

BROWN MARMORATED STINK BUG – WHAT NEXT?

MONITORING BMSB IN PENNSYLVANIA ORCHARDS - 2013 SEASON



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PENNSTATE



College of Agricultural Sciences

AlphaScent SB lure

USDA ARS #10

Monitoring BMSB ...

USDA ARS #20

Ag-Bio Smart lure

Harlequin bug lure

Hercon lure

Rescue Stink Bug Attractant



2013 BMSB monitoring projects

1. Lure comparisons

- a) NIFA SCRI coordinated project
three locations
- b) commercially available lures
single location

2. Trap comparisons

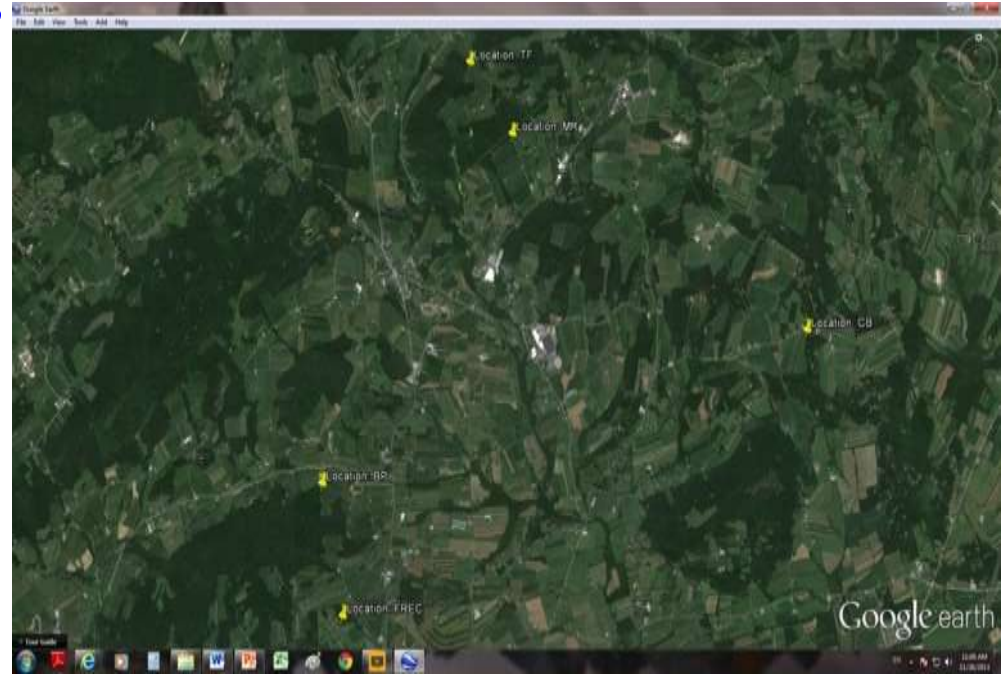
- a) *four locations*

3. Trap placement grid evaluations

- a) *four locations*

4. Alternative methods

- a) BMSB net exclusion project
- b) light trapping



2013 BMSB (commercial) lure comparisons

Treatments:

1. Alpha Scent lure (**AS**)
2. ARS # 20c from Ag-Bio (**#20c**)
3. Native SB (*com. lure*) from Ag-Bio (**H**)
4. H lure plus *Plautia stali* (*com. lure*) from Ag-Bio (**H+PS**)
5. ARS #20c plus *Plautia stali* (*com. lure*) from Ag-Bio (**#20c +PS**)
6. *Plautia stali* (*com. lure*) from Ag-Bio (**PS**)
7. Rescue lure (*com./new lure 2013*) * (**Rescue**)

All treatments replicated three times

Tall Green traps (Ag-Bio) used in all treatments

Trap data collected for 14 weeks starting **from July 29, 2013**

Trap tops rotated weekly within single replicate

Traps placed in the first row of orchard

Each trap equipped with Vaportape 2 (Hercon Env.)



2013 BMSB Lure comparisons

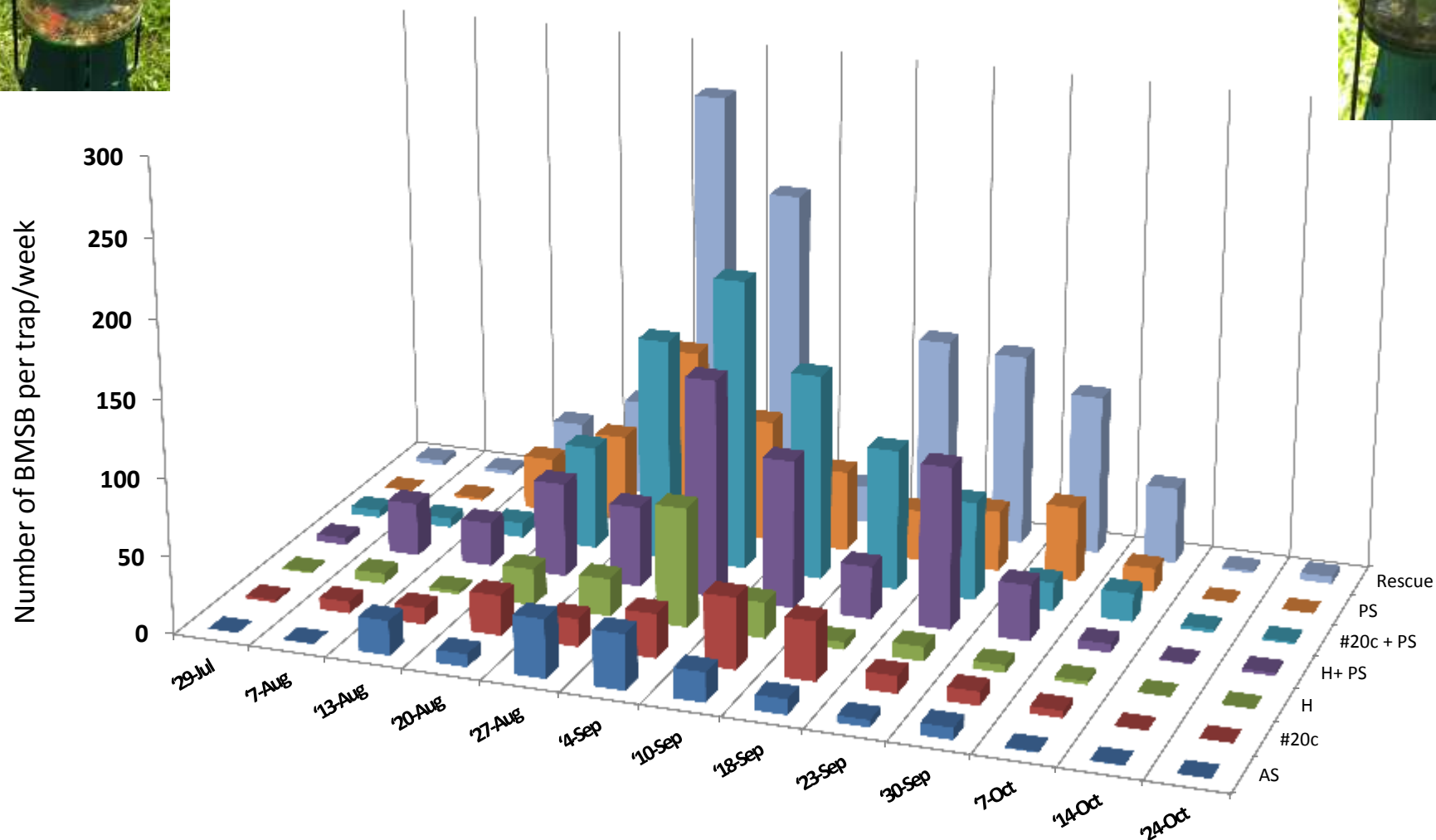


Project started : July 22, lures replicated 3x, Ag-Bio tall green traps, 14 weeks



2013 BMSB Lure comparisons

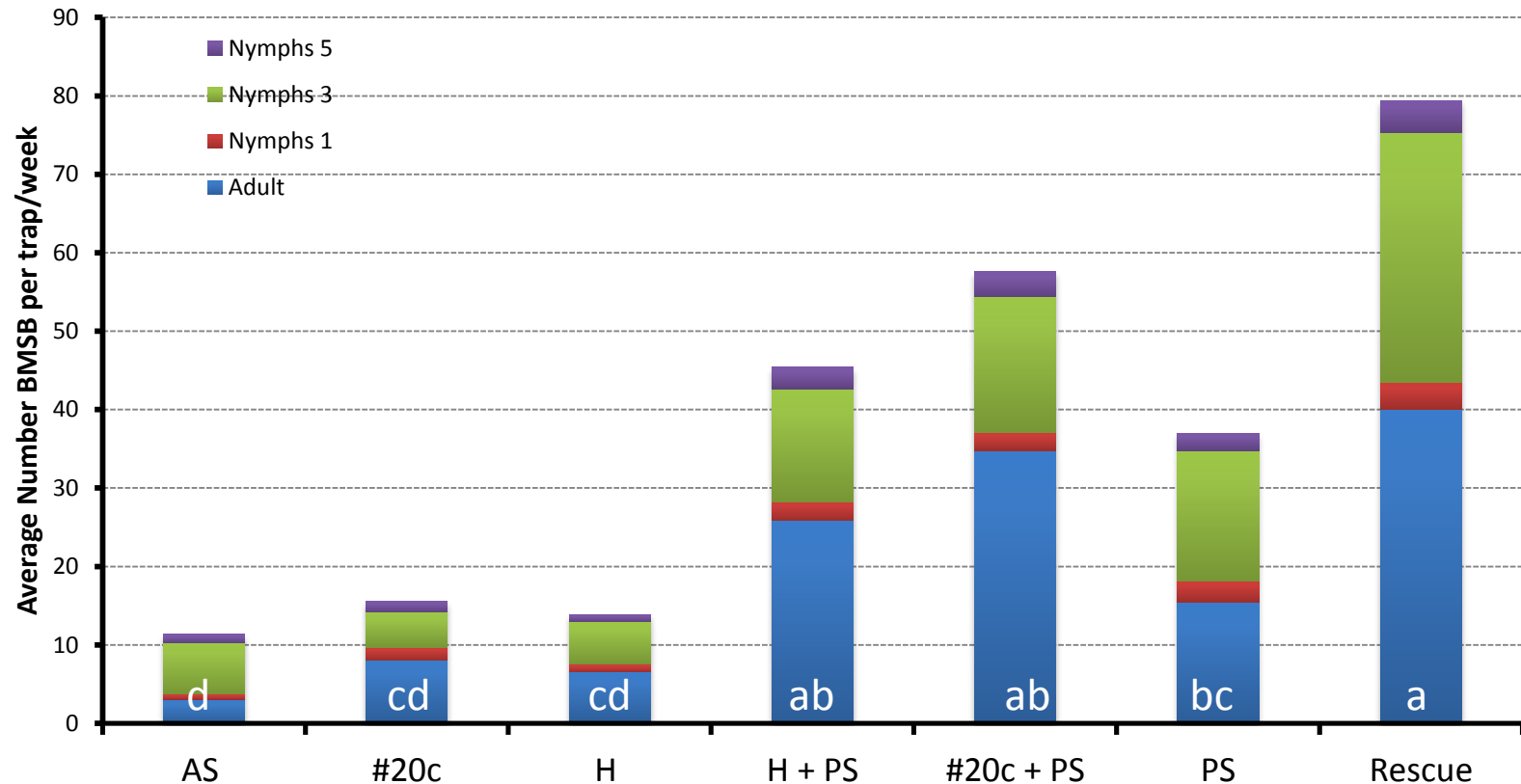
Average number of BMSB captured per trap/week/lure



Project started : July 22, lures replicated 3x, Ag-Bio tall green traps, 14 weeks

2013 BMSB Lure comparisons

Average number of captured BMSB per trap/week (all traps combined)



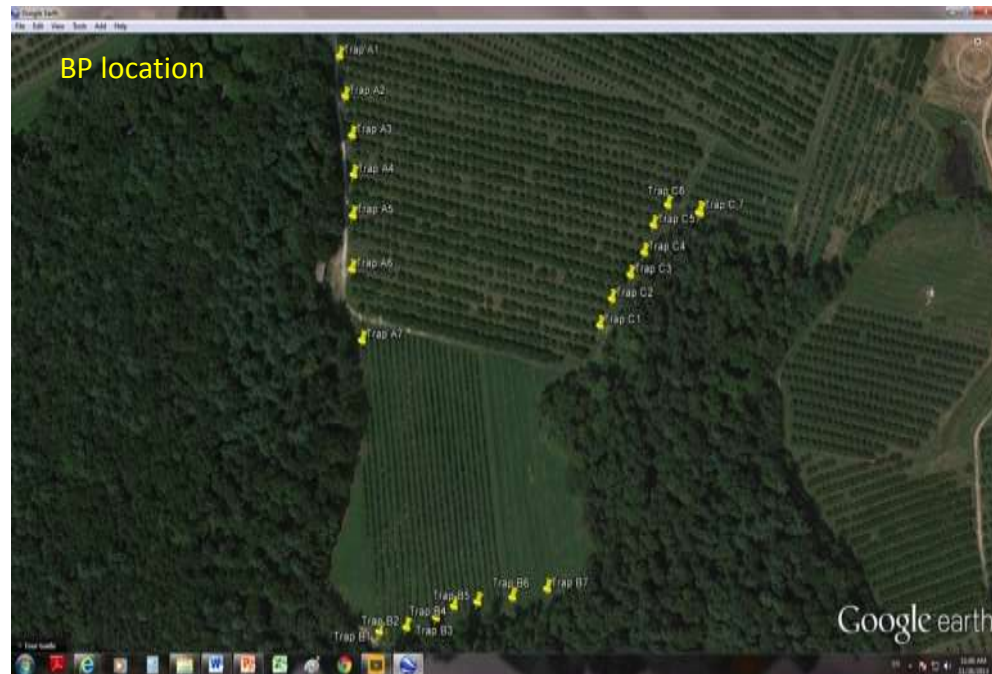
Project started : July 22, lures replicated 3x, Ag-Bio tall green traps, 14 weeks

One-Way AOV, LSD All-pairwise Comparisons, $P \leq 0.05$, sqrt transformation

2013 BMSB Trap and Trap/lure combinations

BP location (started May 23):

1. USDA ARS #20 in Small Black trap
2. USDA ARS #20 in Tall Green trap
3. Ag-Bio BMSB lure in Small Black trap
4. Ag-Bio BMSB lure in Tall Green trap
5. Rescue BMSB lure in Small Black trap
6. Rescue BMSB lure in Tall Green trap
7. Rescue BMSB lure in Rescue trap

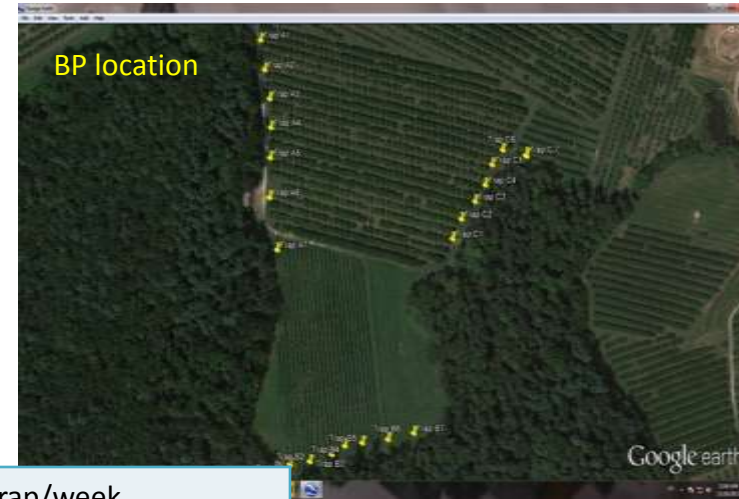


Methods:

1. All treatments, at each location replicated three times,
2. All trap tops within a replicate rotated at a weekly schedule except for stationary Rescue traps,
3. All lures were exchanged every 4 weeks,
4. Additional weekly 12 minutes (6 min during late season) visual counts on vegetation around traps,
5. Each trap equipped with Vaportape 2 (2,2, dichlorovinyl dimethyl phosphate) (Hercon Env.)



2013 BMSB Trap and Trap/lure combinations



Lure/trap	Number of stink bugs per trap/week		
	Adults	Nymphs	Native
Ag-Bio/Small Black	0.29 c	0.33 c	0.71 a
Ag-Bio/Tall Green	1.00 bc	0.57 bc	0.22 bcd
Rescue/Rescue	1.62 bc	0.27 c	0.03 d
Rescue/Small Black	4.87 b	3.47 a	0.43 ab
Rescue/Tall Green	10.46 a	3.26 a	0.32 abc
ARS #20/ Small Black	3.40 b	0.84 bc	0.14 cd
ARS #20/Tall Green	2.73 b	1.11 ab	0.05 d

2013 BMSB Trap Placement Grid evaluations

TH Apple location (started July 01):

1. USDA ARS #20 lure plus PS lure in Ag-Bio tall Black trap,
2. Edge traps (4x2) and interior trap (4 + 1); total 13 traps,
3. Weekly trap and 12 min visual observations,
4. Fruit evaluations at 1, 3 and 5 tree from trap and 1 and 2 rows from trap.
5. **Full insecticide program**



TH Cherry location (started July 01):

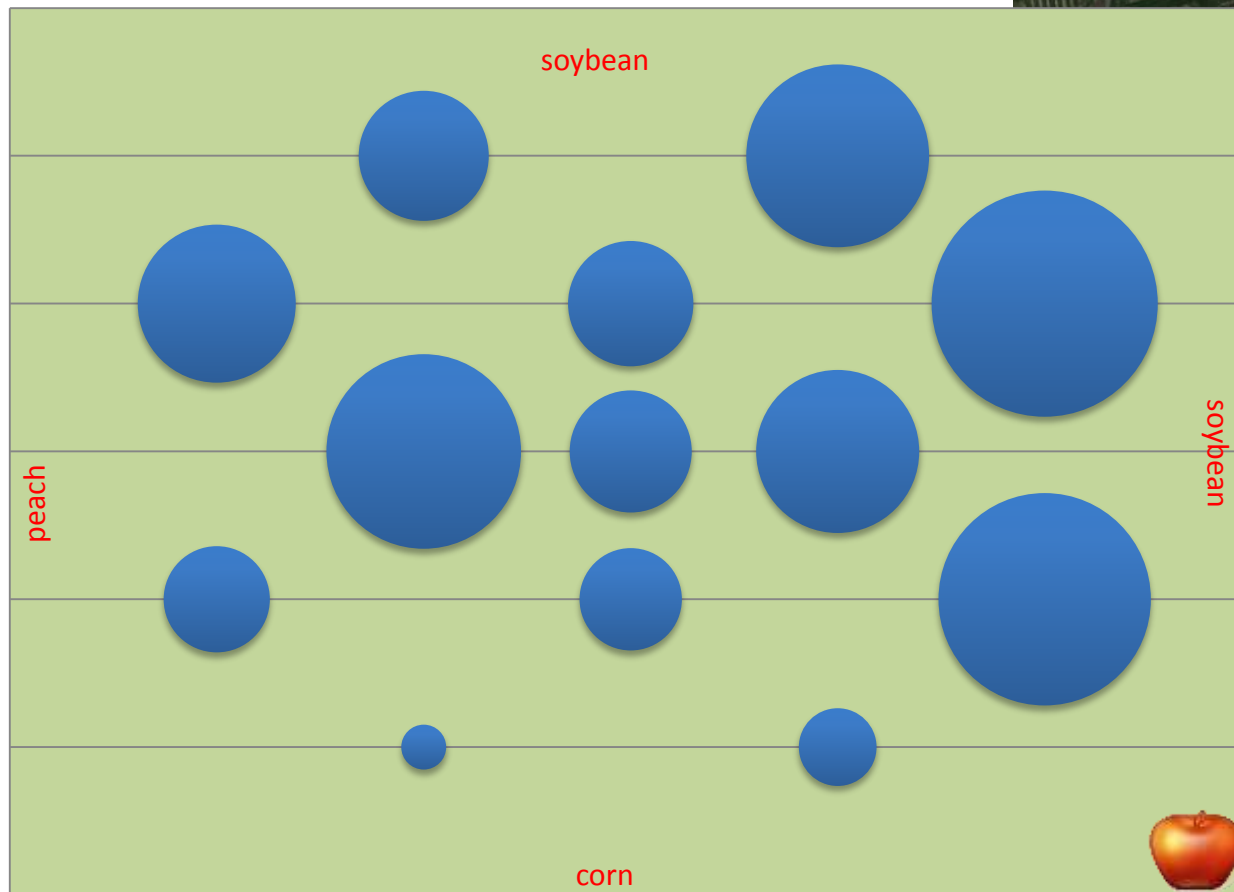
1. Rescue BMSB lures in Rescue traps,
2. Edge traps (5) and interior trap (4); total 9 traps,
3. Weekly trap capture and 12 min visual observations around each trap
4. **Low insecticides during the trial (post-harvest)**



2013 BMSB Trap Placement Grid evaluations

BMSB pressure dynamics (apple)

Average number of BMSB adults per trap/week
July 08 – October 29



Average weekly captures of BMSB adults per trap location varied from

0.5 to 12.8

BMSB Adults

Average number of BMSB adults per trap/week

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

July 8

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

July 15

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

July 22

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

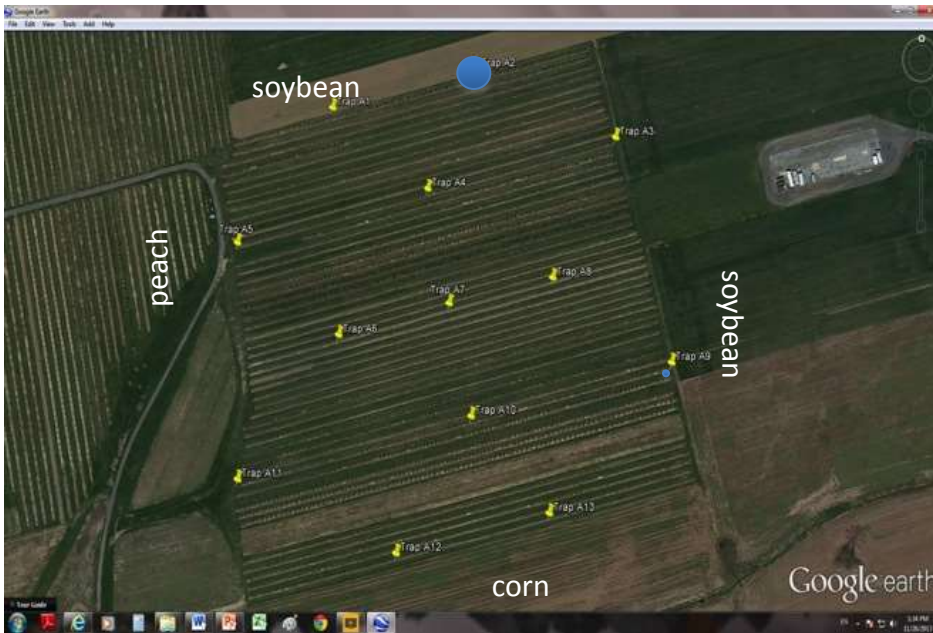
BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

July 30

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 5

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 12

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 19

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 26

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 3

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 9

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 16

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 24

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 1

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 8

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

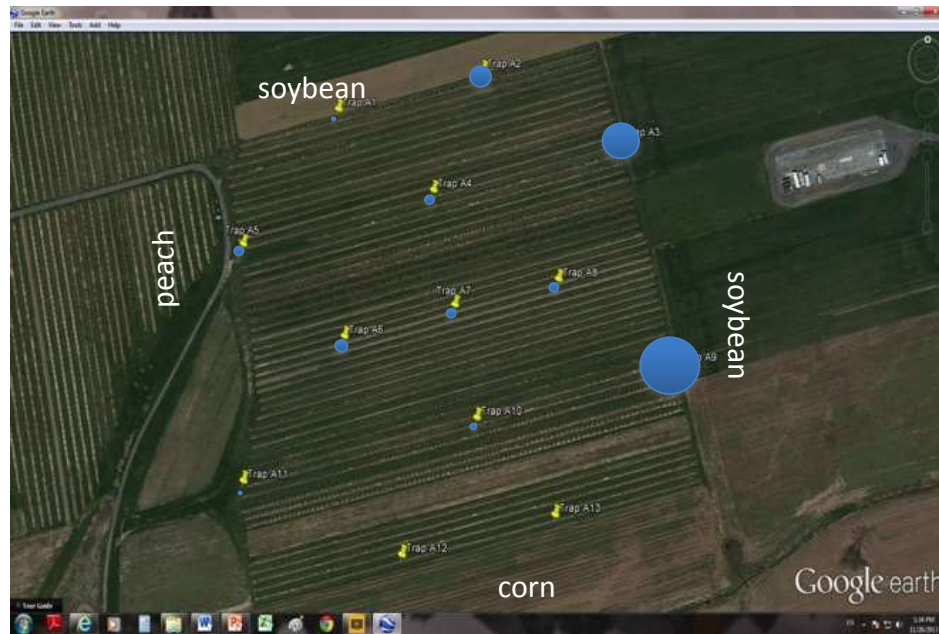
BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 15

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 22

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

TH Apple location



2013 BMSB Trap Placement Grid evaluations

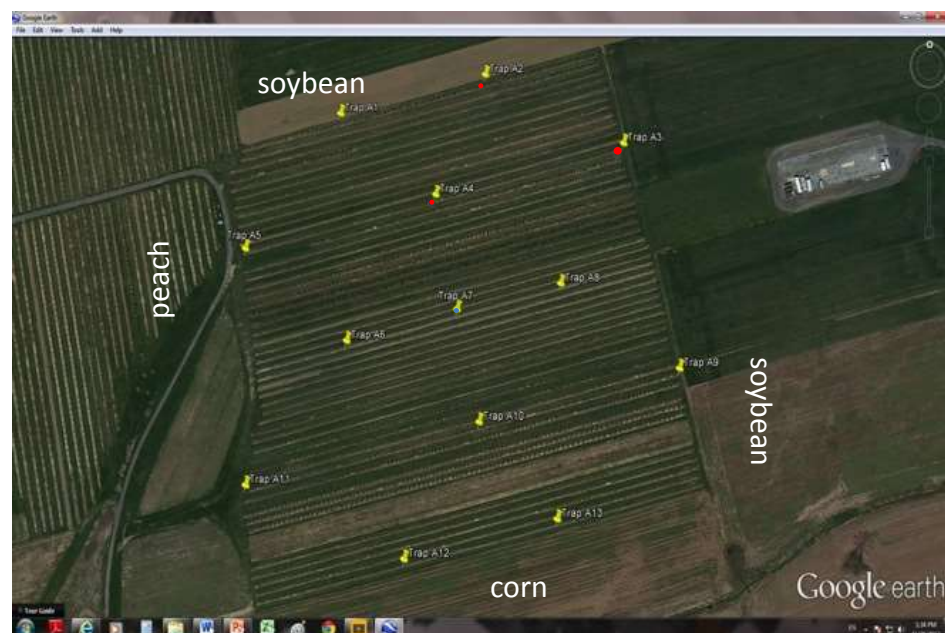
BMSB pressure distribution (apples)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 29

51

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week

BMSB nymphs

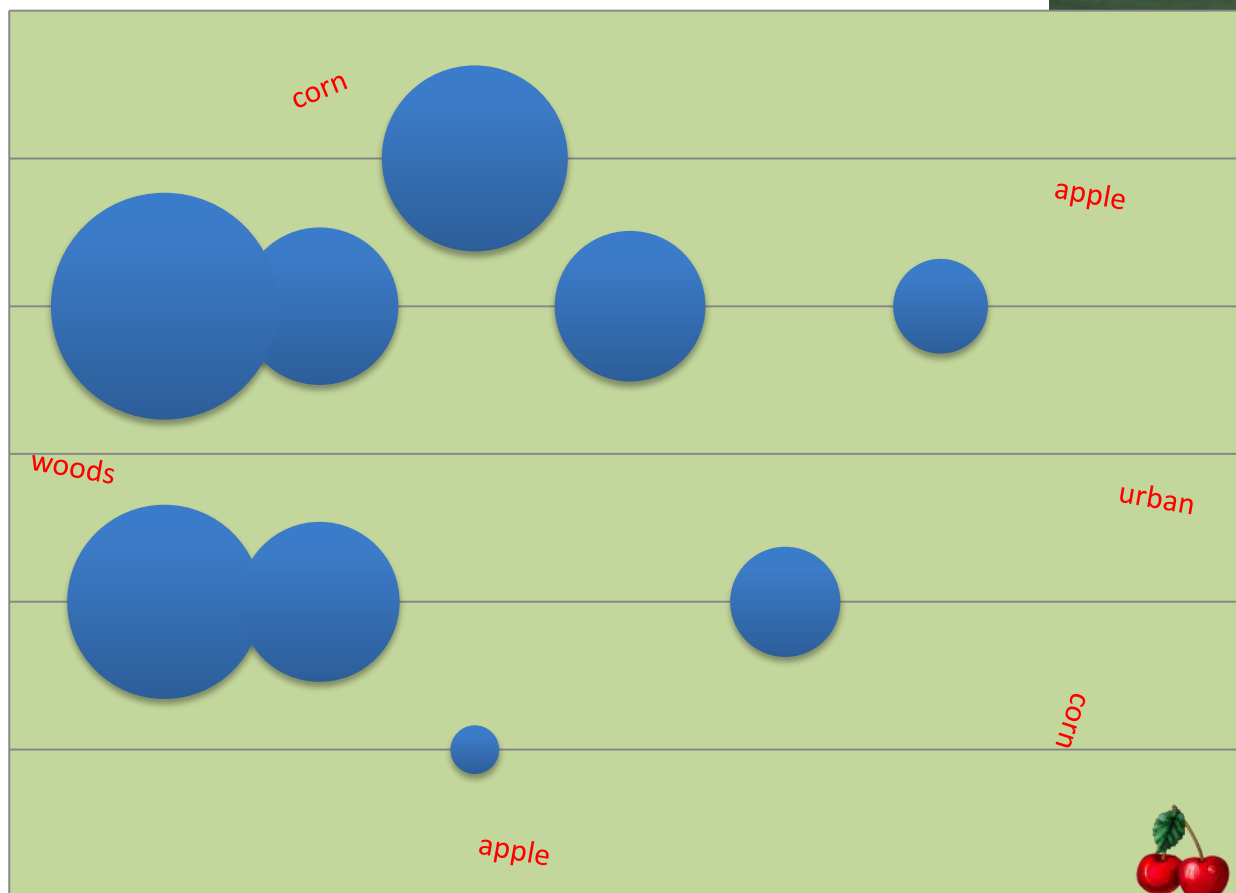
TH Apple location



2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)

Average number of BMSB adults per trap/week
July 08 – October 21



Average weekly captures of
BMSB adults per trap location
varied from
0.9 to 19.5

BMSB ADULTS

Average number of BMSB adults per trap/week

2013 BMSB Trap Placement Grid evaluations

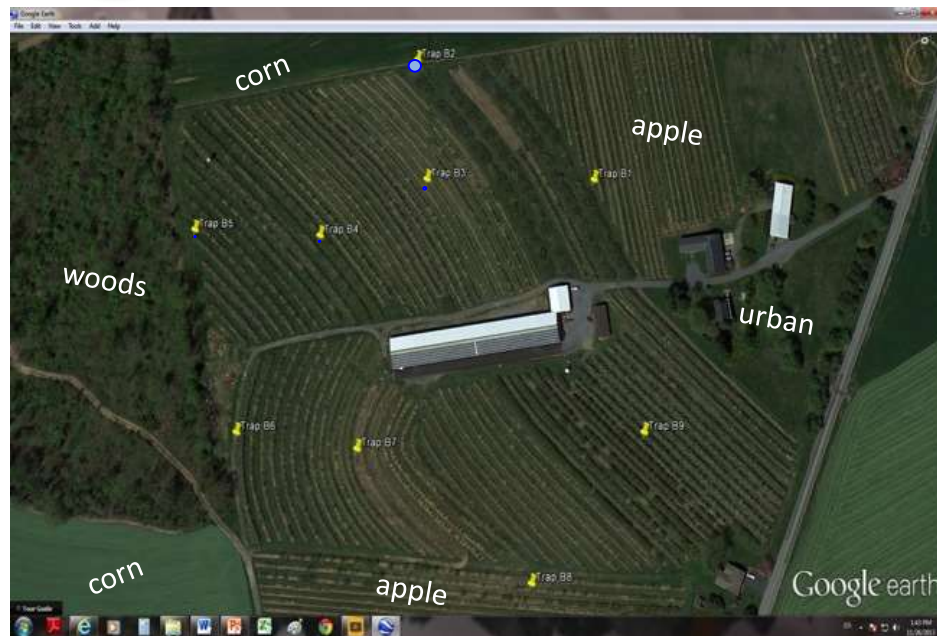
BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

July 8

143

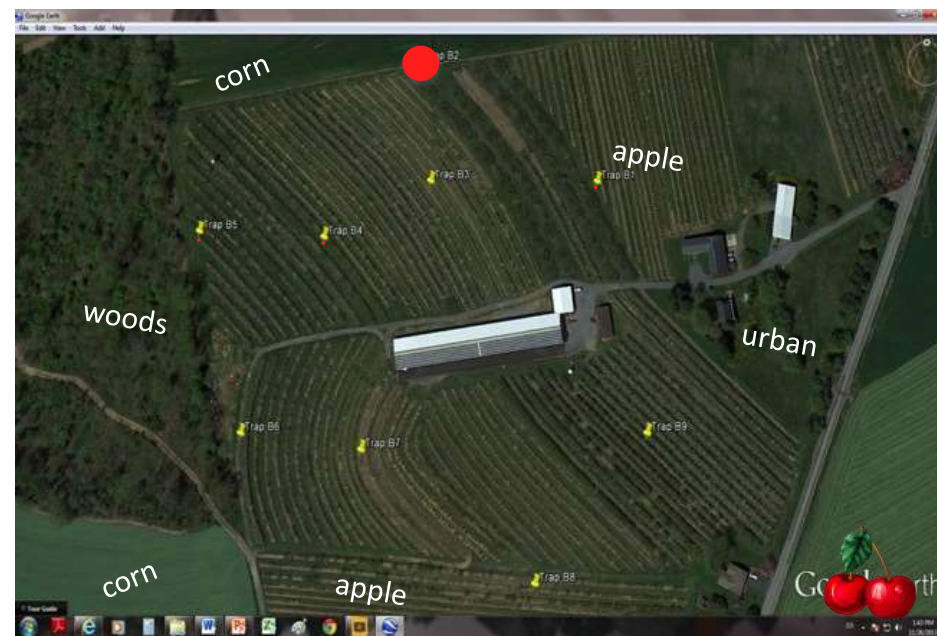
BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

July 15

143

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

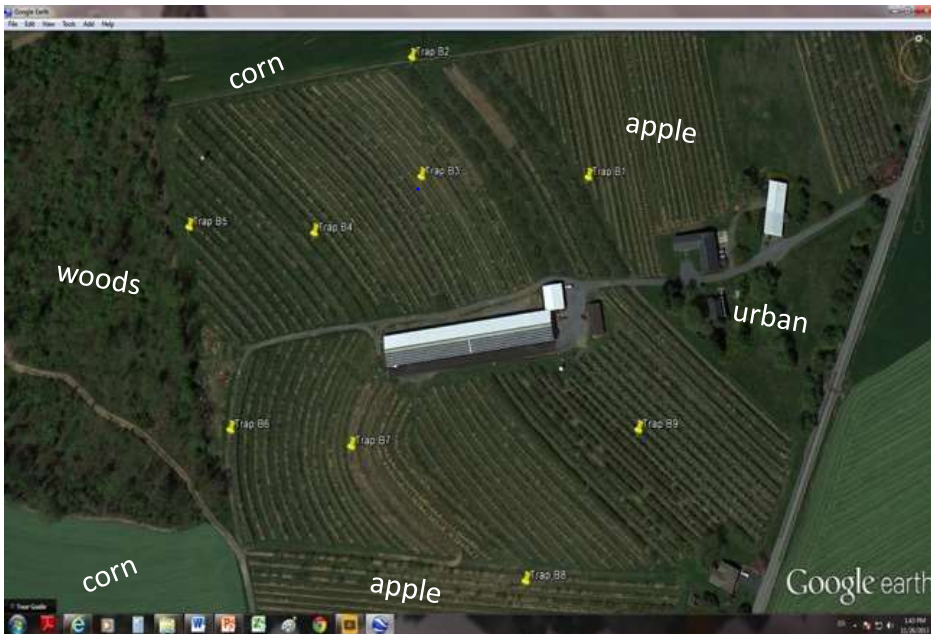
BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

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143

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Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

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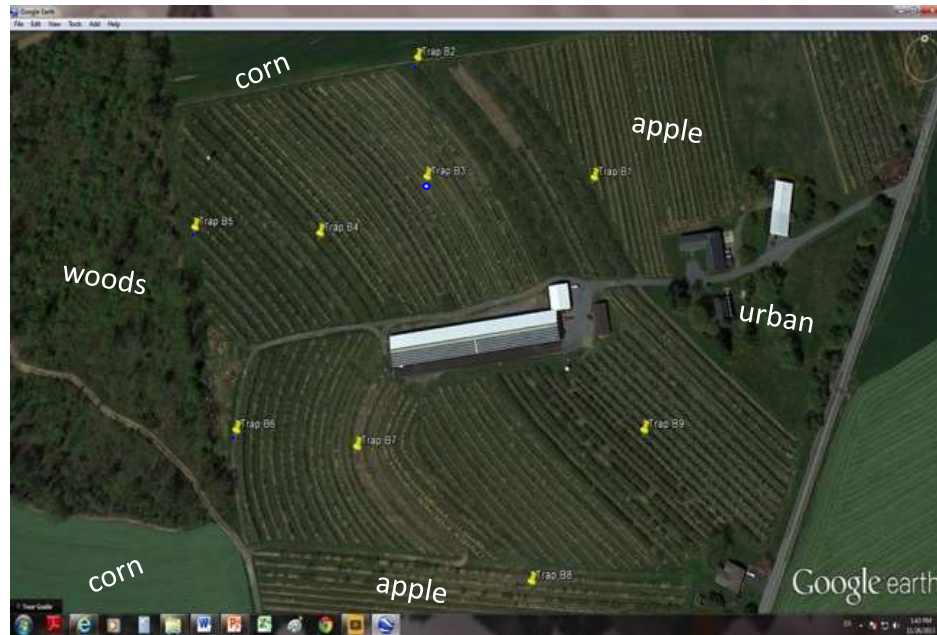
BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

July 30

143

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

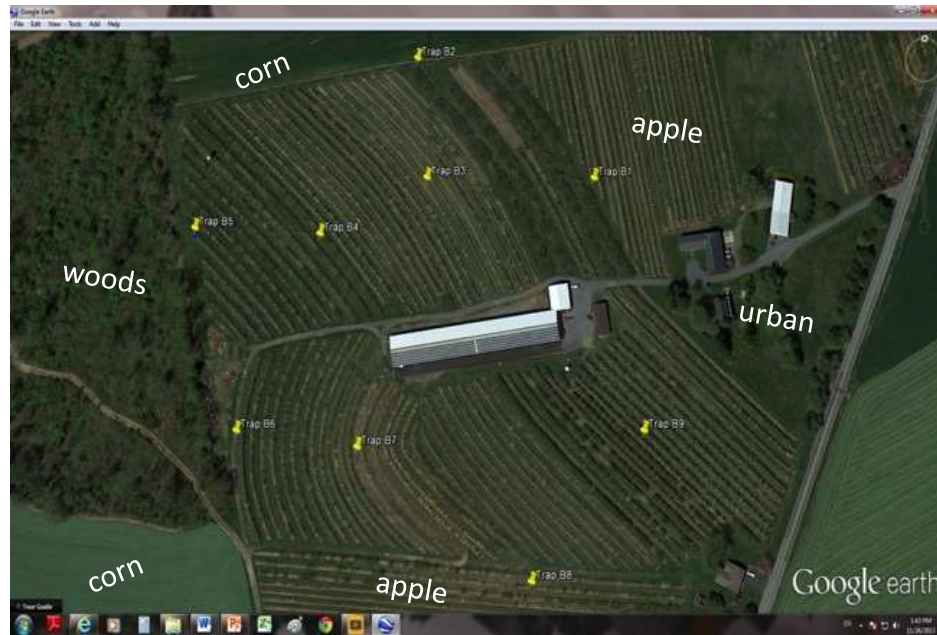
BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 5

143

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 12

143

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 19

143

BMSB

Size proportional to the number of collected BMSB



BMSB adults



Number of BMSB per trap/week

BMSB nymphs

TH Cherry location

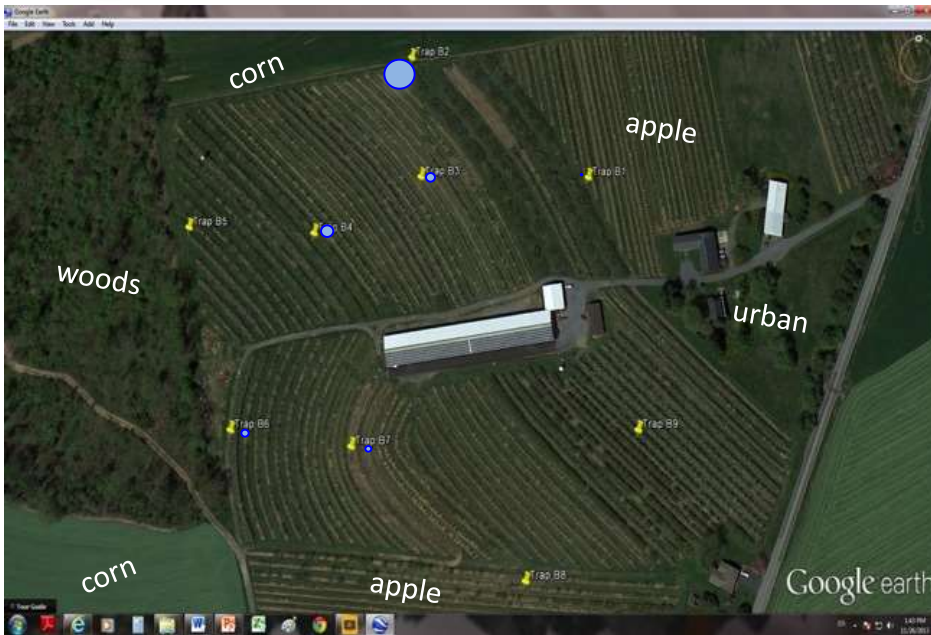
2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

August 26

143
BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 03

143

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

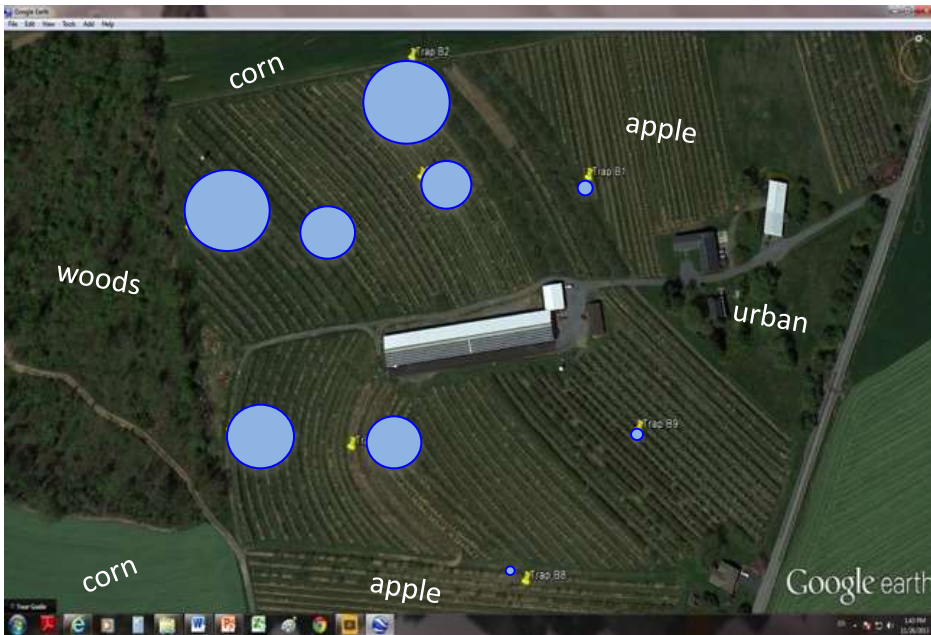
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BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 09

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BMSB

Size proportional to the number of collected BMSB



BMSB adults



BMSB nymphs

Number of BMSB per trap/week

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 16

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BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

September 24

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BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 1

143
BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

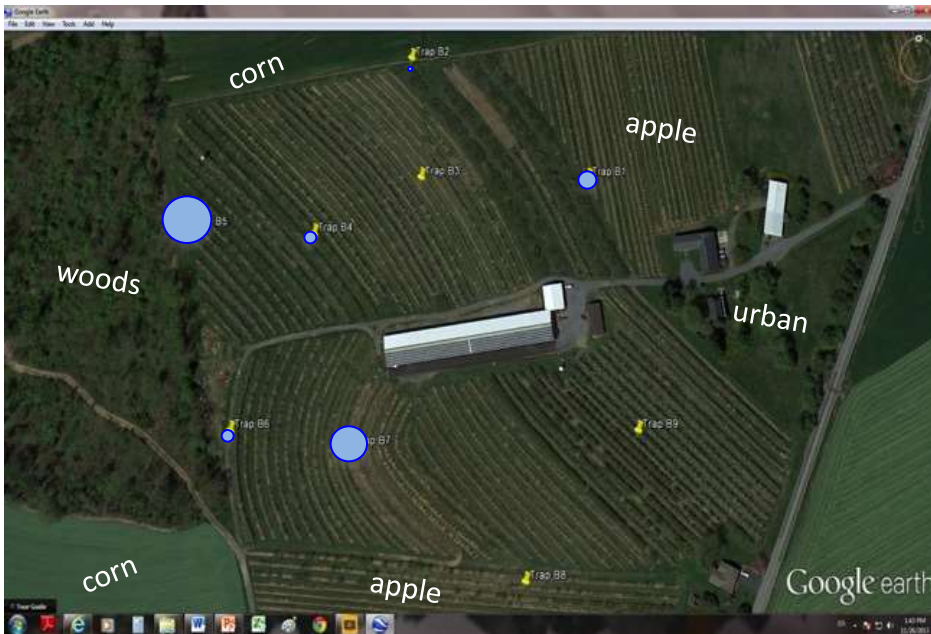
2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 8

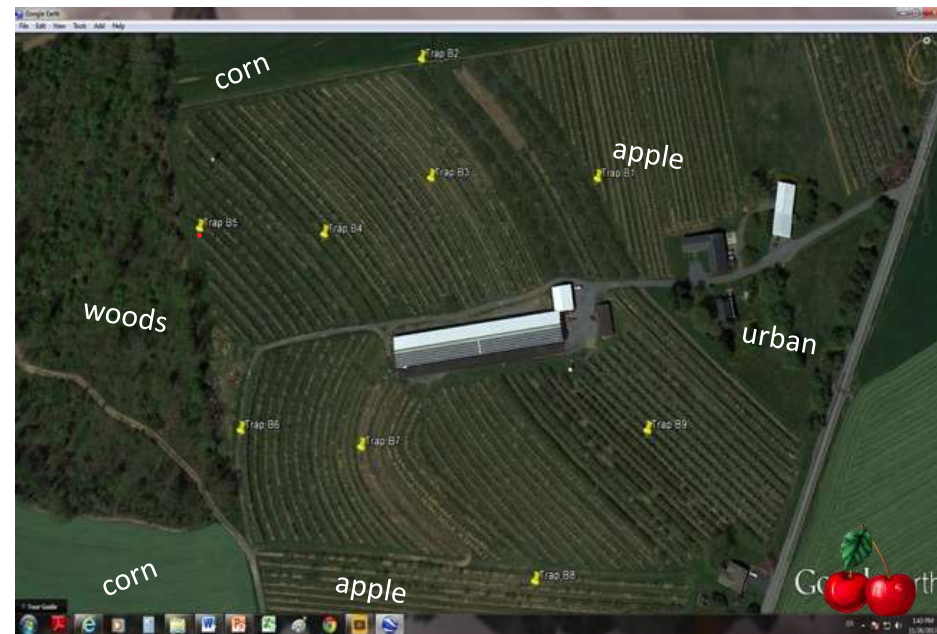
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BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

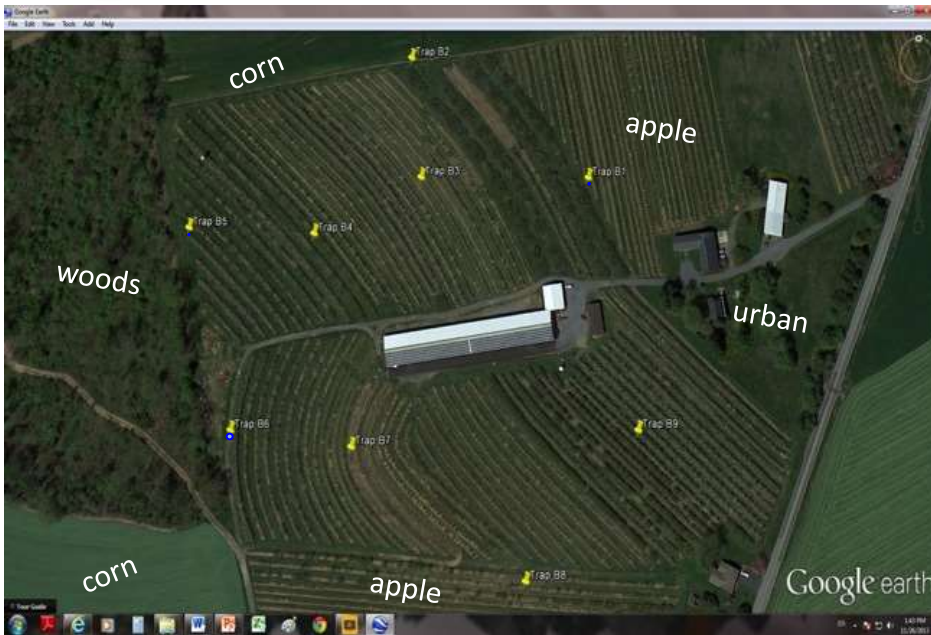
2013 BMSB Trap Placement Grid evaluations

BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 15

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Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

2013 BMSB Trap Placement Grid evaluations

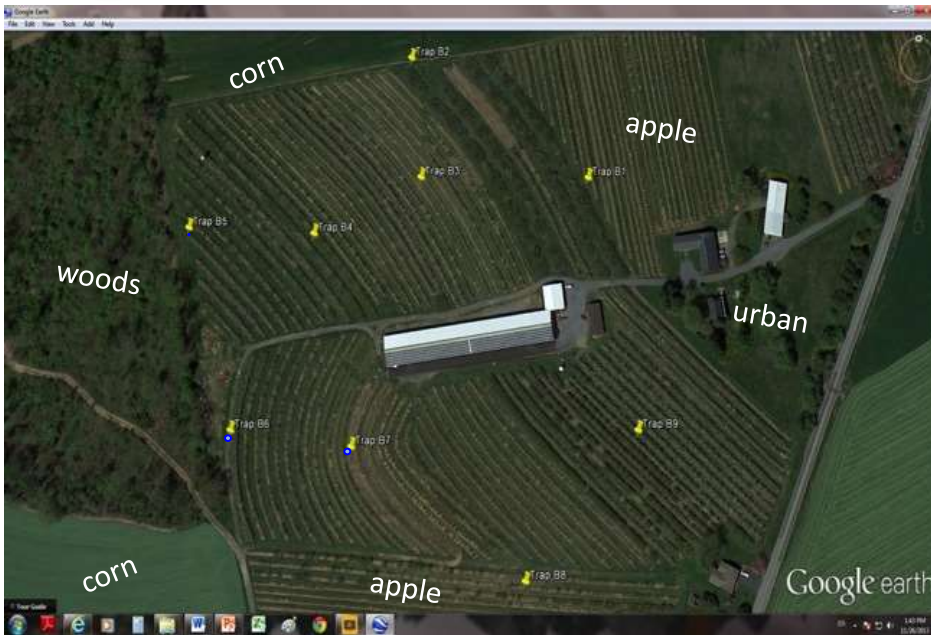
BMSB pressure distribution (cherries)
BMSB ADULTS and **NYMPHS** PER TRAP/WEEK

October 21

143

BMSB

Size proportional to the number of collected BMSB



BMSB adults

Number of BMSB per trap/week



BMSB nymphs

TH Cherry location

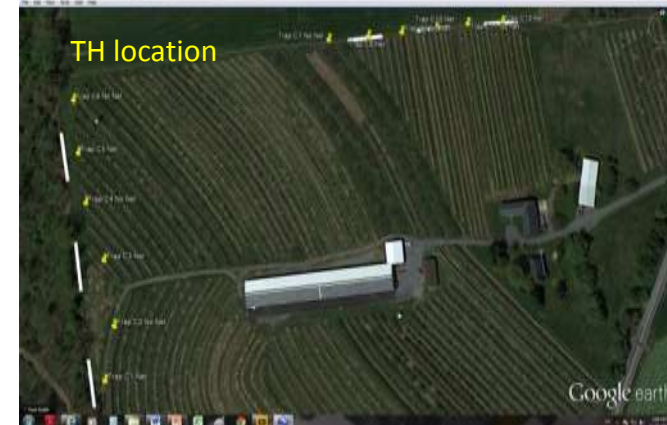
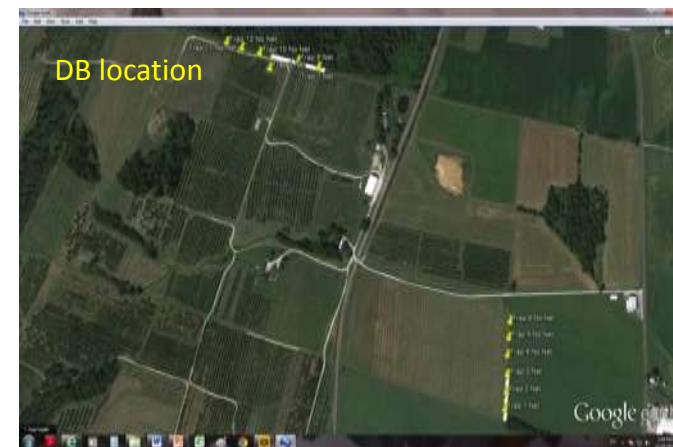
Surroundings....



2013 BMSB net exclusion trial

Methods:

1. Three locations in various parts of the state,
2. Horticultural nets (*Bubois Agrinovation, Saint-Remi, Canada*) placed on existing deer fences;
3. At 2 locations 100 yard long nets were placed at border with corn(1) and border with wood (1); at 1 location three pieces of 33 yards long nets were separated by 33 yard of no net area, still one set placed at corn and wood borders,
4. Twelve BMSB Rescue traps placed in each orchard; three traps per net/no net location
5. Traps were checked weekly
6. Each trap equipped with Vaportape 2 (2,2, dichlorovinyl dimethyl phosphate) (*Hercon Env.*)



2013 BMSB net exclusion trial



2013 BMSB net exclusion trial

Preliminary observations

SITE TH

Location/b order	Treatment	Weekly average number of BMSB per trap	
		Adults	Nymphs
Woods	Net	15.10 a	44.37 a
	No net	19.00 a	35.46 a
Corn field	Net	0.04 b	0.00 b
	No net	5.75 b	6.40 b

SITE DB

Location/b order	Treatment	Weekly average number of BMSB per trap	
		Adults	Nymphs
Woods	Net	12.86 ab	0.85 b
	No net	20.52 a	2.21 a
Corn field	Net	2.62 b	0.23 b
	No net	6.98 b	0.36 b



Comments...



Commercially available BMSB lures and traps are effective in detecting the presence of BMSB adults and nymphs during late part of the season.



The addition of attractant(s) to experimental USDA ARS #10 (or #20) enhanced greatly the effectiveness of the bait.



The “pyramid” shaped traps are generally very effective in attracting BMSB adults and nymphs, although additional studies are needed to develop universal trap working with different lures. As of now, for BMSB adults and nymphs “attracting” does not equal “capturing”.



Alternative BMSB monitoring/capturing methods such as commercial light trapping or nets are needed to support management programs especially during the early part of the season.

EXTENSION TREE FRUIT ENTOMOLOGY PROGRAM SUMMER 2013



Our crew:

Deonna Soergel – M Sc Graduate student

Travis Enyart, Brian Lehman – Research technologists

Luke Bailey, Kerry Campbell, Andy Goodyear, Tyler Lieberum, Andy Schmucker - Summer assistants

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Pennsylvania Department of Agriculture,
USDA ARS, USDA NIFA SCRI # 2011-51181-30937)*