Small Acreage Organic Orchard Success

CrimsonCrisp

Pixie Crunch

NOFA-NY
NORTHEAST ORGANIC FARMING ASSOCIATION OF NEW YORK

September 17, 2014
Hudson Valley Research Laboratory
Highland, NY 12528
4:00pm-7:00pm

Hudson Valley Research Laboratory

This program is sponsored by NOFA-NY through the NYSDAM, Risk Management and Crop Insurance Education Targeted States Program and Cornell University Dept. of Entomology at the Hudson Valley Research Laboratory.

What Factors Optimize Small Acreage Organic Orchard Success?

Economics / Profitability driven by:

- **High Yield:** High density: (1000 trees per acre 1200-2000 bu./A); predictable return bloom, fruit set and optimize crop load, precocious tree growth and large fruit size for organic management.
- **High Quality:** Market driven; near perfect fruit in most markets (ideal fruit characteristics for specific varieties based on color, shape, free of blemishes by insect and disease, bird or stem puncture, large size, sugar or tart, acids, pressure, texture, flavor.
- **Profitable Varieties**: Market acceptance of highest pricing (>$3.00/lb.); disease and insect resistance, requiring reduced inputs for organic production systems.
- **Production system:** Optimized control of pests, reduced costs of fertilizing and irrigation, economic pruning, training and harvest system (platform friendly).

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Ecco Block: Four-wire Trellised Slender Spindle Orchard

Established by Dr. Dave Rosenberger, Peter Jentsch & Steve Hoying

- Design of the orchard for RCBD experimentation on apple production
- Scab Resistant Varieties (SRC) on G.11 Rootstock
- 11 PRI SRC selections.

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Ecco Block: Four-wire Trellised Slender Spindle Orchard

Established by Dr. Dave Rosenberger, Peter Jentsch & Steve Hoying

- Design of the orchard was for continued experimentation on apple production using SRC's on G.11 using reduced risk pest management programs compared to conventional programs using 11 PRI SRC selections chosen.

  - 2009: Tree removal, till, disk, level
  - 2010: Drill and plant per variety at 3' in row spacing x 11' row spacing
  - Drip irrigation establish after planting, trellis supported above wood chip mulch.
  - Diagonal end and anchor post support; four-wire trellis slender spindle tree architecture; annual bench cut pruning for ventral bud break, horizontal branch replacement, increased fruit bud development.

Three new varieties top worked in 2012

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Ecco Block: Four-wire Trellised Slender Spindle Orchard

Varieties	Approx Harvest Date
1. *Winecrisp*	*Early-mid October*
2. *Pixie Crunch*	*Mid-late* September
3. Crimson Topaz	*Early October*
4. *Nova Easygro*	*Early-mid September*
5. *Honeycrisp*	*Mid September*
6. *Crimson Crisp*	*Mid-late September*
7. *Liberty*	*Late September*
8. *Scarlet O'Hara*	*Late September*
9. *Florina Querina*	*Late October*
10. *Enterprise*	*Late October*
11. *Goldrush*	*Mid November*

Cummins Nursery
1408 Trumansburg Rd
Ithaca, NY 14850

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Ecco Block: Four-wire Trellised Slender Spindle Orchard

- Low Organic Management (Trmts. 1-4)
- *High Organic* Management (Trmts. 5-8)
- *Conventional IPM* (Trmt. 9)
- *Untreated (Organic thinning & fungicides)*

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Ecco Block: Four-wire Trellised Slender Spindle Orchard

2014 Organic Inputs for fertilizer & weed mgt.

- 12.5 ton *Giroux's Composted Poultry Manure: $750.00 (1/2 of a 25 yard load)*
- *5 (100) yard loads of mixed harwood wood chips Load with skidsteer & spread using tractor mounted spreader (2 person 77.0 hrs. $924.00)*
- *Weed mgt prior to fertilizer and wood chip (8.0 hrs @ $12.00 per hr. $96.00)*

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Ecco Block: Four-wire Trellised Slender Spindle Orchard

In Row Tree Weed Management

* 500 yards ‘Free Hard Woodchip’ 500 yards / A
- 4-6” depth on 12 rows @ 330’ in 11’ row spacing
- Skid steer loader and woodchuck spreader
- Ave. 103’ per hour + Equip.(Total 77 hours)
- Spreading cost of labor: $924.00
- Increased time due to binding and cleaning of of auger

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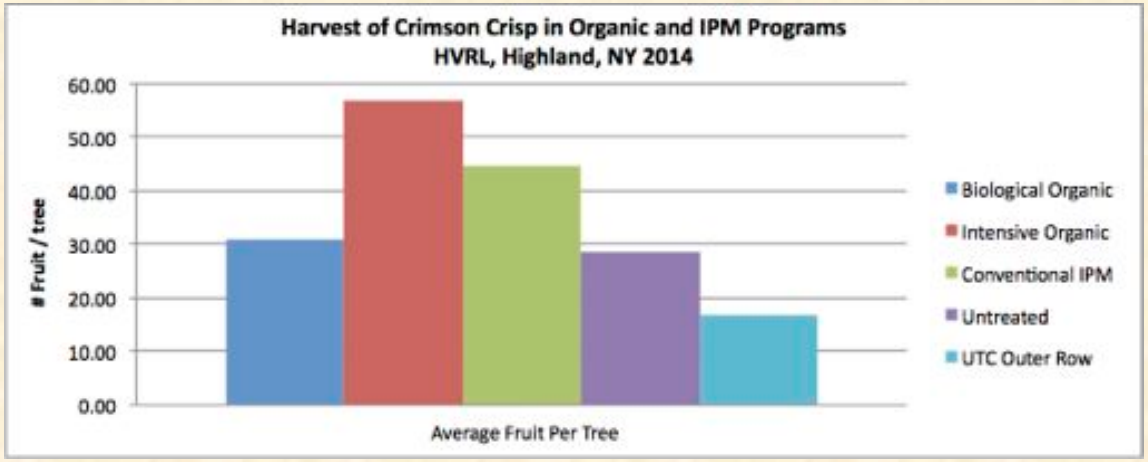
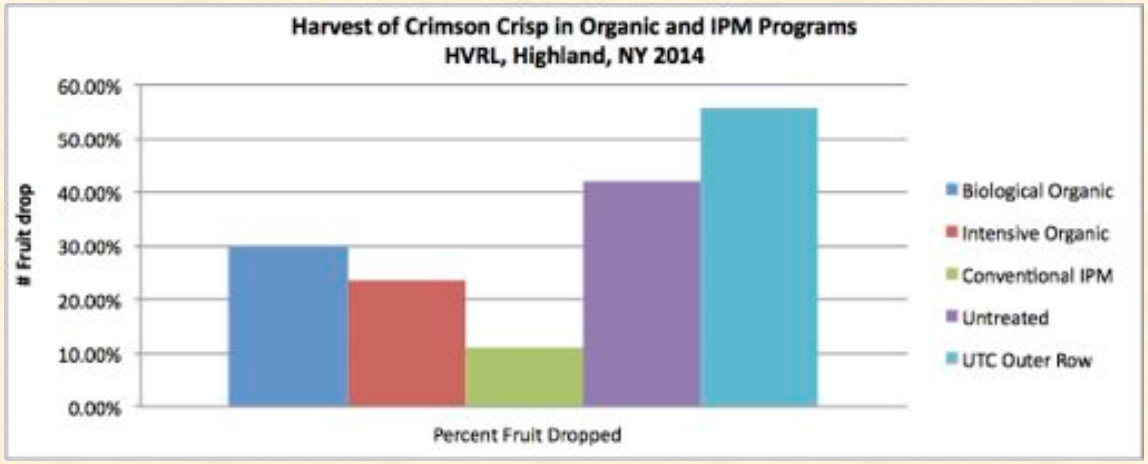
Ecco Block: Four-wire Trellised Slender Spindle Orchard





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Biological Control & Mating Disruption in Organic Apple Production

Foundational Principal: Cultivar selection

Table 2. Mean fruit injury at harvest from various arthropod pests on 23 apple cultivars grown at Kearneysville, W.Va., in the1995 NE-183 Multidisciplinary Apple Cultivar Evaluation Regional project planting for 2000–03.

Cultivar	Percent fruit injury by						Percent clean fruit
	TPB[z]	PC	CM and OFM	TABM and RBLR	AM	EAS	
Arlet	2.9 e[y]	7.9 a–d	8.9 lm	5.9 hij	39.9 ab	0.5 ef	43.4 f–i
Braeburn	1.4 e	3.9 d	24.3 e–i	17.0 bc	27.7 bcd	2.2 bcd	35.3 h–k
Cameo	6.6 a–d	9.1 a–d	37.0 a	12.7 cde	13.6 g–j	2.1 b–e	32.2 jk
Creston	3.5 de	8.5 a–d	28.1 c–h	8.4 e–i	15.2 f–j	1.5 b–f	41.2 f–j
Enterprise	2.7 e	10.0 a–d	21.3 h–j	16.7 bc	16.2 f–i	1.6 b–f	42.4 f–i
Fortune	2.8 e	6.3 cd	30.0 b–f	14.6 cd	25.3 c–f	0.7 def	40.9 f–k
Fuji Red Sport #2	3.9 cde	4.5 d	25.6 d–h	17.0 bc	18.6 e–h	2.3 bc	42.8 f–i
Gala Supreme	4.3 b–e	6.9 bcd	35.9 ab	26.5 a	8.8 h–l	1.9 b–e	31.1 k
Ginger Gold	4.2 b–e	14.0 ab	6.3 lm	6.8 g–j	47.1 a	0.0 f	37.9 g–k
Golden Delicious	3.7 cde	7.9 a–d	33.1 abc	6.0 hij	12.9 g–j	0.8 c–f	44.3 e–h
Golden Supreme	8.1 a	12.6 abc	17.6 ijk	5.3 ij	11.0 h–k	4.9 a	56.7 bcd
GoldRush	4.1 cde	4.5 d	37.9 a	20.3 b	0.8 kl	0.9 c–f	45.0 e–h
Honeycrisp	3.9 cde	14.6 a	13.0 kl	4.6 ij	33.4 bcd	3.0 b	43.0 f–i
NY75414-1	1.3 e	9.7 a–d	23.1 g–j	7.1 f–j	2.0 kl	1.0 c–f	59.7 b
Orin	2.2 e	9.5 a–d	23.8 f–j	12.7 cde	14.3 g–j	0.8 c–f	49.4 c–f
Pioneer Mac	1.6 e	12.7 abc	17.0 jk	5.4 ij	13.7 g–j	0.9 c–f	53.5 b–e
Pristine	3.3 de	8.1 a–d	2.8 m	6.5 g–j	0.0 l	0.0 f	80.3 a
Sansa	2.7 e	8.8 a–d	7.3 lm	7.1 f–j	35.1 bc	1.0 c–f	47.8 d–g
Senshu	2.6 e	6.0 cd	29.9 b–g	6.7 g–j	4.8 jkl	0.1 f	53.7 b–e
Shizuka	3.7 cde	5.6 cd	23.8 f–j	10.2 d–h	35.0 bc	1.5 b–f	33.5 ijk
Suncrisp	7.7 ab	3.5 d	31.1 a–e	11.7 def	15.9 f–i	2.7 b	41.4 f–j
Sunrise	4.8 a–e	8.0 a–d	2.4 m	3.1 j	23.6 d–g	0.7 def	59.1 bc
Yataka	1.8 e	9.7 a–d	21.3 h–j	4.5 ij	16.5 f–i	2.7 b	54.2 b–e

[z]TPB = tarnished plant bug; PC = plum curculio; CM = codling moth; OFM = oriental fruit moth; TABM = tufted apple bud moth; RBLR = redbanded leafroller; AM = apple maggot; EAS = european apple sawfly.

[y]Different letters denote significant differences among means according to the Waller-Duncan test ($P \leq 0.05$).

Hogmire, H.W., Miller, S.S.
Relative Susceptibility of New Apple Cultivars
To Arthropod Pests. Hort. Science 40(7); 2071-2075. 2005

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Biological Control & Mating Disruption in Organic Apple Production

i. Orchard Introduction of Predatory Mite

ii. Granulosis Virus for Codling Moth

iii. Bt for leafroller management

iv. Establishment of long-term persistent nematode populations for endemic plum curculio control (Prospect Farm, Fishkill Farm & Westwind Farm 2013; HVRL 2014)

v. Trap and Kill for BMSB

vi. Mating disruption Codling Moth & Oriental Fruit Moth

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Implementing Biological Control of Mite in Hudson Valley Apple Orchards.

Biological Control Workshop

Development of Biological Control in Conventional and Organic Tree Fruit.

http://blogs.cornell.edu/jentsch/northeast-sustainable-agricultural-education-nesare-projects/

J.Ogrodnick

New York State Agricultural Experiment Station

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- **Mite complex on Hudson Valley apple.**

European Red Mite
***Panonychus ulmi* Garman**

Two Spotted Spider Mite
***Tetranychus urticae* Koch**

Apple Rust Mite
***Aculus schlechtendali* Nalepa**

Amblyseius fallacis

Zetzelia mali

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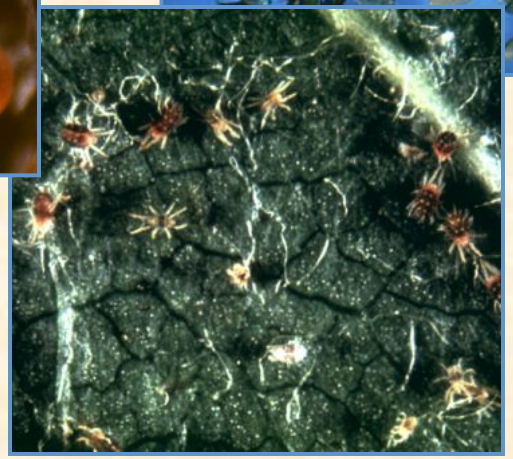
European Red Mite *Panonychus ulmi* Garman

- ERM over-winters as and egg, hatching by tight cluster. It can develop and sustain high populations. Resistant to many pesticides, some of which flare mite populations.

- Bronzing caused by prolonged leaf feeding reduces photosynthesis and production of carbohydrates. Reducing fruit size, color, return bloom and set.



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Amblyseius fallacis

Over-winter as adults primarily in ground cover. Over-wintering mortality typically low.

Move into the trees well after ERM have become established.

Feed on phytophagous mite. Move off of the trees when ERM populations are low.

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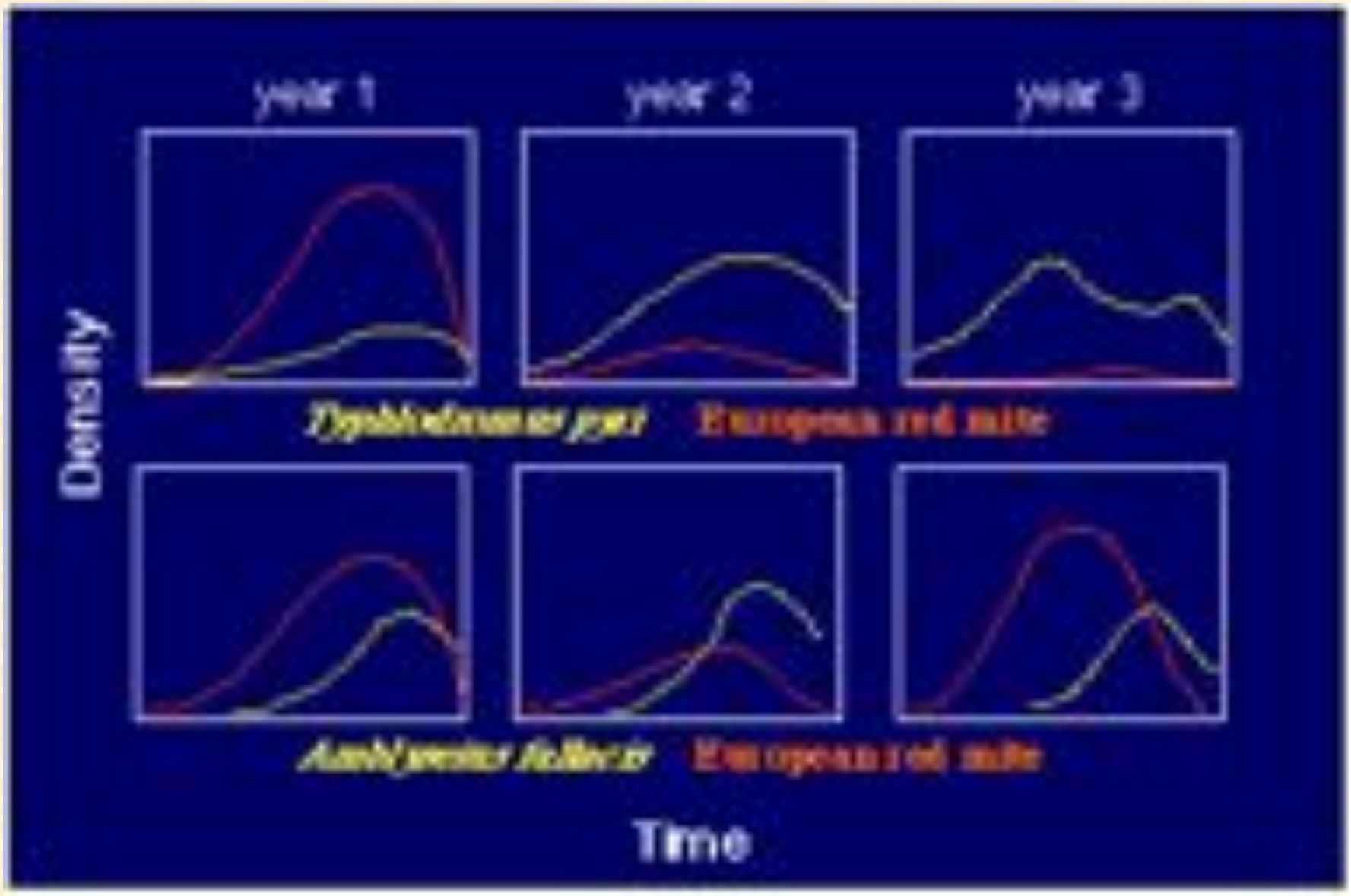
Biology of Typhlodromus Pryi.

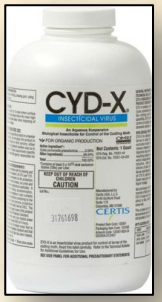
- Overwinter as mated females in trees & emerge at bud break.
- Feed on early rust mite population until TC.
- Feed on ERM populations as they hatch through bloom.
- Will also feed on pollen during bloom.

Biology of Typhlodromus Pryi.

- *T. pyri* continue to feed on rust mite, ERM and TSSM throughout the season.
- It requires 2-3 years for *T. pyri* populations to become established.
- Populations of *T. pyri* at or above 1 per leaf will maintain ERM populations below economic threshold & provide sustainable mite management.
- Conservation of *T. pyri* populations is the key to successful mite control.


year 1
year 2
year 3
Density
Time

ii Granulosis Virus for Codling Moth



Cydia pomonella granulosis virus (CpGV):

A granulovirus, large rod-shaped viruses divided to two genera in which granulovirus is found in the family *Baculoviridae*. The virus forms small bodies called granules containing a single virion.

- CpGV is a virus of invertebrates specific to *Cydia pomonella*, **Codling moth.**
- CpGV is highly pathogenic, it is known as a fast GV that will kill its host in the same instar as infection making it a strong biological control.
- Formulations include: CYD-X Insecticidal Virus, Virosoft CP4. Labeled formulations suggest applications of GV be made at first hatch for each generation. The first spray for CM is recommended at first egg hatch, which occurs 220-250 DD (base 50°F) after sustained trap catch followed by 5-7d intervals through complete hatch.
- Use in combination with CM / OFM mating disruption.

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iii **CM / OFM mating disruption.**

- **Application: For CheckMate CM-OFM DUEL** use 150 to 200 dispensers per acre shortly before oriental fruit moths begin to emerge in the spring (biofix), or when the moths are first detected in pheromone traps.

- If application occurs following biofix or during the growing season, the orchard must be treated with insecticide treatments that will effectively control hatching larvae until egg laying by previously mated female moths has ceased to occur.

- Dispensers are hung from a thumb-size tree limb approximately three feet (one meter) below the top of the tree, within the canopy.

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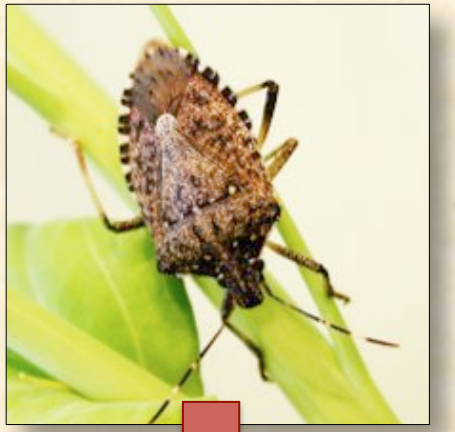
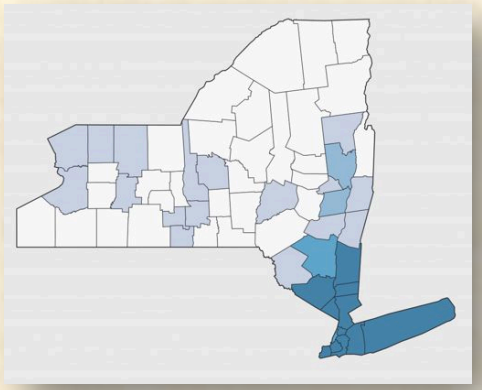
Integrated BMSB Management





BMSB use of Deciduous Host Trees

Adult BMSB movement

Trap and Kill Station
Adult Reduction

Use of *Beauveria bassiana* strain GHA in organic mgt.

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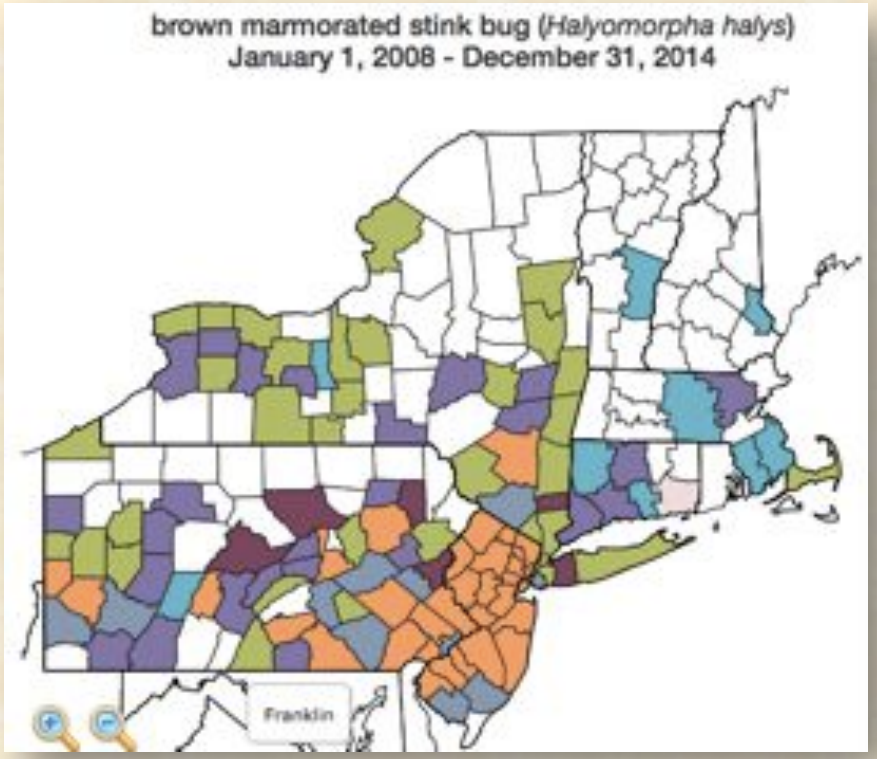
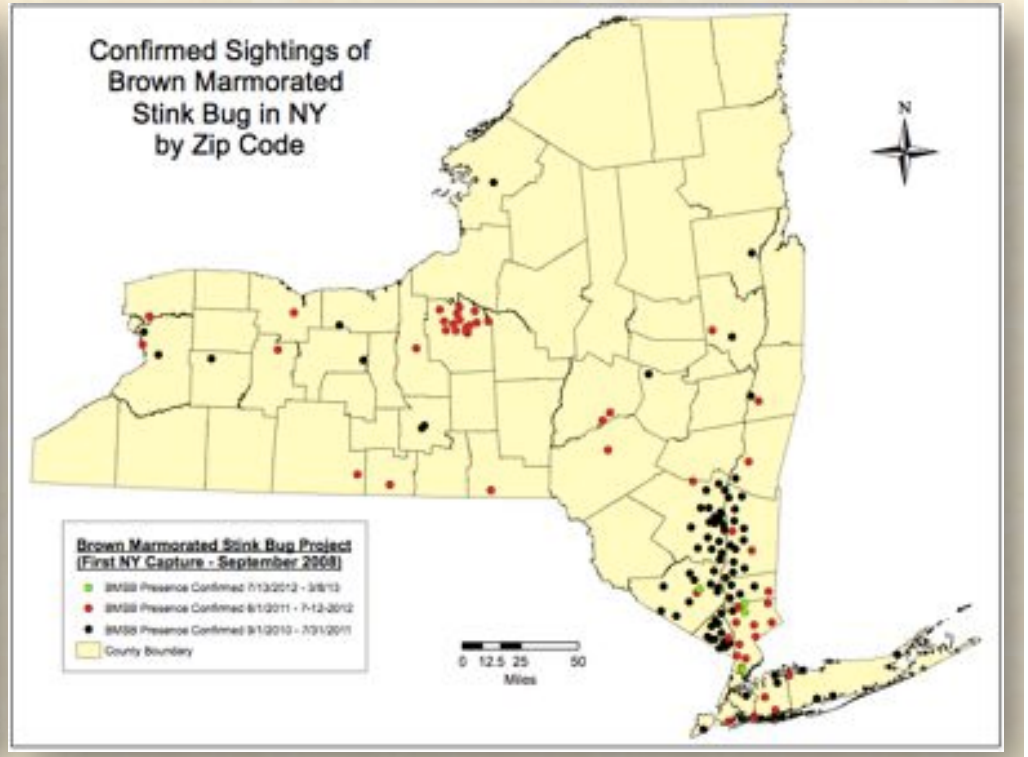
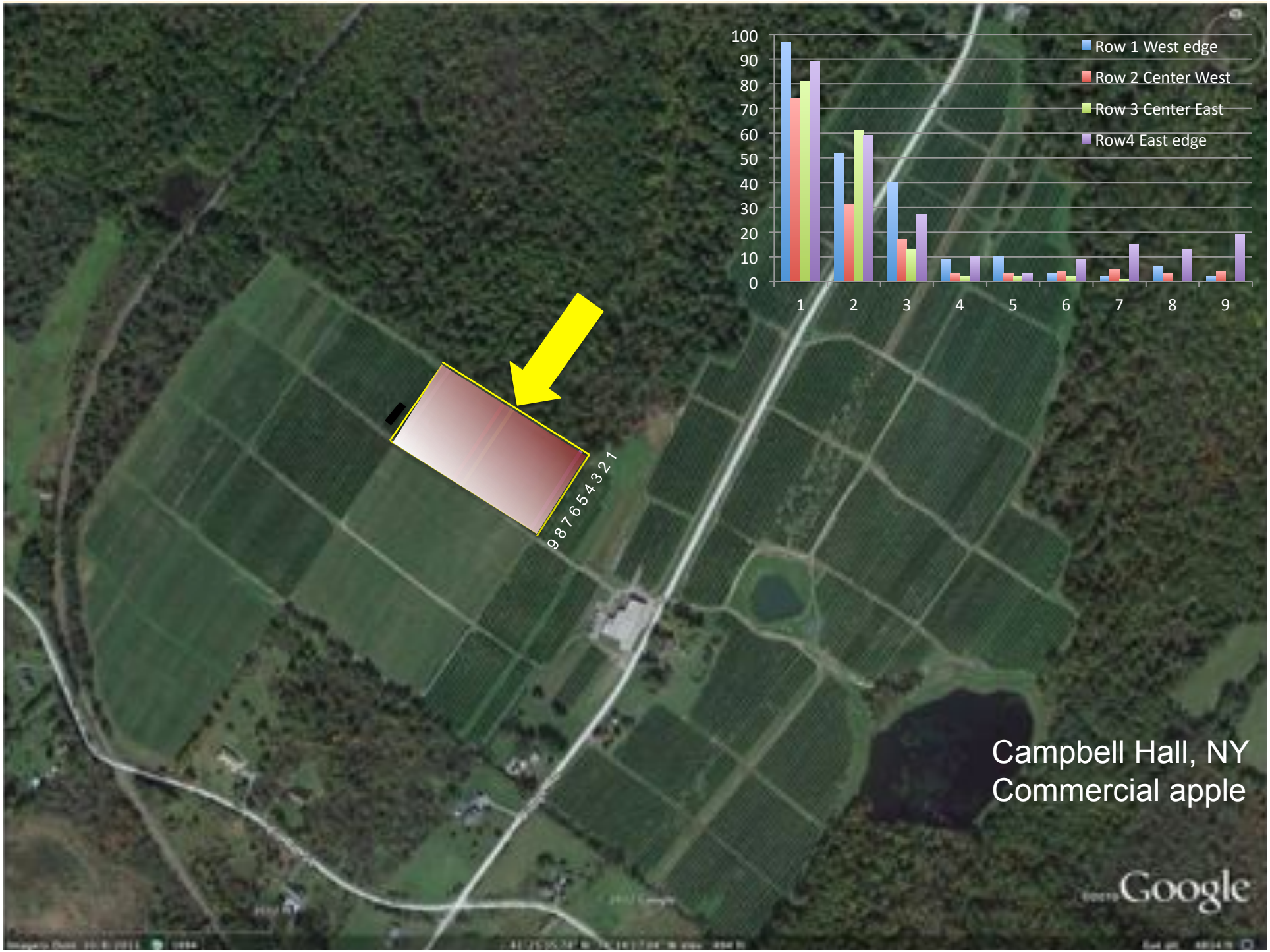
2013 BMSB Injury to Organic Pepper Hudson Valley, NY

The species was first documented in NY in the Hudson Valley Region in 2008**. In 2012 the pest cause significant injury to pome fruit in three NY counties.**






100
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70
60
50
40
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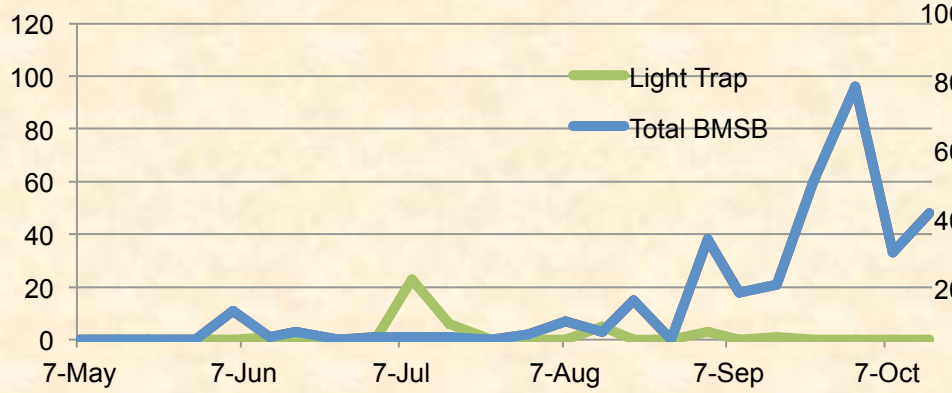
4
5
6
7
8
9
Row 1 West edge
Row 2 Center West
Row 3 Center East
Row4 East edge
9 8 7 6 5 4 3 2 1
Campbell Hall, NY
Commercial apple
Google

Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State

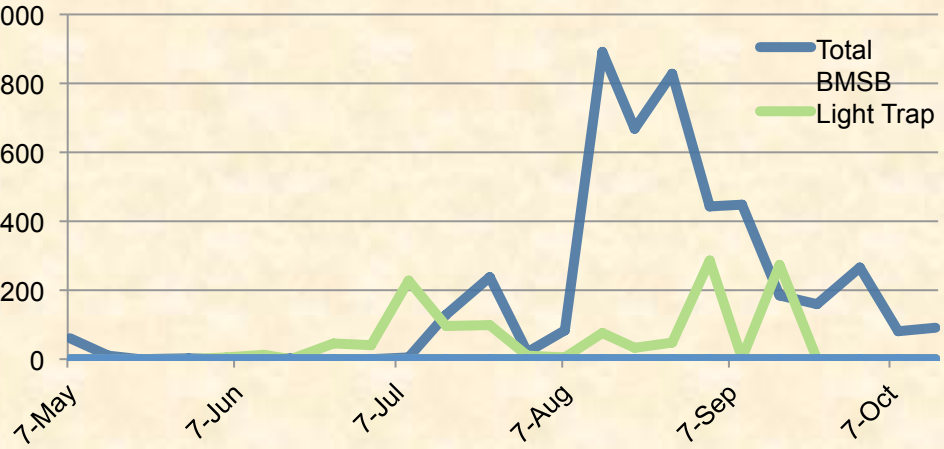
BMSB Trap Captures; #10 + MDT & Black Light

Campbell Hall, NY 2013



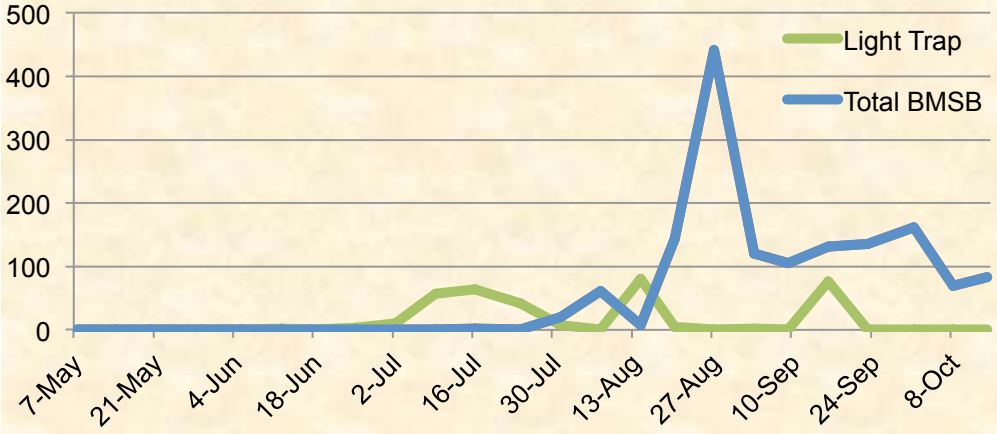
BMSB Trap Captures; #10+MDT & Black Light

Marlboro, NY 2013



BMSB Trap Captures; #10+MDT & Black Light

Milton, NY 2013



CORNELL'S
Hudson Valley
LABORATORY

- Integrated pest management using 4 components employed to reduce BMSB field populations.
  - Netting
  - Halogen light
  - Pheromone blend (USDA #10 & MDT lures)
  - Biological control (*Beauveria bassiana*)

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MDT
USDA #10
Hudson Valley
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Proceedure:

- Nets were of Blockade™ Insect Screen 36 x 25 mils by PAK Unlimited, INC.
- To a single trap was added a 500W light.
- On day 0 (7 September), each net were sprayed with 0.75 gal. of Bifenthrin 10DF solution using 3.0 oz./gal.
- On days 0-1, nets were monitored with no captures of BMSB observed.
- On day 2 (9 September), lures and 500w Halogen light were added.
- Sampling of netted traps were made through October.

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Proceedures Con't

- Generator driven 500W Halogen light directed toward the field population of BMSB.
- Plastic sheets were used to define location and number of BMSB trap and kill data.
- Study was designed to:
  1. Determine the attractiveness of lights with net relative to net alone
  2. Determine the number of BMSB observed coming from field vs forest sides of trap

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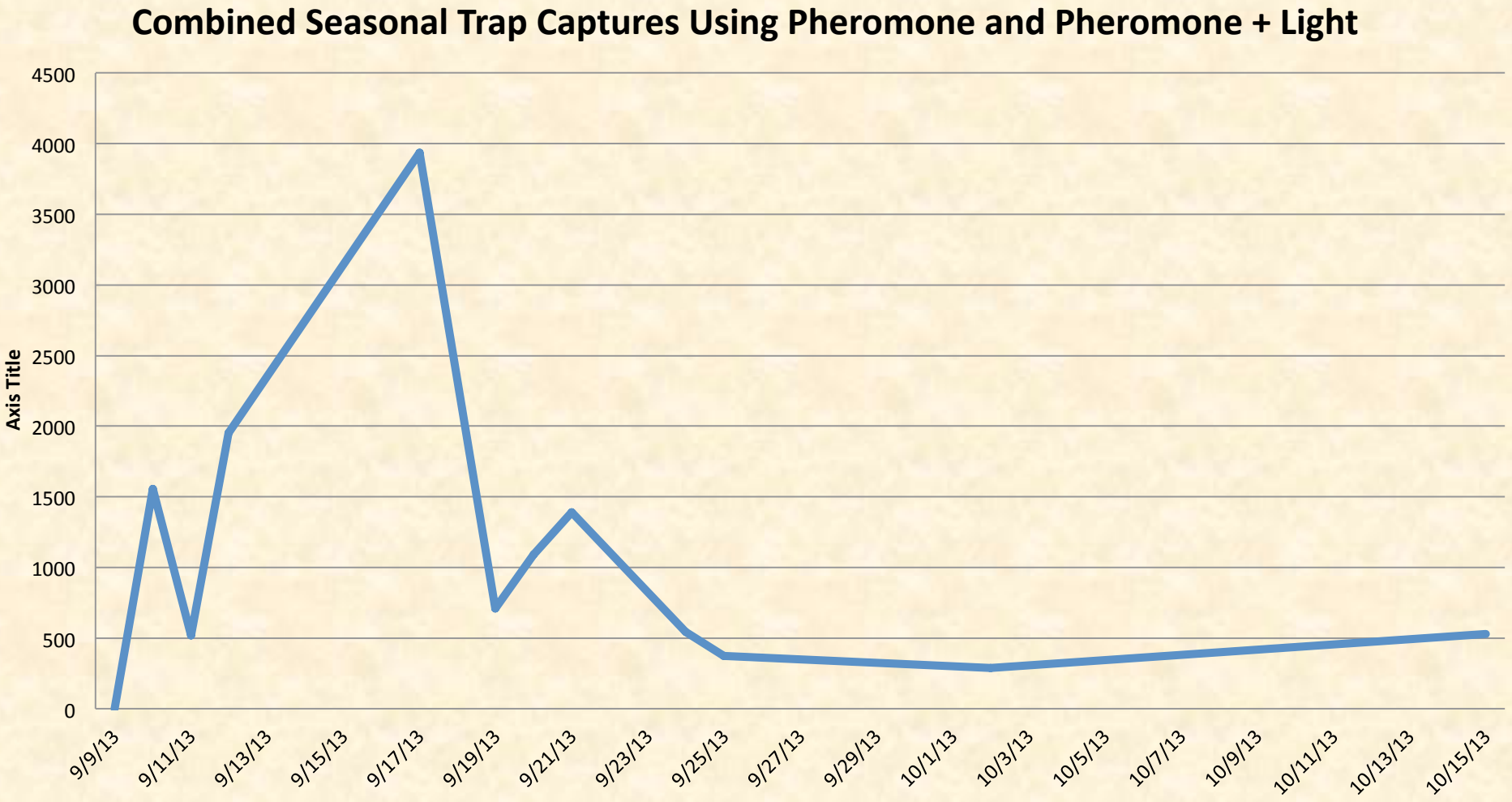
- BMSB populations were observed on Black Walnut and Tree of Heaven, appearing to have acted as intermediate hosts, fostering migrations
- BMSB locations on netting traps with only pheromone were equally dispersed on the field and forested sides of net.
- Nights when lights were on, BMSB were heavily concentrated on the field side in front of the light with higher numbers observed.

Ailanthus altissima

Juglans nigra

Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State



Total BMSB = 12,894

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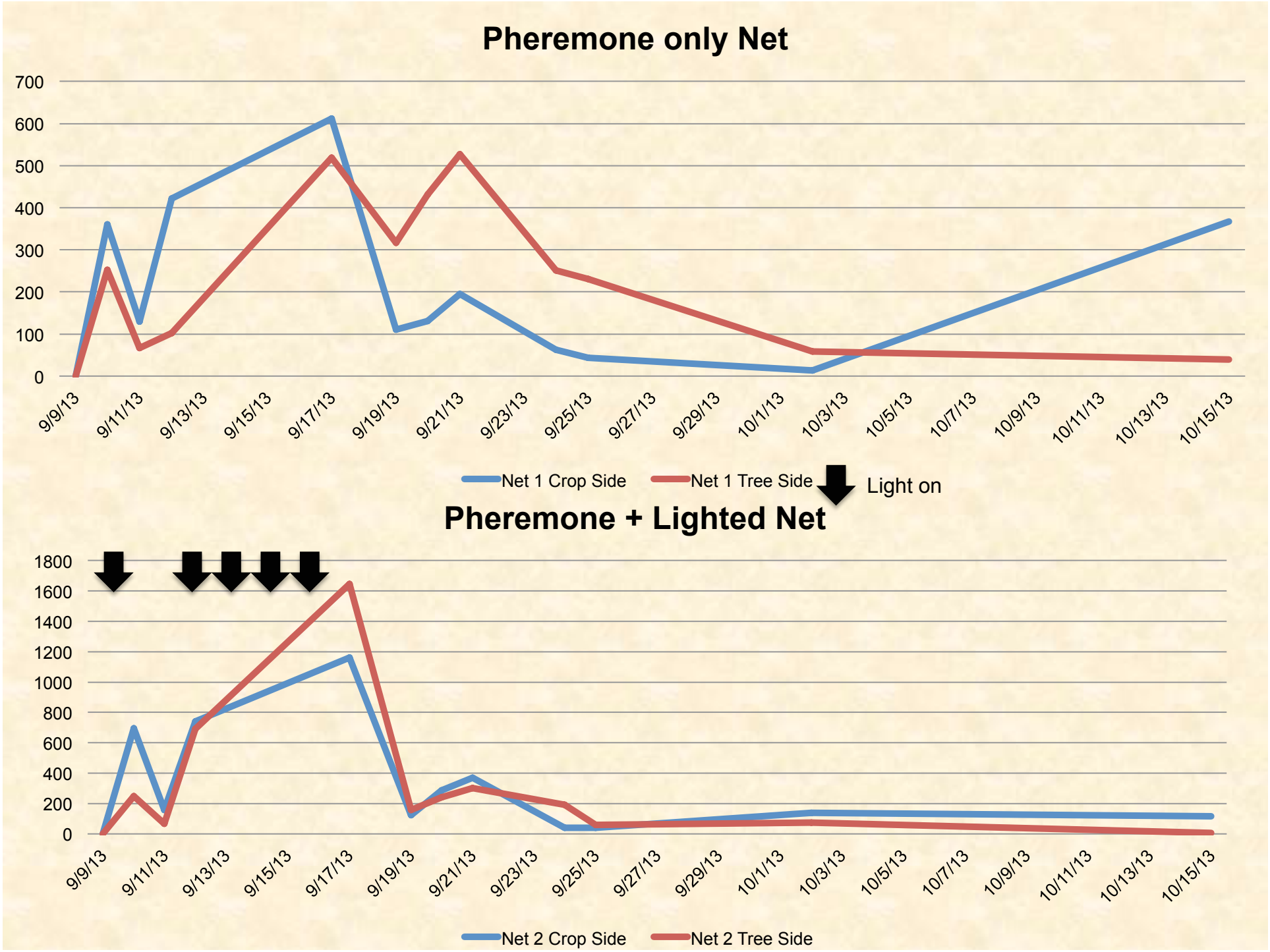
Pheremone only Net
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10/9/13
10/11/13
10/13/13
10/15/13
Net 1 Crop Side
Net 1 Tree Side
Light on
Pheremone + Lighted Net
1800
1600
1400
1200
1000
800
600
400
200
0
9/9/13
9/11/13
9/13/13
9/15/13
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10/1/13
10/3/13
10/5/13
10/7/13
10/9/13
10/11/13
10/13/13
10/15/13
Net 2 Crop Side
Net 2 Tree Side


BMSB Infested With
Beauveria bassiana strain GHA
(Mycotrol-O @ 16 oz./A)
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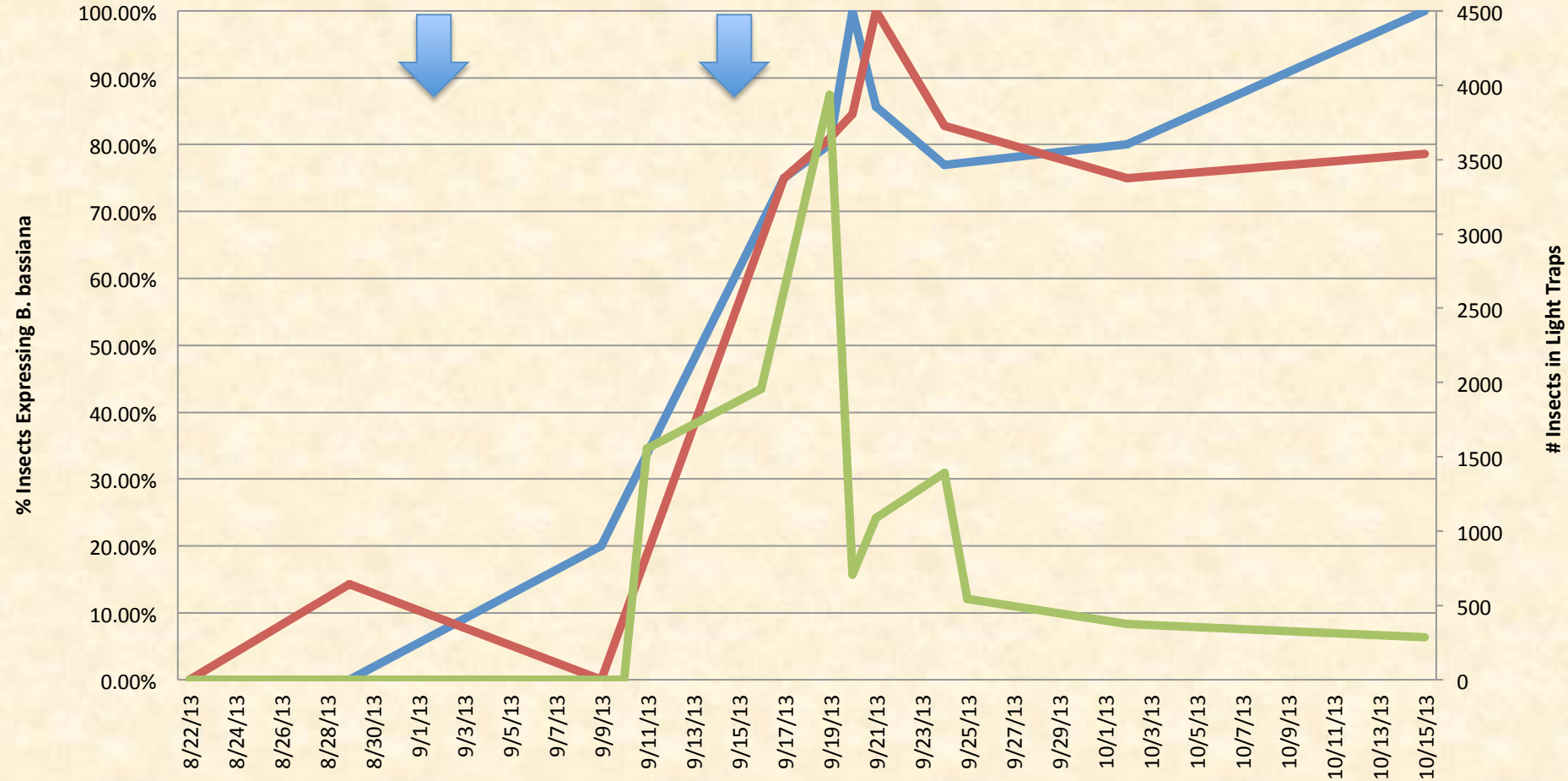
B. bassiana expression over Time



	8/22/13	8/29/13	9/9/13	9/10/13	9/11/13	9/16/13	9/17/13	9/19/13	9/20/13	9/21/13	9/24/13	9/25/13	10/2/13	10/15/13	
Net 1 infection	0.00%	0.00%	20.00%			73.66%		75.00%	80.00%	100.00%	85.71%	76.92%		80.00%	100.00%
Net 2 infection	0.00%	14.29%	0.00%			82.95%		75.00%	80.95%	84.62%	100.00%	82.76%		75.00%	78.57%
Population	0			0	1556	521	1954		3935	708	1090	1392	545	375	287

Beauvaria bassiana strain GHA applications
(Mycotrol-O @ 16 oz./A)

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Foundational Principals for Success with Insect Pest Management:

- **Cultivar selection for reduced insect preference**
- **High density planting system**
- **Biological control for Mite, Codling Moth, Plum Curculio**
- **Mating Disruption for Dogwood Borer, Oriental Fruit Moth and Codling moth.**
- **Employing Trap and Kill for BMSB**
- **Oil during dormant for San Jose Scale management**
- **Surround for repellency of adult Plum Curculio**

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