golden Delicious' Apple Trees During Winter 2008-2009. Journal- American Pomological Society. 65. 178-184.

(Georgia Mountain Research and Education Center in Blairsville, GA)

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‘M.9 Series: Pajam 2, T-337 & Nic 29

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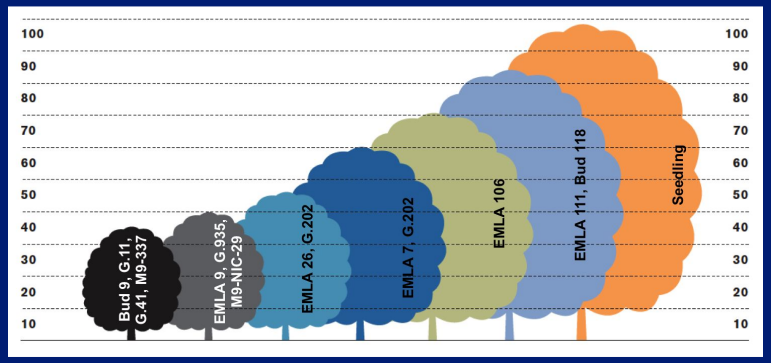
- **‘Sudden Apple Decline’** (**2013 Kari Peters**, Penn State **‘M.9-337 & Nic 29**).
  - **Graft union** is affected: Severe shedding of bark around graft union.
  - **Necrosis** begins at the **graft union** and it proceeds up the trunk of the tree.



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Apple Tree Decline

D.R. Rosenberger (Cornell / HVRL, Highland, NY; Hort. Expo Proceedings 2017):

1. Winter Injury (Supported By Jason Londo, Cornell University)
2. Fire Blight In The Rootstock (M-9 Series)
3. Herbicide Injury
4. Drought Stress
5. Orchard flooding / Tree Row Depressions
6. Fungal Canker And Wood-rot Pathogens
7. Latent Apple Viruses
8. Boring Insects

Sudden Apple Decline: Trunk-Related Problems in Apples

David Rosenberger, Professor Emeritus
Cornell University's Hudson Valley Lab, Highland, NY

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Apple Tree Decline

Winter Injury (Supported By Jason Londo, Cornell University, 2023)

most cold **sensitive** rootstocks

- G.814
- M.9
- G.11
- CG.4004
- CG.6589
- CG.8189
- B.9
- G.222
- CG.4004
- G.214
- G.202

- G.210
- G.890
- G.935
- G.203,
- G.87
- G.257
- G.213
- G.202
- G.214
- G.41
- CG.525
- 7

most cold **hardy** rootstocks

February

Rootstock sensitivity recordings of temperature observations

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Apple Tree Decline

Winter Injury (Supported By Jason Londo, Cornell University, 2023)

most cold **sensitive** rootstocks

- G.814
- M.9
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- G.41
- CG.525
- 7

most cold **hardy** rootstocks

Additional Factors Contributing to **Winter Injury**

- Dry ground (Shale / Sandy soil
- **Wet soils** (Topography 'Depressions)

1. Raise tree scion / rootstock at planting
2. Creating Tree Row Berm to shed water
3. Bark-chip / Woodchip mulch to maintain soli moisture during drought. (Voles)

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Apple Tree Decline


D.R. Rosenberger (Cornell / HVRL, Highland, NY):

1. Winter Injury (Supported By Jason Londo)
2. Lack Of Adequate Nutrition (J. Schupp at al., Penn State et al.)
3. Fire Blight In The Rootstock (M-9 Series root suckers)
4. Herbicide Injury
5. Drought Stress
6. Flooding / Tree Row Depressions
7. Fungal Canker And Wood-rot Pathogens
8. Latent Apple Viruses
9. **Boring Insects** ⟷

- **Broad Necked Root Borer** (B)
- **Black Stem Borer** (B)
- **Round-headed Apple Tree Borers** (B)
- **Flat-headed Apple Tree Borer** (B)
- **Dogwood Borer** (Lep.)
- **Leopard Moth** (Lep.)

Sudden Apple Decline: Trunk-Related Problems in Apples

David Rosenberger, Professor Emeritus
Cornell University's Hudson Valley Lab, Highland, NY

Hudson Valley NYS: 2021-24
M9 T337 Cambium Necrosis

Bark / Cambium Separation

- **Tree Stress Producing Ethanol (EtOH)**
- **Tree Foliage 'Yellowing'**
- **Ambrosia Beetle Infestation**
- **Tree Collapse**

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M9 T337 Cambium Necrosis & BSB Infestation

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April 10th, 2024

Ambrosia Beetle: Black Stem Borer *Xylosandrus germanus*

Wildfire Gala **G41** along woodland.

- BSB infected tree with remaining trunk showing galleries and fungal growth in rearing chambers.

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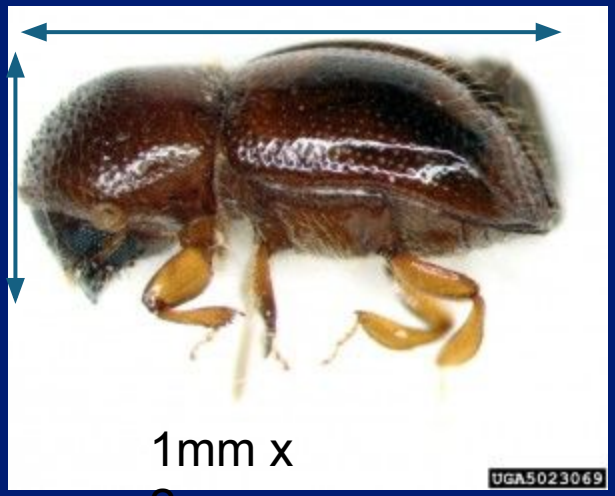
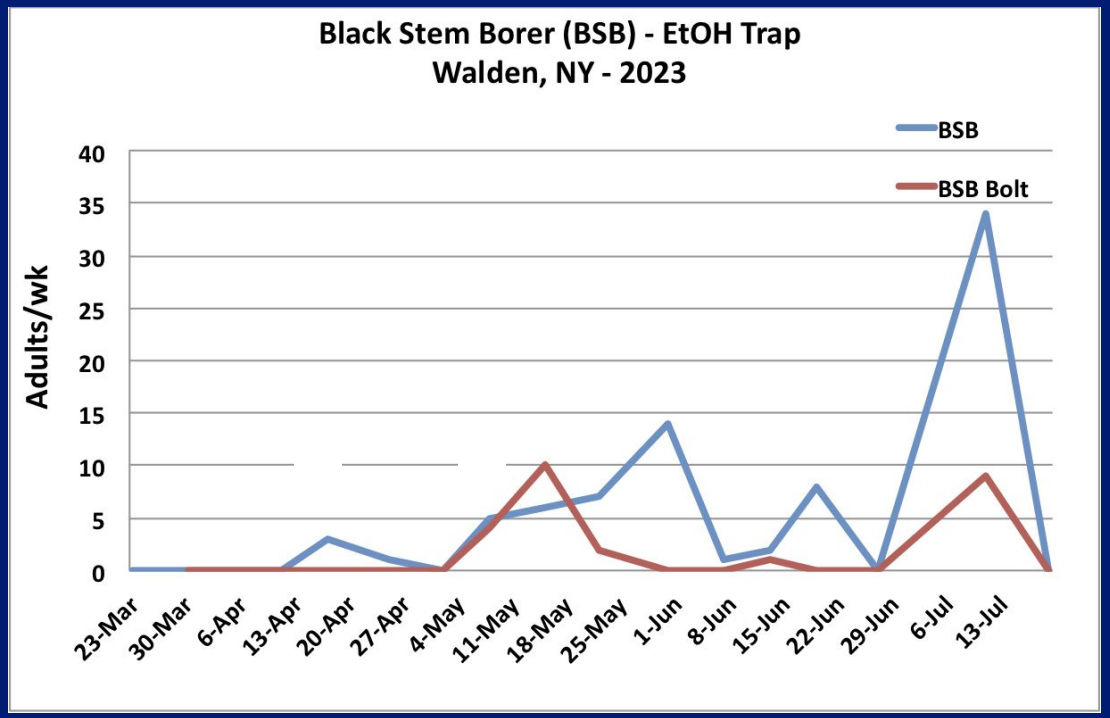
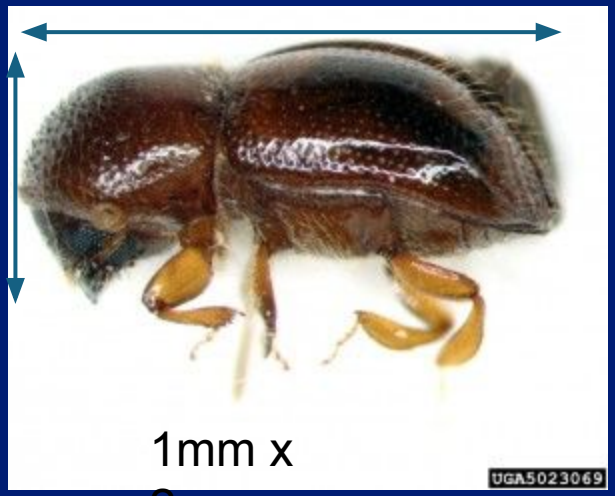
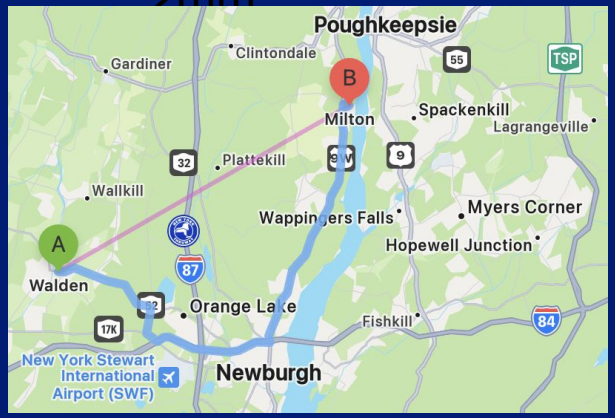


Early Spring Management Monitoring 2023

- Cool Season = Late Adult Trap Captures
  - Delayed Infestation of Trees
    - 1st Adult April 13th
    - 1st Boring Site Approx. May 10th

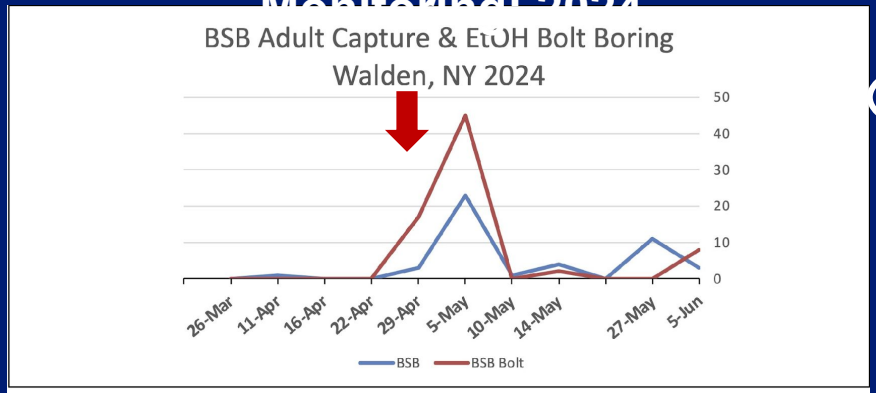


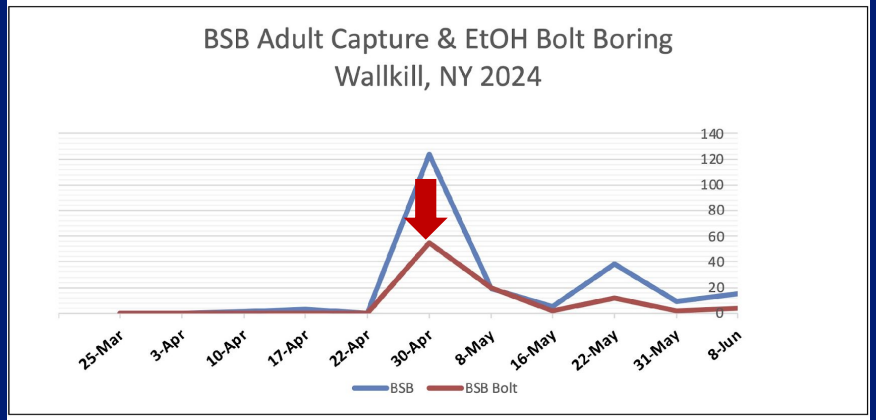


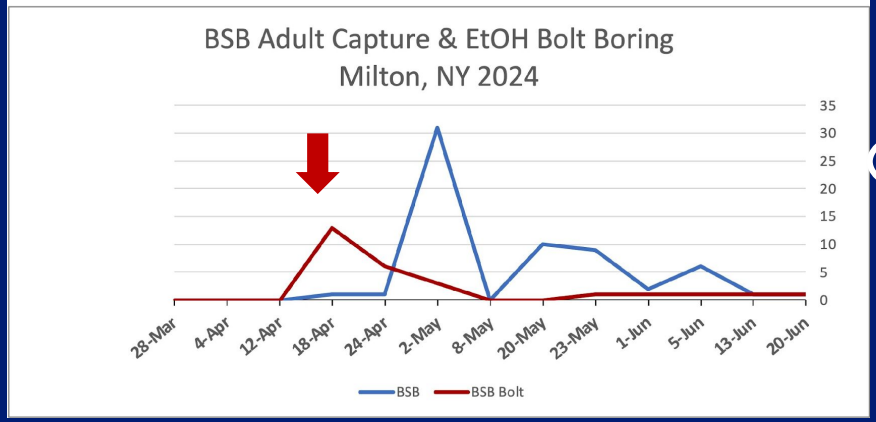


14 miles between N/S sites

Early Spring Management



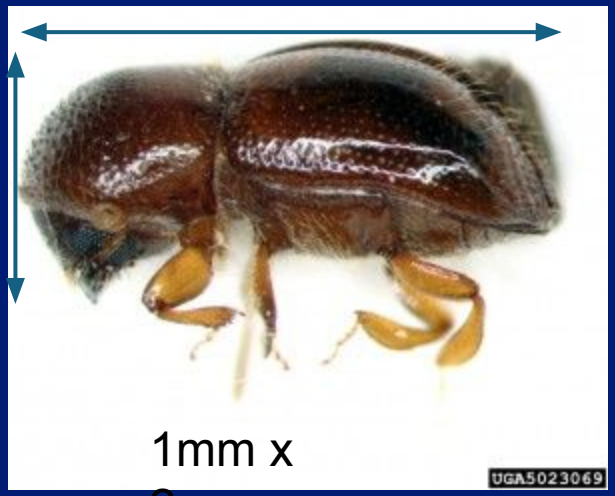




Walden & Wallkill
- 1st bolt Infestation on 30th April
- Cooler sites

Wallkill
- High BSB captures

Milton (Hudson River)
- 1st bolt Infestation on 18th April
- Warmer site along Hudson River



Black Stem Borer (BSB), *Xylosandrus germanus*

Management Studies

2021 Conducted studies

- Beetle Guard (ISCA Tech)
- Verbenone / methyl silicate **repellent** 'gel' @ 10' intervals
- Determine efficacy of the product to reduce populations of BSB within the orchard
- **Goals:** Reduce the attack of stressed apple trees.
- Unable to show a decrease in trap #'s & infestation

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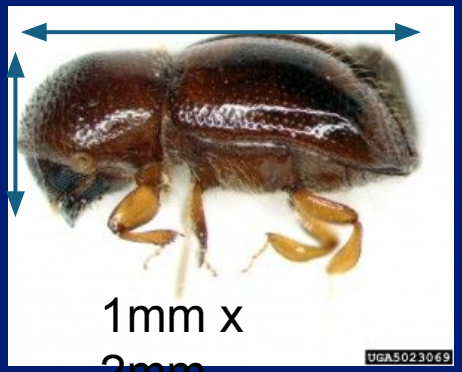
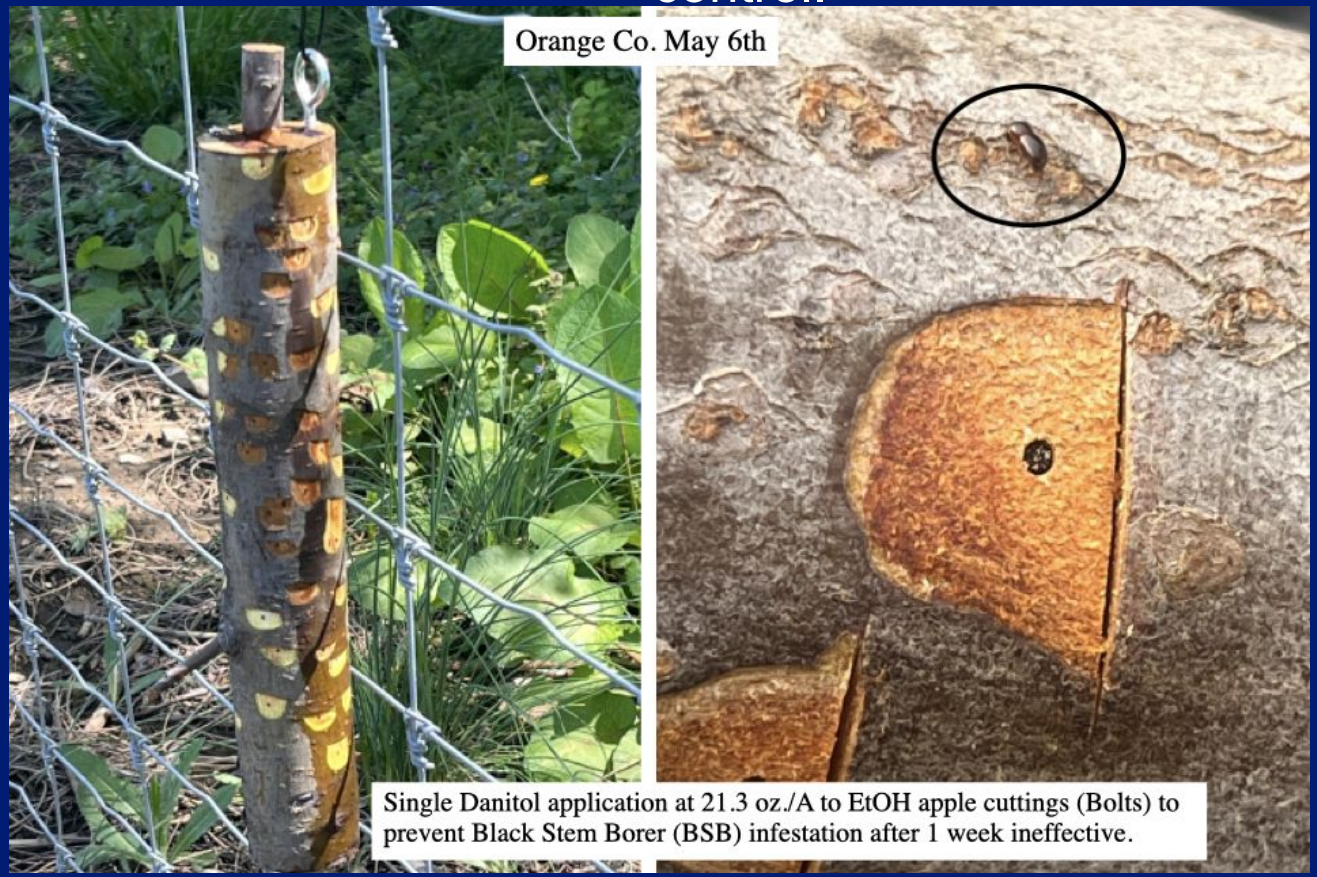


1mm x 2mm

Black Stem Borer (BSB), *Xylosandrus germanus*
Management Studies

April 30th 2024: Replicated Danitol (fenpropathrin) application to EtOH bolts. No reduction of infestation to treated Bolts @ 21.3 fl. oz./A rate compared to the untreated control.



Single Danitol application at 21.3 oz./A to EtOH apple cuttings (Bolts) to prevent Black Stem Borer (BSB) infestation after 1 week ineffective.

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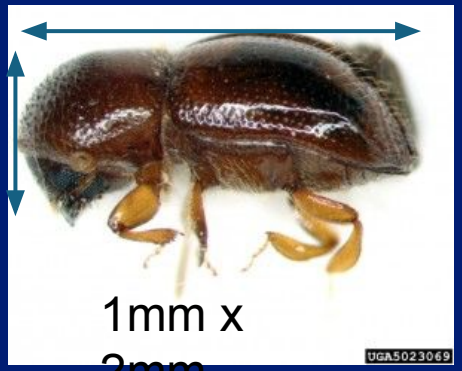

1mm x 2mm

Black Stem Borer (BSB), *Xylosandrus germanus*

Recommended Management (Reducing Tree Stress)

1. Early Spring **Trunk** Applications to 'stressed trees'
   a. Permethrin (Pounce, Mustang Max)
      i. Pyrethroids most effective in cool temperatures
      ii. Detoxified by insects in temps above 70°F

Black stem borer	3A	*Danitol 2.4EC	16 fl oz/acre	14	24	Moderate
	3A	*Warrior II	2.56 fl oz/100 gal water	21	24	Moderate

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BSB Management

Canopy & Trunk Management for TPB

Adult Ambrosia Beetles

* Use larger output for lower two nozzles on AB sprayer to cover trunks for BSB @ TC-Pink and PF

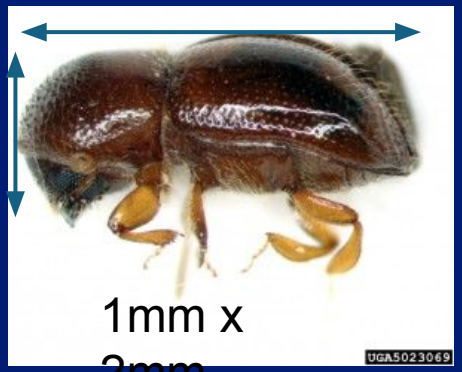
Table 11.1.1 Pesticide Spray Table - Apples.

IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy
3A	Ambush 25WP	6.4-25.6 oz/acre	PF	12	High
3A	*Asana XL	4.8-14.5 fl oz/acre 2-5.8 fl oz/100 gal water	21	12	High
3A	*Baythroid XL 1EC	2-2.4 fl oz/acre	7	12	High
3A	*Danitol 2.4EC	10.67-16 fl oz/acre	14	24	High
3A	*Mustang MAXX	1.28-4.0 fl oz/acre	14	12	High
3A	*Pounce 25 WP	6.4-16 oz/acre	PF	12	High
3A	*Warrior II	1.28-2.56 fl oz/acre	21	24	High
22	Avaunt 30WDG	5-6 oz/acre	14	12	Moderate
29	Beleaf 50SG	2-2.8 oz/acre	21	12	High
3A/6	*Gladiator EC	19 fl oz/acre 4.75 fl oz/100 gal water	28	12	High
3A/28	*†Besiege	6-12 fl oz/acre	21	24	High

Lower Manifold Flip Nozzles

1st App. Pounce (permethrin) @ 16.0 oz/A

2nd App. Danitol (fenpropathrin) @ 16.0



Black Stem Borer (BSB), *Xylosandrus germanus*

Recommended Management (Reducing Tree Stress)

1. Early Spring Trunk Applications to ‘stressed trees’
   a. Permethrin (Pounce, Mustang Max), Danitol
2. Removing Infested Trees
3. Selecting Winter Hardy Rootstocks in New Plantings
4. Maintain adequate nutritional levels
5. Develop Water Drainage Plan
   a. Berm Trees In Orchard Depressions
6. Develop Increased Irrigation Capacity
   a. Maintain adequate moisture

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Spring Insect Pest Management

Appear Late April-Early May

Spongy Moth *Lymantria dispar* (formally Gypsy Moth)

Early Instar Larva

Late Instar Larva

Male

Female

Spring Insect Pest Management

Spongy Moth *Lymantria dispar* (formally Gypsy Moth)

Fungal Infected SM larva

Since 1989, 'Gypsy Moth' was controlled by the introduced entomophagous fungus,

Entomophaga maimaiga, a Japanese fungus, Infecting the insect larval stage.

The **fungus resides in the top layer of soil** as resting spores and persists for at least 11 yrs.

- It has successfully managed spongy moth populations in North America since its introduction in the US.
- It has caused high levels of infection among spongy moths in populations, leading to yearly population crashes.

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Spring Insect Pest Management

Spongy Moth *Lymantria dispar* (formally Gypsy Moth)

- **Researchers theorize that recent drought during the summer-fall fungal infection period has reduced the efficacy of the biological control to reduce the Spongy Moth populations, giving rise to recent outbreaks.**

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202
4

Larva create silk threads and ’float’ from the woodlands into the orchard (L)

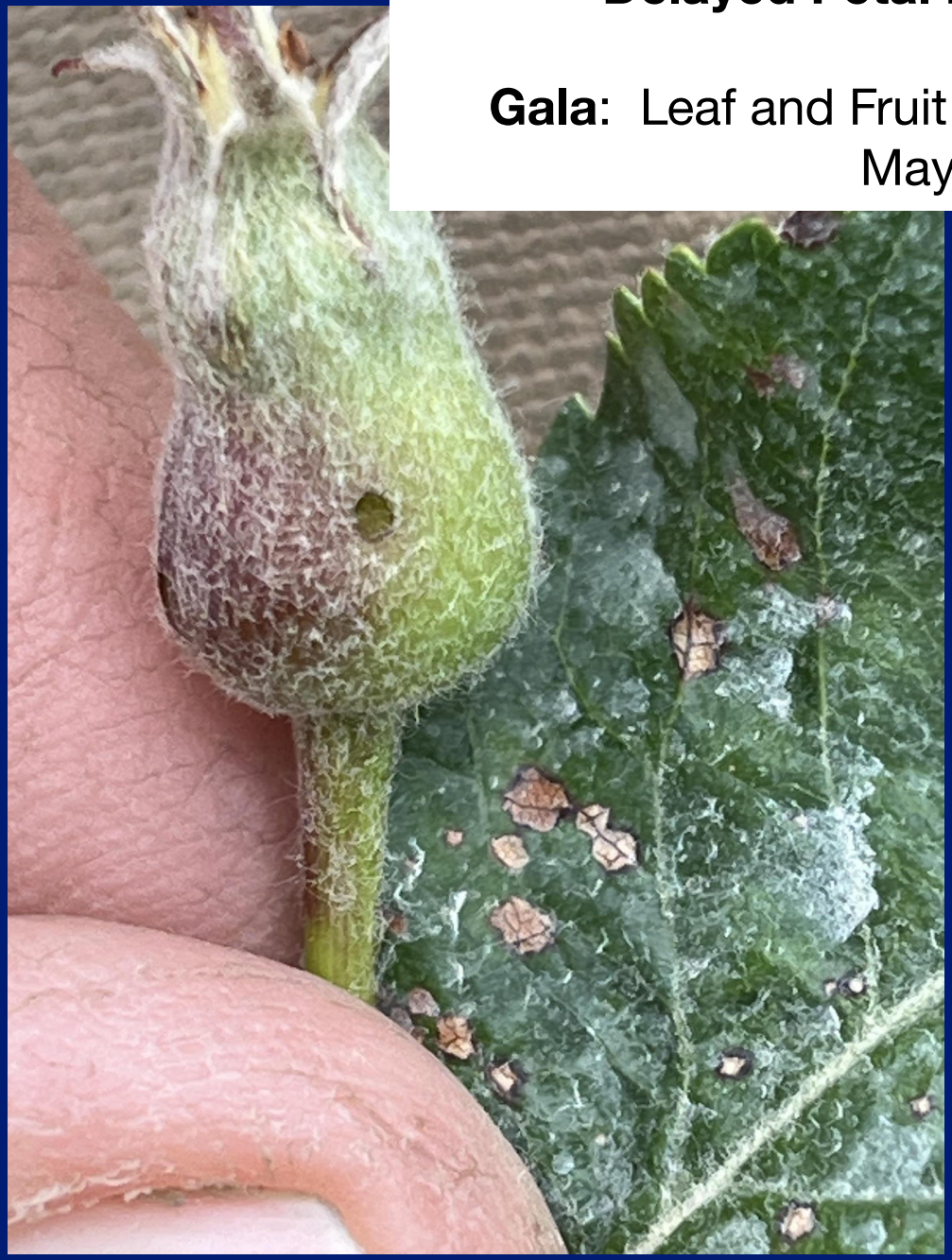
Foliar feeding beginning Late April through June.
Moving to fruitlets caused significant injury to fruit

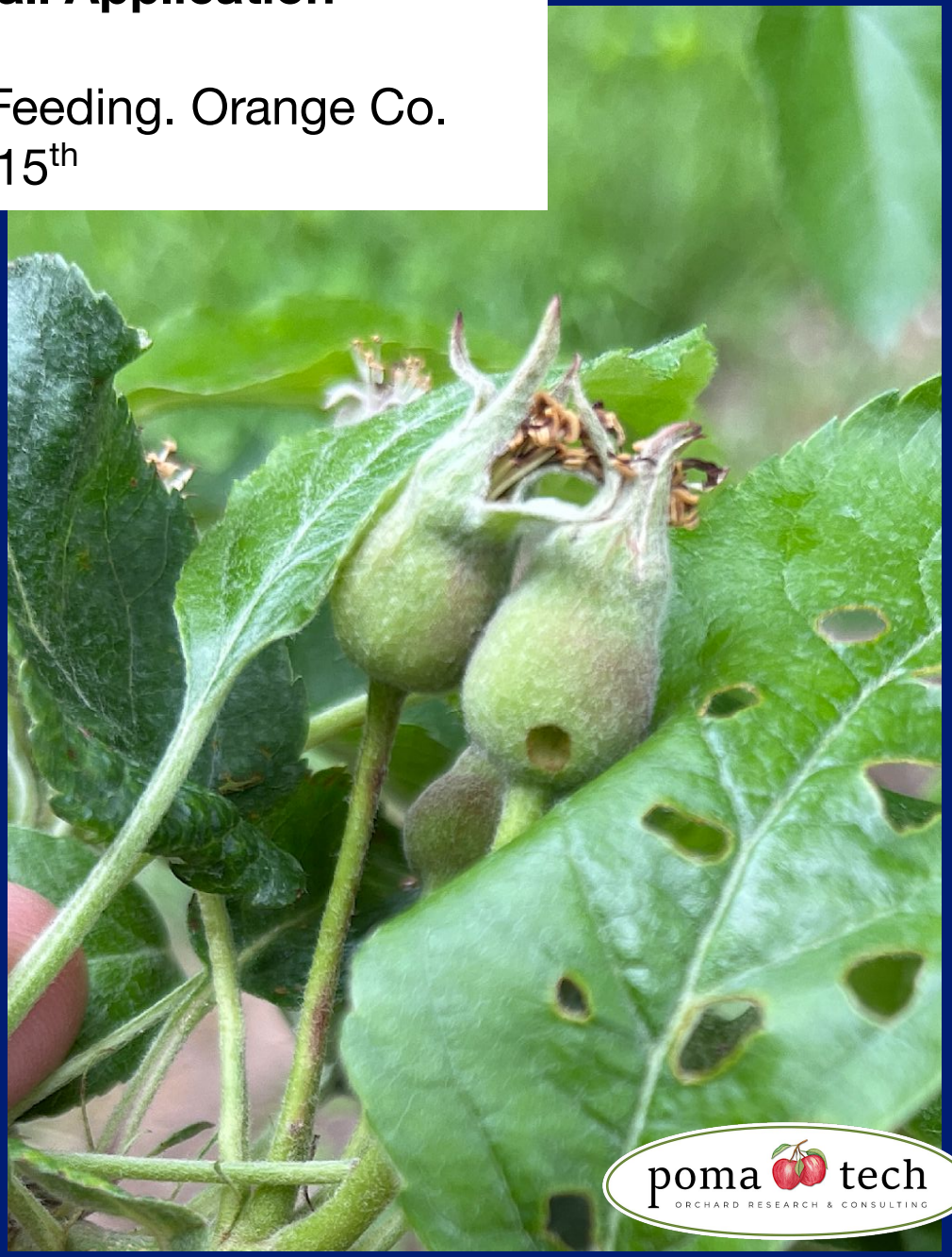
Cause allergic reactions to orchard workers.

- The gypsy moth caterpillars have spiny hairs which may caus

Delayed Petal Fall Application

Gala: Leaf and Fruit Feeding. Orange Co.
May 15th





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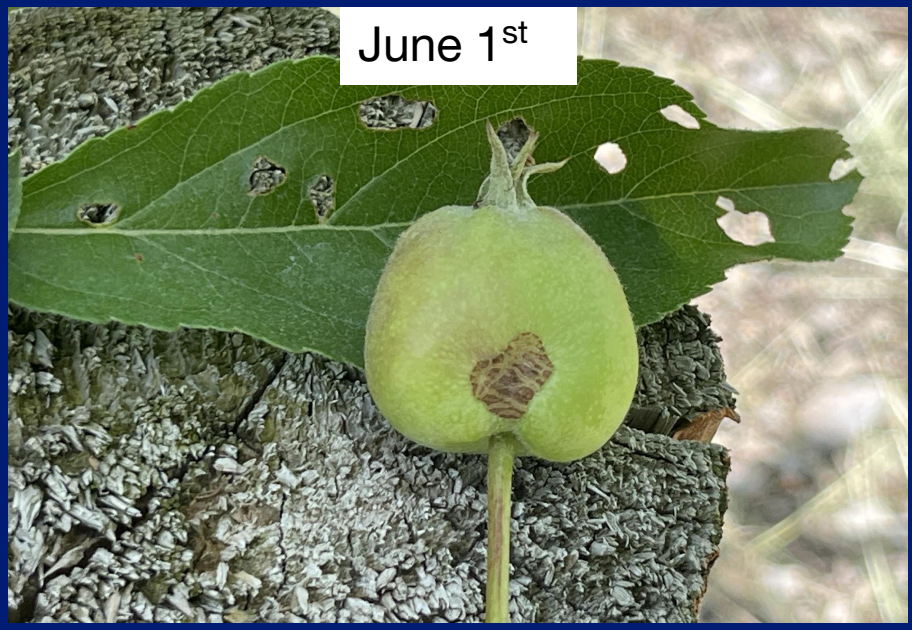
Spongy Moth Fruit Injury Expansion

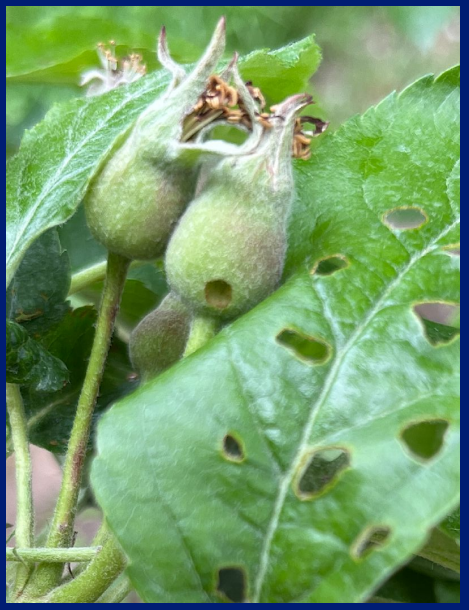


Previous feeding more prominent during fruit expansion.

Hand Thinning Required

Migration of larger Spongy Moth from wooded edge feeding on terminal foliage.
June 12th

Spring Insect Pest Management



Managing the Insect Pest Complex: April- Early May

Spongy Moth (formally Gypsy Moth)

- **Green Fruitworm: (SGFW)**
- **Obliquebanded Leafroller (OBLR)**
- **Oriental Fruit Moth (OFM)**
- **Redbanded Leafroller (RBLR)**

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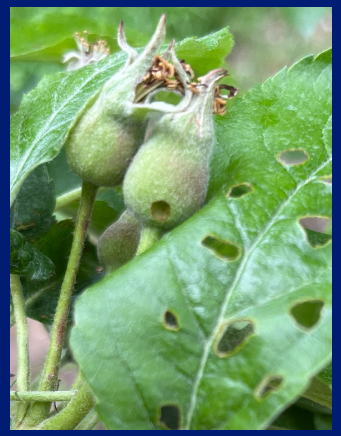
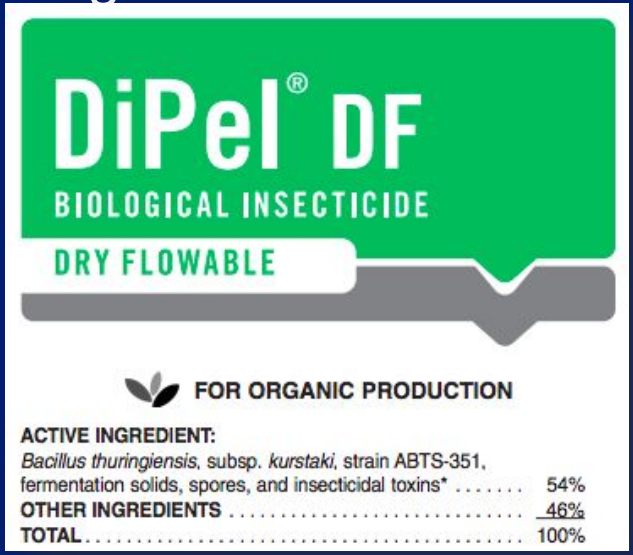
Spring Insect Pest Management

Spongy Moth *Lymantria dispar* (formally Gypsy Moth)



Threshold: Applications upon 1st emergence & migration

Bacteria: *Bacillus thuringiensis*/B.t. is a fermented toxin used at low rates using 5-day intervals is an excellent materials for OBLR, GFW, RBLR, OFM and can be used during bloom to manage immature larval stages.



- **UV sensitive**
  Best use during overcast sky
- **Low rates using short re-application intervals**
- **Can be used during bloom**
- **Pollinator safe**

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Lepidopteran complex:

Overwintering larvae

Speckled green fruit worm (SGFW) *Orthosia hibisci*

Red banded leafroller (RBLR), *Argyrotaenia velutinana* (Walker)

Obliquebanded leafroller (OBLR) *Argyrotaenia velutinana* (Walk

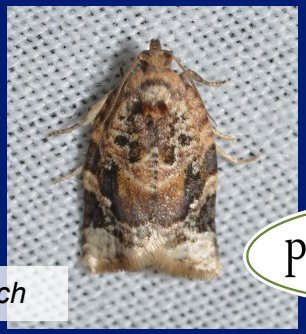
Utah State Univ.

The tools for use against the lepidoptera complex
IRAC Class:

5	**Spinosyns**	**(Delegate, Entrust)**
28	**Diamides**	**(Altacor, Exirel, Verdepryn)**
28 / 3	**Pre-Mix**	**(Besiege…)**

Todd M. Gilligan and Marc E. Epstein, CSU,

J. F. Walgenbach file



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Spring Insect Pest Management (Pre-Bloom)

- Green Fruitworm: (SGFW)
- Obliquebanded Leafroller (OBLR)
- Oriental Fruit Moth (OFM)
- Redbanded Leafroller (RBLR)

a. San Jose Scale (SJS) (OW In-Orchard)

Application @ 2% Oil at GT / 1% at 1/2" green (Copper)

Esteem 35WP @ 4-5 oz./A (IGR) GT – Pink (no oil needed)

Sivanto Prime @ 10.5-14.0 fl. oz/A (oil needed - Captan)

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Spring Insect Pest Management

Managing The Insect Pest Complex: April: Tight Cluster - Pink

Tarnished Plant Bug (TPB)

- Scout Perimeter 'Early' Apple Var. Along Broadleaf Weed Complex for adults
- Adult Feeding: 'Bleeding' Sap Flower Bud Clusters (Temp. 50° - 60° F For 3d)
- White 6x8" Traps Hung @ 2' Low Branches Trap Threshold 3 / Trap





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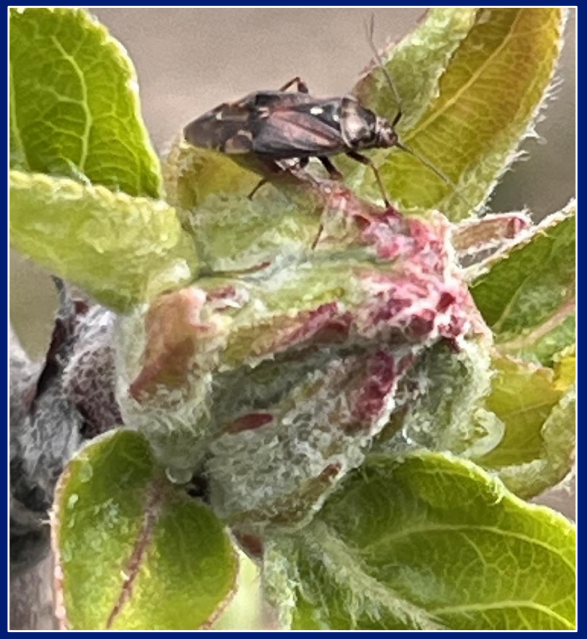
Spring Insect Pest Management

Managing The Insect Pest Complex: April: Tight Cluster – Pink - PF

Tarnished Plant Bug (TPB)

- **Beleaf 2.0 - 2.8 oz/ A IRAC 29**



Pyrethroids

- **Danitol 2.4EC 10.67 - 16 fl. oz/ A IRAC 3A**

Pyrethroid Premix

- **Besiege 6.0 - 12 fl. oz/ A IRAC 3A + 28**

***Besiege** Chlorantraniliprole (Altacor) / Lambda-cyhalothrin (Warrior)

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Spring Insect Pest Management

Managing the Insect Pest Complex: Early May (Pink)

European Apple Sawfly: Hymenopteran / primitive wasp

- Emerges during late pink-early bloom

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Spring Insect Pest Management

Managing the Insect Pest Complex: Early May

European Apple Sawfly: Hymenopteran / primitive wasp

- Active egg laying beginning at Pink – early fruit set
- Applications made prior to king bloom (Pink) or Petal

Fall

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Spring Insect Pest Management

Managing the Insect Pest Complex: Early May

European Apple Sawfly: Hymenopteran / primitive wasp

- Verdepryn 100 SL, Altacor, Exirel (IRAC 28)
- Pyrethroids / Pre-Mix (Leverage 360)
- Imidan 70W





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Spring Insect Pest Management

Managing the Insect Pest Complex: Pink – 2C

Plum Curculio

- Active migration into orchards @ mean ambient temperatures exceeding 50 °F for at least 3 days
- Monitor in stone fruit (Plum tree) / Tedders

  Trap
- tion can begin at King set @ 4mm

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Spring Insect Pest Management

Managing the Insect Pest Complex: Pink – 1C

Plum Curculio PC (Pre-bloom)

- Pyrethroid used for BSB / TPB reduces risk of early PC orchard entry provides ‘insurance’ extended bloom, delayed honeybee removal, rain..

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Plum Curculio @ PF

Insecticide	Rate (High)	Efficacy PC	IRAC
1. Avaunt 30WDG	5-6 oz./A	High	22A
2. Imidan 70-W	2.13 – 5.75 lb./A	High	1B
3. Verdepryn 100 SL	11.0 fl. oz./A	High	28
4. Exirel	20.5 fl. oz./A	High	28
5. Voliam Flexi WDG	7.0 oz./A	High	28 + 4A
6. Besiege	12.0 fl. oz./A	High	28 + 3A

***Besiege** Chlorantraniliprole (Altacor) / Lambda-cyhalothrin (Warrior)

***Voliam Flexi WDG** Chlorantraniliprole (Altacor) / Thiamethoxam (Actara)

Management of Early Season Insect Pests: Tarnished Plant Bug. HVL 2008

Treatment	Formulation amt./A.	Timing	% TPB	% PC
Actara	4.0 oz./A	P, PF, 1C	8.3 b	2.0 a
Calypso SC	4.0 oz./A	P	7.6 b	2.1 a
Baythroid XL	2.8 oz./A	PF		
Calypso SC	6.0 oz./A	1C		
Asana XL	14.5 oz./A	P	5.3 ab	2.6 a
Calypso SC	6.0 oz./A	PF-1C		
Asana XL	14.5 oz./A	TC, P	2.5 a	0.0 a
Calypso SC	6.0 oz./A	PF-1C		
Untreated			8.8 b	3.3 a

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Optimizing Insect Pest Management

Monitoring Tools

Identifying Pest: Presence

Monitoring Tools

Species Specific : Traps, Lures

- Employ Sustained Trap Capture
- NEWA Degree-Day Modeling: Codling Moth

Sustained CM Trap Capture

3/trap

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Codling Moth Mgt. Milton, NY 2024

1st Codling moth in pheromone trap May 10th

- Cool temps delayed sustain capture until 15th May
- Using Biofix date of **May 14th** of sustained capture
- Expected egg laying begin at 50DD on 18th May
- **First hatch** began at **250 DD_{50BE}**
- **1st Cover application: May 28th**

Sustained CM Trap Capture

3/trap

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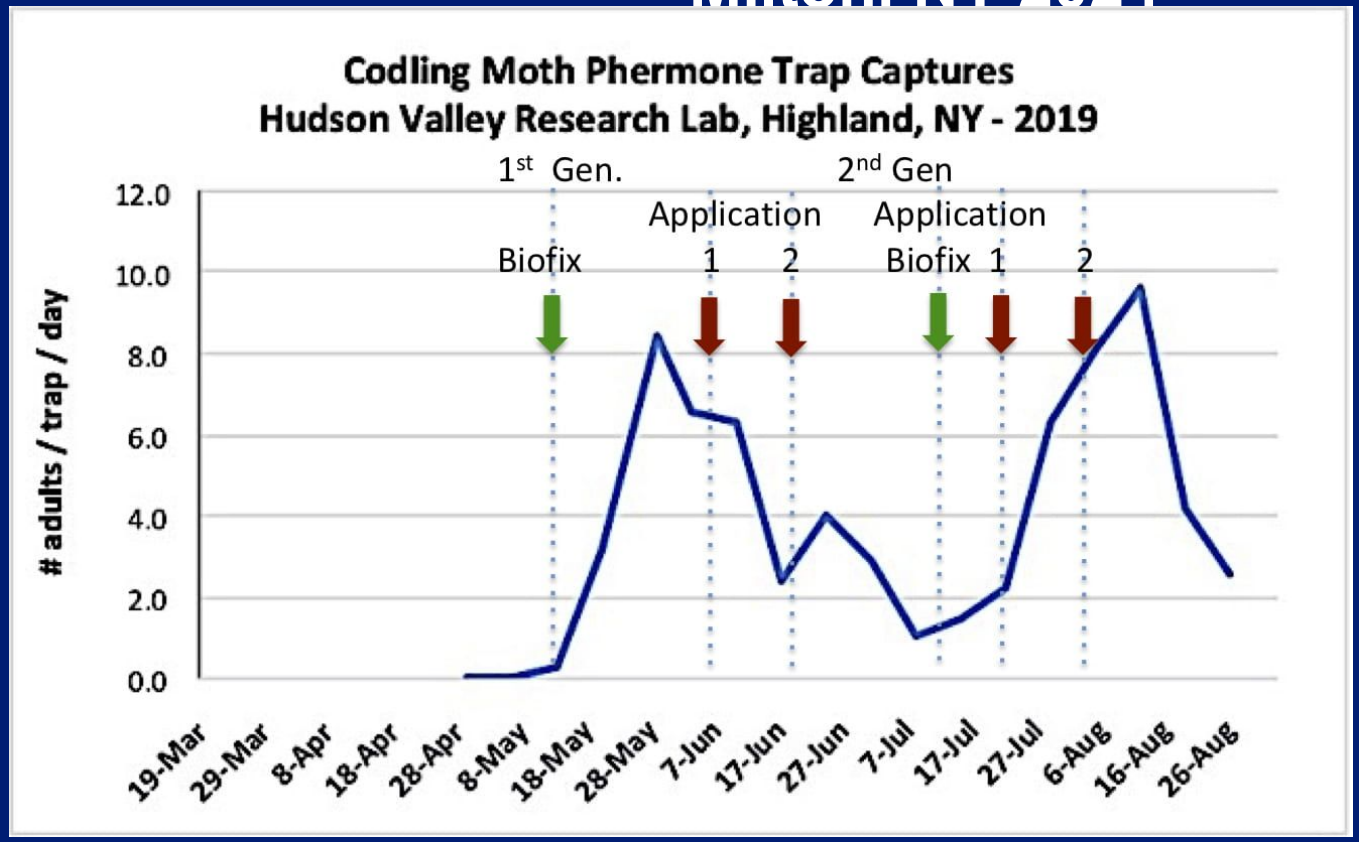
Codling Moth Mgt. Milton. NY 2024



First hatch begins at **250 DD_{50BE}**
June 7th , 2019
May 28th, 2024

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1st Cover for PC & Codling Moth

2nd Cover for Codling Moth

Insecticide		Rate (High)	Efficacy PC	CM	IRAC	
1.	Verdepryn 100 SL	11.0 fl. oz./A	High	High	28	
2.	Exirel	20.5 fl. oz./A	High	High	28	
3.	Voliam Flexi WDG	7.0 oz./A	High	High	28 + 4A	Neonic
4.	Besiege	12.0 fl. oz./A	High	High	28 + 3A	Pyreth

2nd Generation for Codling Moth & OBLR

A.	Delegate	12.0 fl. oz./A		High	5
B.	Assail 30SG	8.0 oz./A		High	4A

Rotate IRAC classes to reduce the insecticide resistance potential for each generation

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Optimizing Insect Pest Management

Management Tools

Managing the Pest Complex: May - August

Wooly Apple Aphid 1st Cover

Movento 6-9 fl. oz. /acre + 0.25% penetrant

***Green, Rosy Wooly Apple Aphid* / Apple Maggot:**

Start with: *Admire Pro* / Assail 30SG (Acetamiprid) Neonicotinoid

- Active ingredient MOA inhibits egg laying into fruit
- Assail will not kill AM flies unless it ingests the active ingredient.
- AM Spheres will continue to capture AM flies throughout the season

Stink Bug Management
Green & Brown Marmorated Stink Bug

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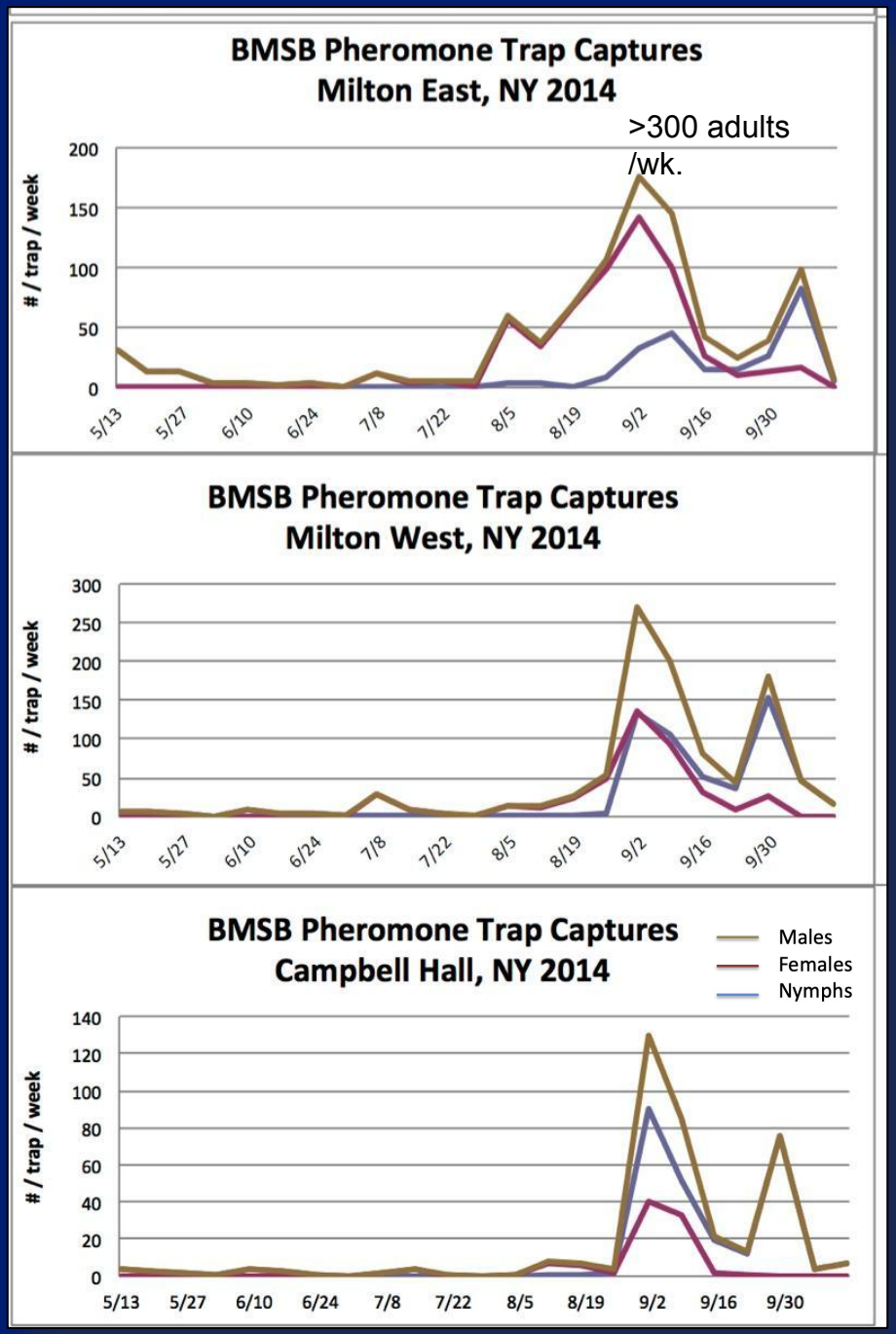

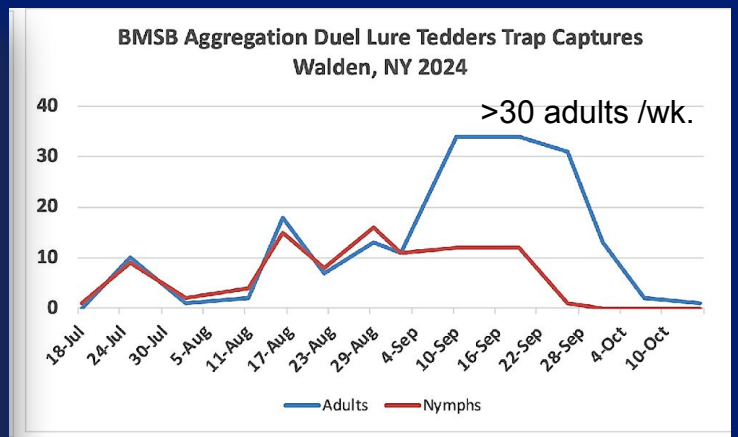

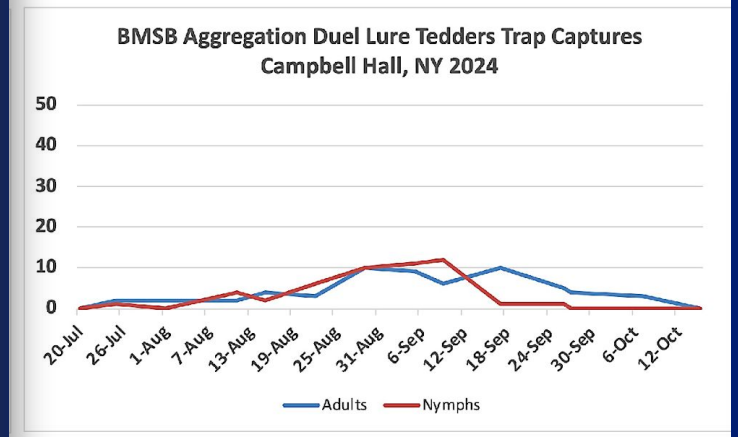

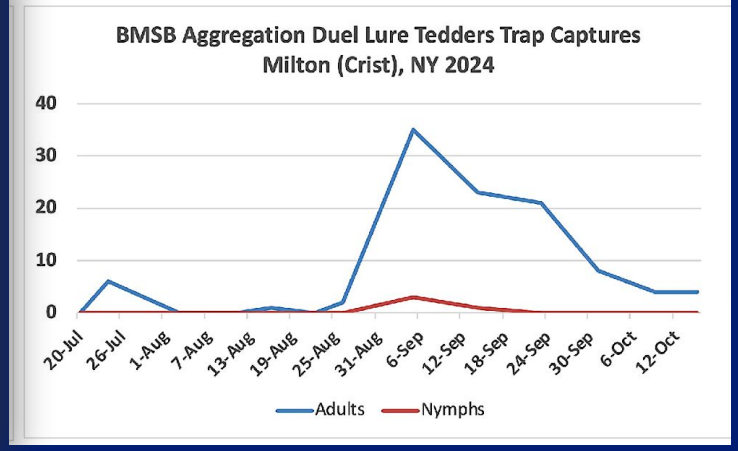

10 year decline

- Exponentially lower captures
- Biological control

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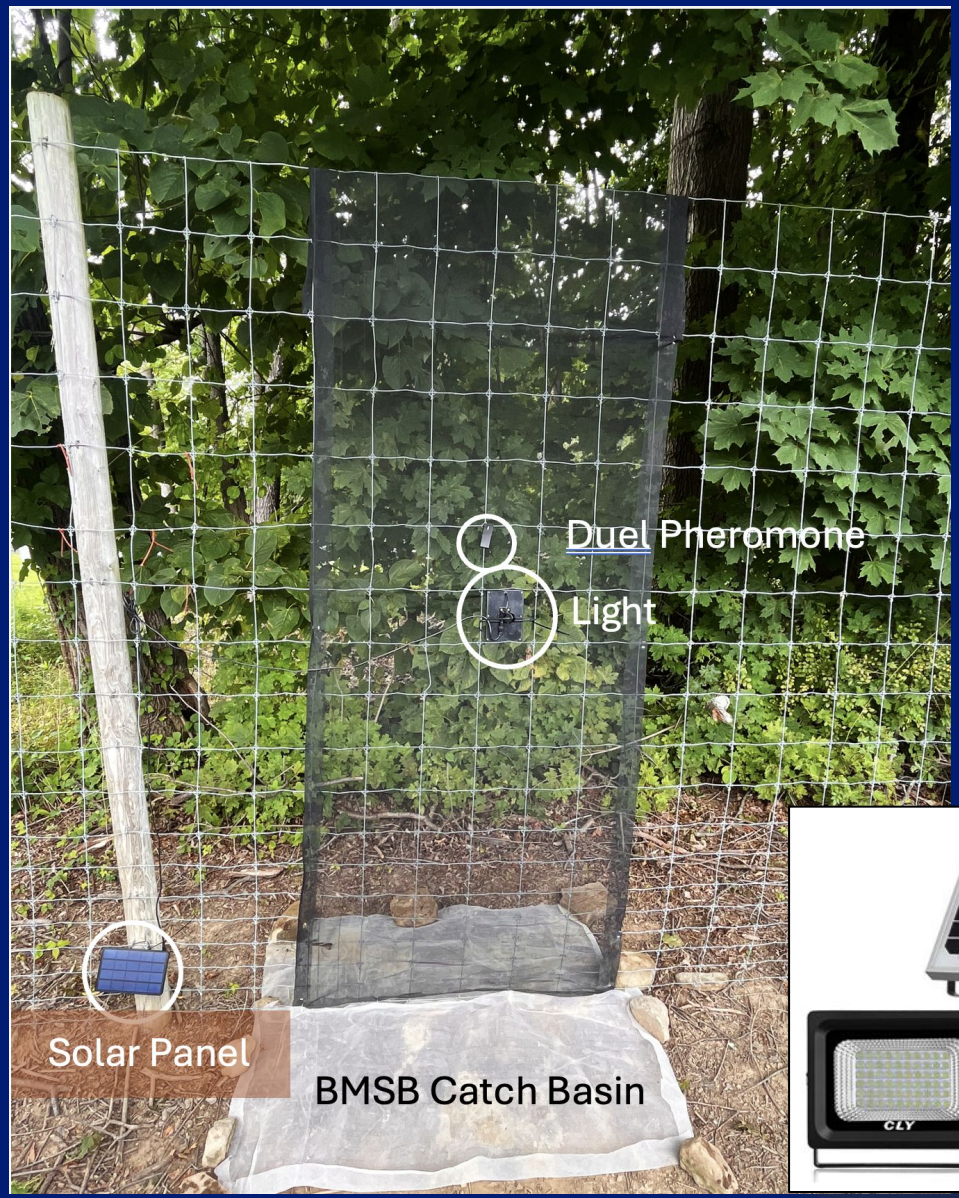
Stink Bug Management : High Value / Late Season Fruit (Ruby Frost & Pink Lady)

Perimeter Attract and Kill Stations @ 30 meters (Bifenthrin Treated)

Perimeter Applications of Venerate XC (Profarm) @ 128.0 fl. oz./ A



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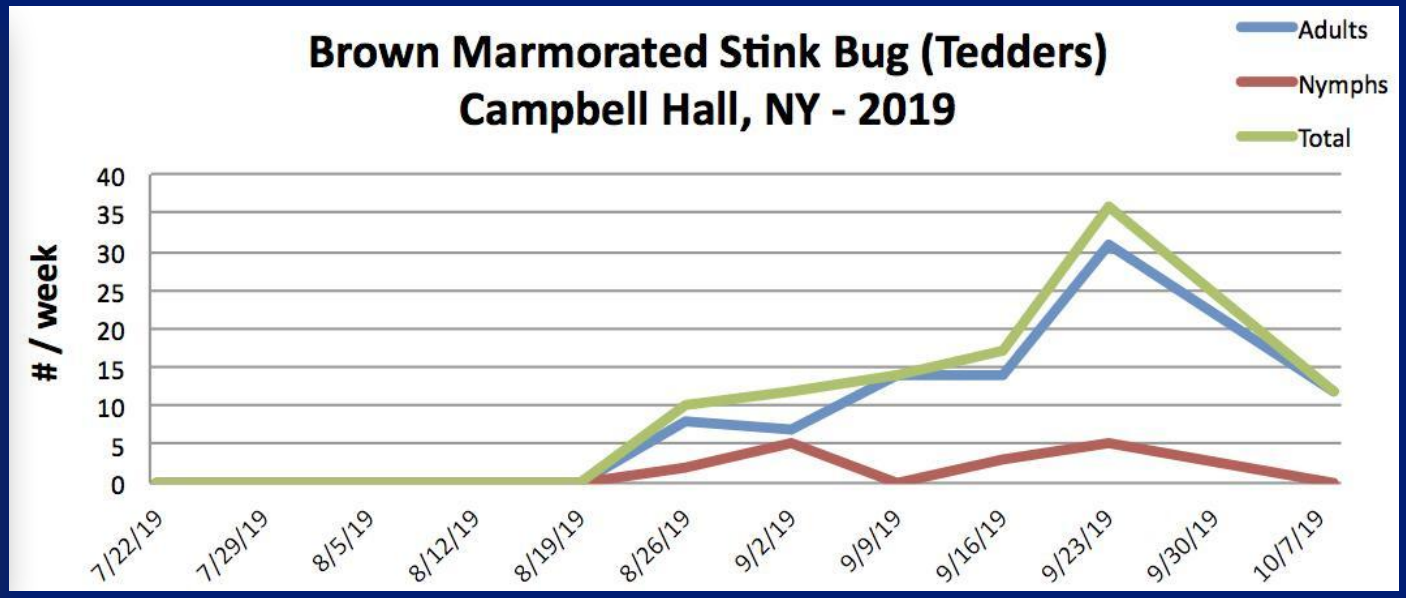
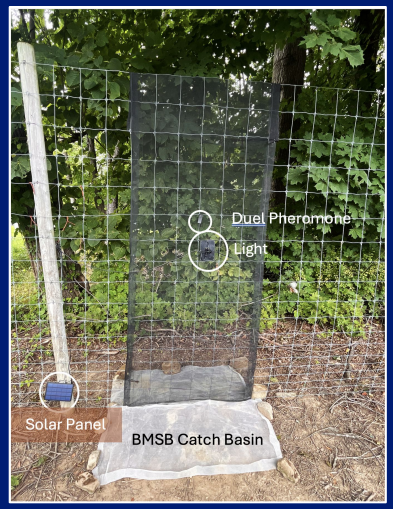
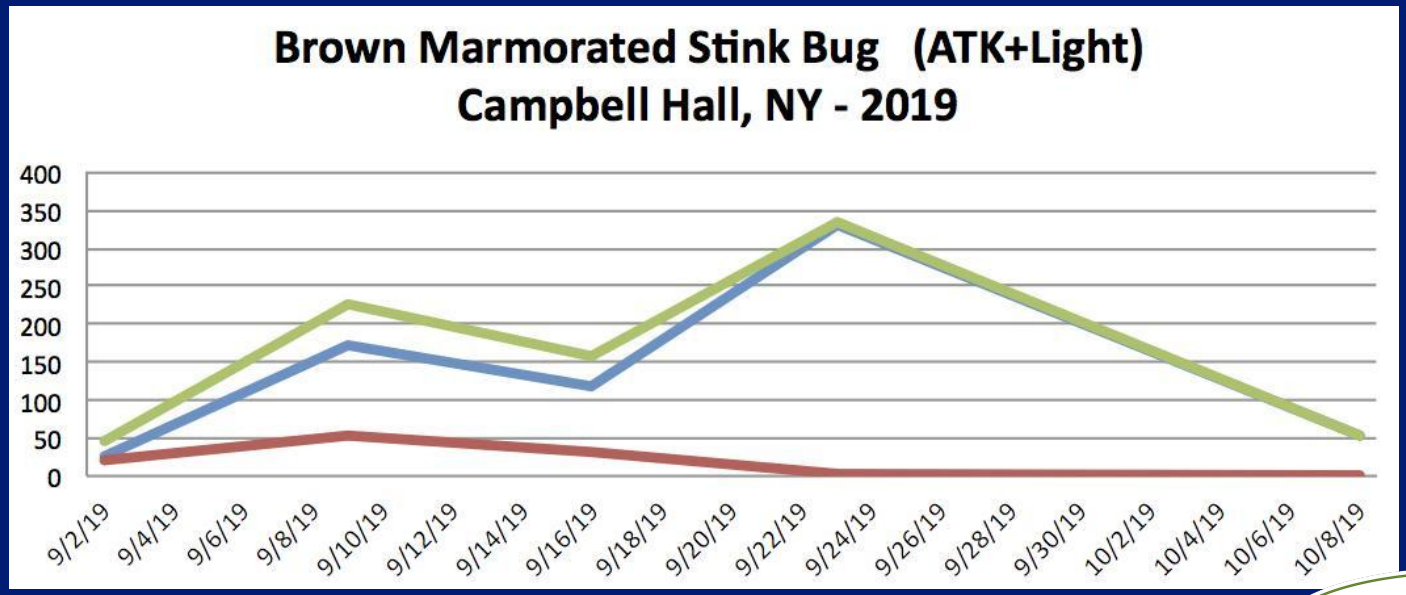


Peak Adults

35

73 Total





Peak Adults

341

850 Total

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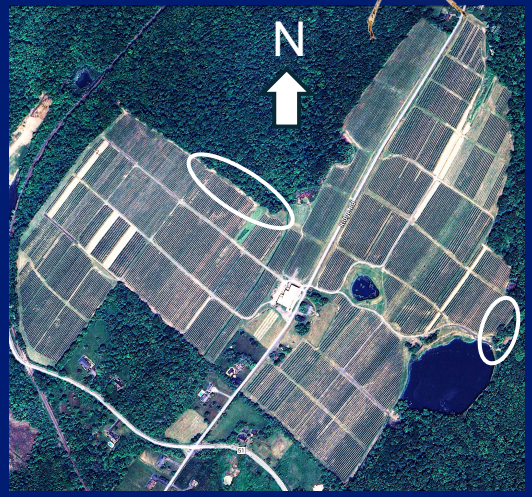
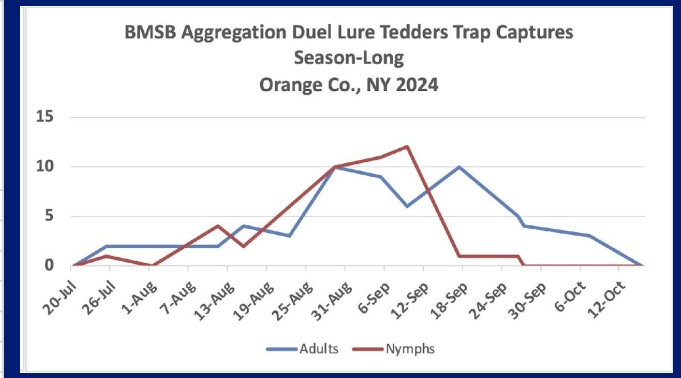
On-Farm Research to Determine Efficacy of Venerate XC to Reduce Fruit Feeding Injury to Pink Lady. Campbell Hall, NY 2024

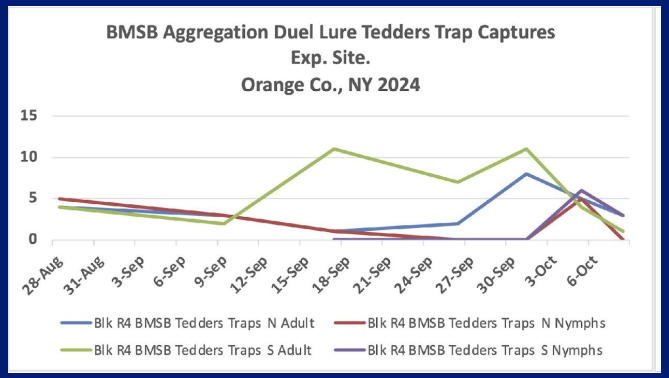
Treatment	% BMSB Mortality	% Fruit Sting	% fruit with Internal Corking	Total # of Internal Corking Sites
Brigade	100.0	0.0	0.0	0.0
Venerate XC	8.3	0.0	0.0	0.0
UTC	0.0	16.7	33.3	2.0



Tedders Trap sites, Campbell Hall, NY

Treatment	Adult Caged Application Date	% BMSB Mortality	% Fruit Sting	% fruit with Internal Corking	No. of Internal Corking Sites
Brigade	17-Sep	100.0	0.0	0.0	0.0
Brigade	21-Sep	100.0	0.0	0.0	0.0
Brigade	28-Sep	100.0	0.0	0.0	0.0
Brigade	1-Oct	100.0	0.0	0.0	0.0
Means		100.0	0.0	0.0	0.0
Venerate XC	17-Sep	0.0	0.0	0.0	0.0
Venerate XC	21-Sep	0.0	0.0	0.0	0.0
Venerate XC	28-Sep	0.0	0.0	0.0	0.0
Venerate XC	1-Oct	33.3	0.0	0.0	0.0
Means		8.3	0.0	0.0	0.0
UTC	17-Sep	0.0	0.0	66.7	4.0
UTC	21-Sep	0.0	33.3	33.3	2.0
UTC	28-Sep	0.0	33.3	0.0	0.0
UTC	1-Oct	0.0	0.0	33.3	2.0
Means		0.0	16.7	33.3	2.0





BMSB caged adult on fruit Var. Pink Lady
for 14d.

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for your fruit trees, together.

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SUBMIT

Thank You For Your Attention

Questions ??

Climate Influences On Pest Management

Under Dry or Drought Conditions

Benefits

- Longer pesticide residual (Exception: Bt – Dipel susceptible to UV Light….)
- Reduced incidence of disease
- Reduced emergence of Apple Maggot in dry soils (June-Aug.)
- Increased Phytophagous beneficial mites (low fungi pathogens)

Deficits

- Increased foliar feeding ERM, TSSM, Aphids
- Increased success of Lepidopteran larva (low fungi pathogens)
- Increased stink bug activity
- Increased bird feeding of fruit

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Climate Influences On Pest Management

Under High Moisture

Relative Humidity / Rain Conditions

Benefits

- Increased biological control
  - *Beauveria bassiana* (prior season conditions for fungi success)
  - *Entomophaga maimaiga* species specific for Spongy (Gypsy) Moth

Deficits

- Decrease in Pesticide Residual
- Increased disease pressure (Apple scab, Fire Blight)
- Standing water causing tree anoxia (prompting production of EtOH ethylene increasing ambrosia beetle infestation.
- Trees in depressions of standing water become susceptible to Ambrosia Beetle infestation

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