Obj. 3. IPM Principles for BMSB

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Stop BMSB .org

Moving Toward IPM

1) maximize the use of non-chemical controls: cultural tactics, resistant varieties, biocontrol
2) treat only crops or portions needing control - use of sampling and thresholds
3) apply controls when they are most effective
4) If needed, use pesticides with reduced risk to beneficial organisms

What have we learned so far and how can we use that knowledge?

Biological Control

Natural BMSB egg mortality data from MD nurseries, 2013-14

- **Egg mortality from all sources was approx. 58%**
- **Mortality increased throughout the season**

- **Native parasitoids are attacking BMSB eggs**
- **Greatest cause of egg mortality (range 7-80% parasitism)**
- **Higher rates of parasitism in year 2**
- **Increased proportion of females in year 2**

- ***Anastatus reduvii* was the most abundant parasitoid**
  - **Generalist across orders**

Natural predators

Trissolcus japonicus

Natural Born Stink Bug Killer Found in Washington State

October 23, 2015 by Entomology Today Leave a Comment

Since 2007, the U.S. Department of Agriculture has been directing studies of a tiny Asian wasp called Trissolcus japonicus. These wasps are parasitoids of the brown marmorated stink bug (Halyomorpha halys), which has caused millions of dollars in damage to fruit orchards since it was discovered in the U.S. less than two decades ago. Researchers […]

Filed Under: Entomology News Tagged With: biocontrol, biological control, brown marmorated stink bug, Halyomorpha halys, Parasitoid wasp, Trissolcus japonicus

Moving Toward IPM

- Understanding the ecology and dispersal behavior of the bug

Some Favorable Host Plants of BMSB

Paulownia

Tree of Heaven

Catalpa

Peach

Wild cherry

Mature Mustard

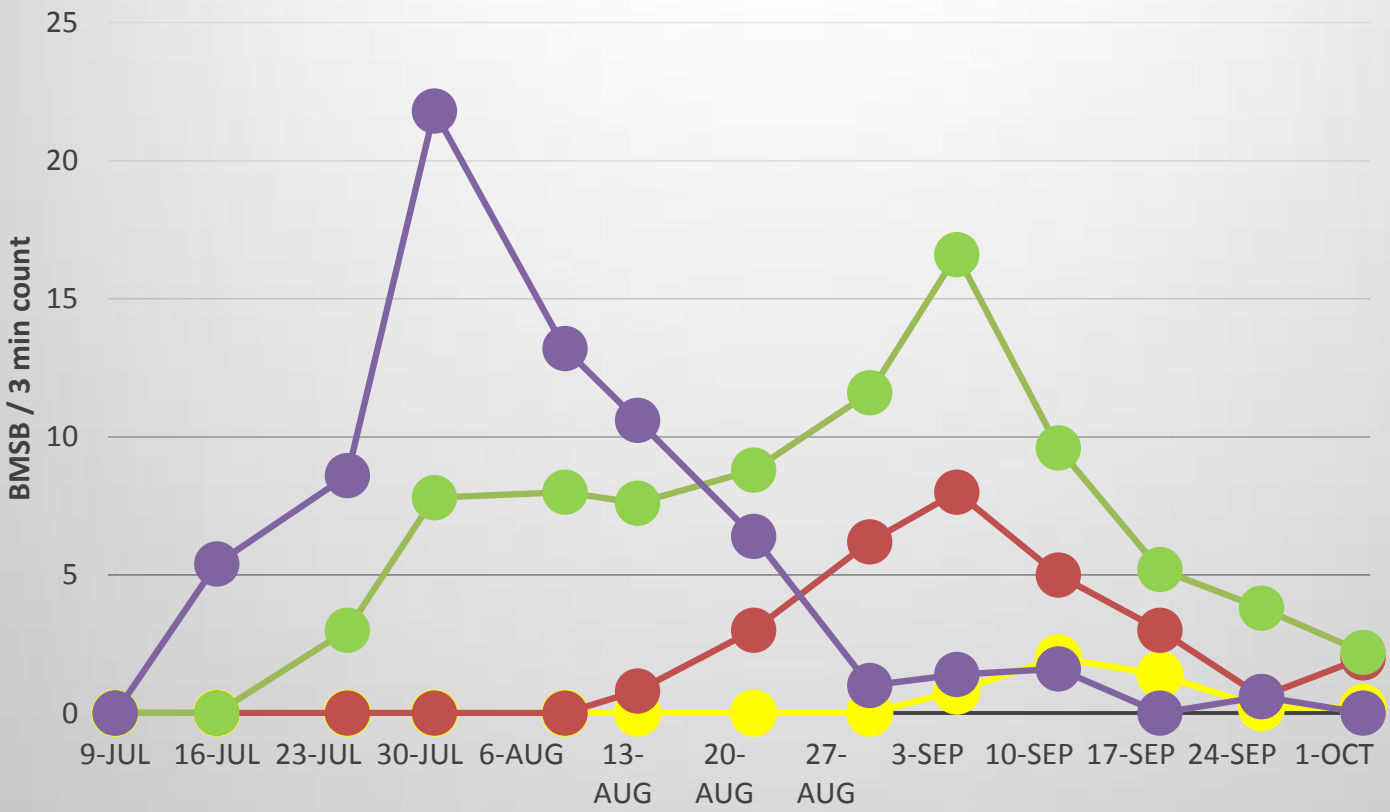
Mulberry

Mimosa

Tree of Heaven

Orange Co., VA, 2011

Sampling soybean fields in VA



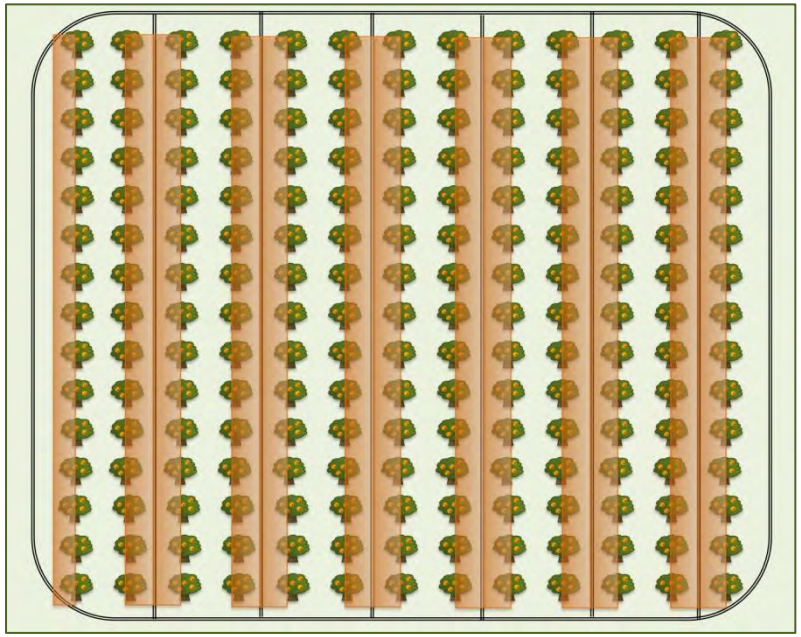
Moving Toward IPM

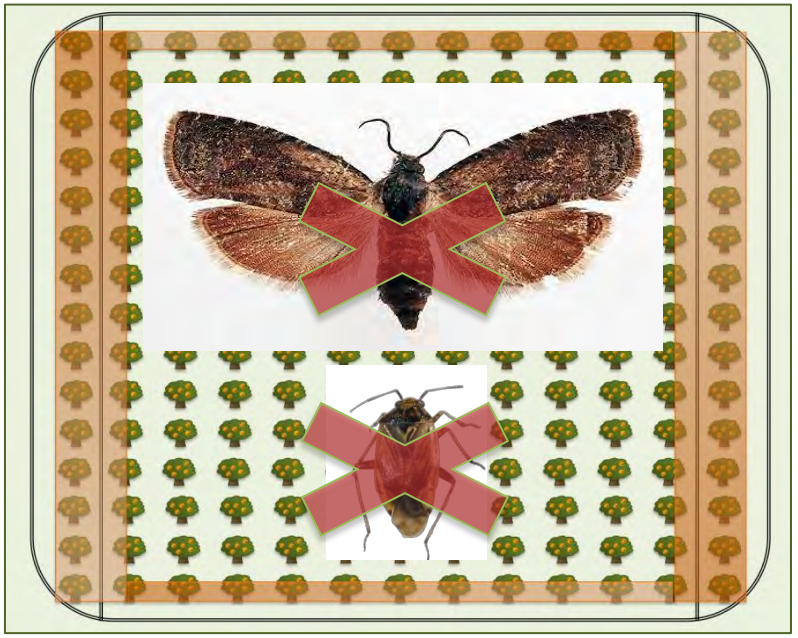
- treat only crops or portions needing control
  - use of sampling and thresholds

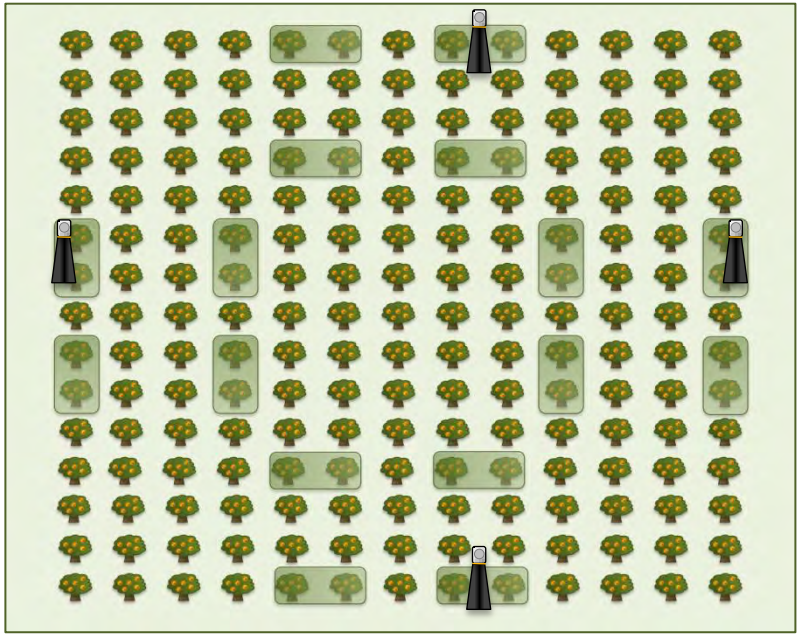
Spraying soybean border rows only

Soybean border spray data – VA, 2013

Location	Date treated	R-stage	Post-treatment sample—number per 15 sweeps									
			Date 1		Date 2		Date 3		Date 4		Date 5	
Stafford	13-Aug	R-5	21-Aug	0	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0
Culpeper-1	22-Aug	R-5	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0
Culpeper-2	24-Aug	R-5	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0
Culpeper-3	24-Aug	R-5	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0
Rappahannock	21-Aug	R-5	28-Aug	0	6-Sep	<1	11-Sep	<1	18-Sep	0	2-Oct	0
Clarke-1	30-Aug	R-5	5-Sep	0	11-Sep	<1	18-Sep	0	2-Oct	0	---	---
Clarke-2	30-Aug	R-5	5-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0	---	---







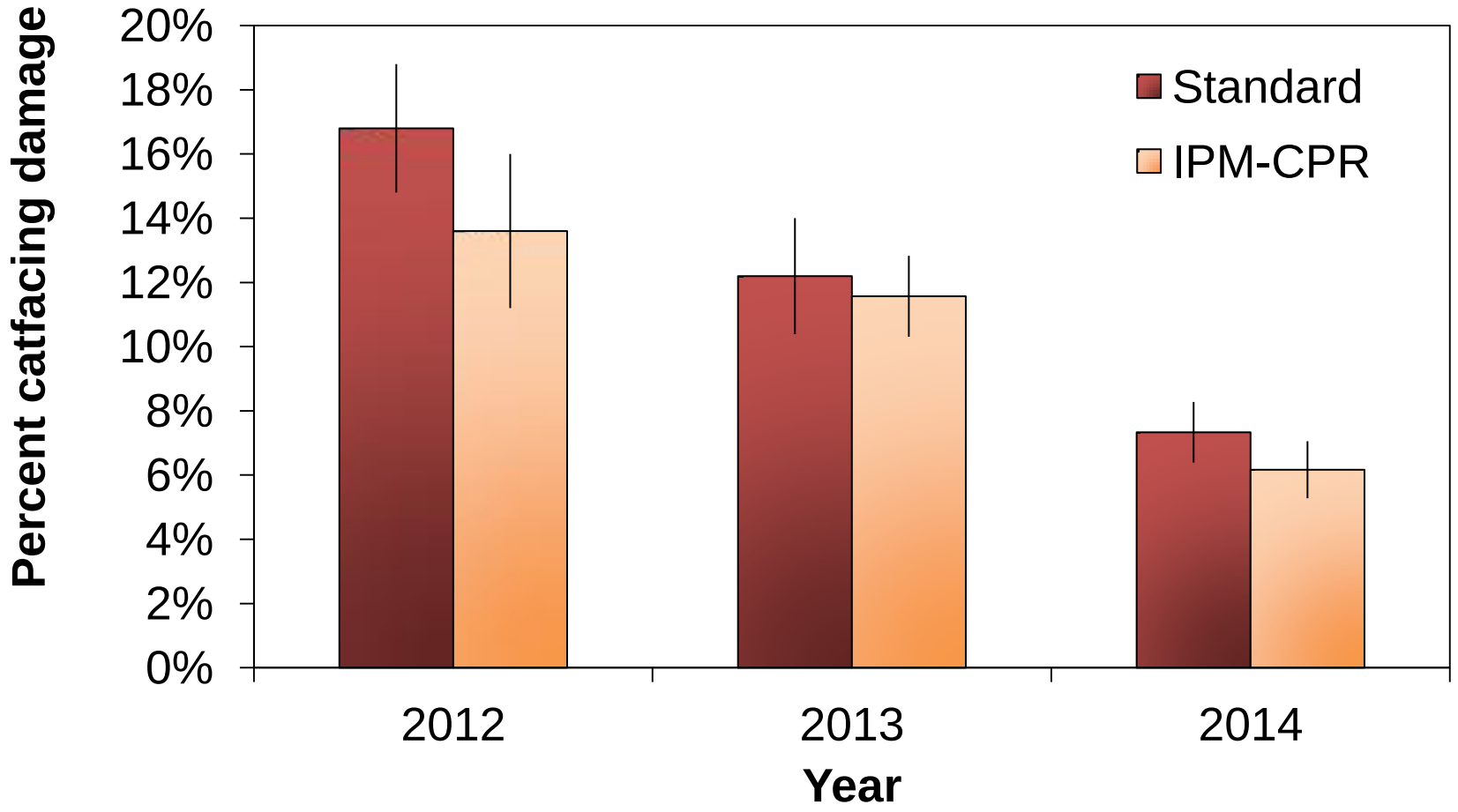
- **3 commercial farms (5-10ac), 3 years**
- Standard: whole block or ARM sprays
- IPM-CPR: perimeter + first full row
  - *+ Ground cover management*
  - *+ Mating disruption for OFM*
- Weekly insecticide applications beginning late-May (140-266 DD_{57})
- Visual and trap based monitoring
- Harvest sample for injury assessment (850 fruit/block)

Pesticide application

Sampling sites

Pyramid monitoring trap

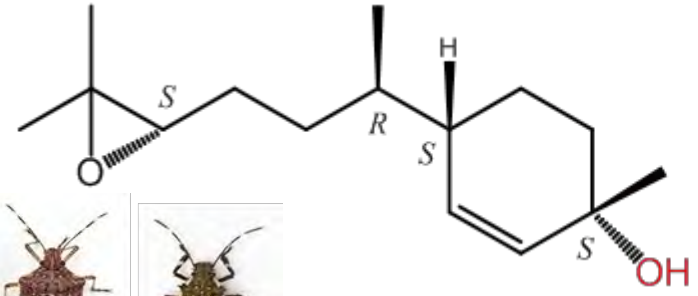
Consistently Less Stink Bug Damage in IPM-CPR Blocks (NJ)



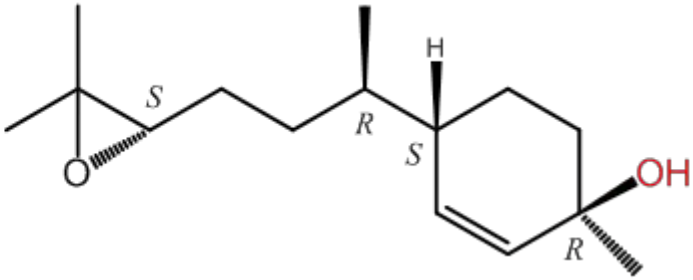
Blaauw et al. 2014, Pest Management Science

Identification of BMSB Pheromone and Synergist

Main component of BMSB aggregation pheromone
(3*S*,6*S*,7*R*,10*S*)-10,11-epoxy-1-bisabolen-3-ol



Minor component of BMSB aggregation pheromone
(3*R*,6*S*,7*R*,10*S*)-10,11-epoxy-1-bisabolen-3-ol



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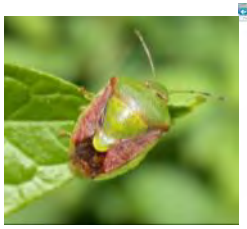
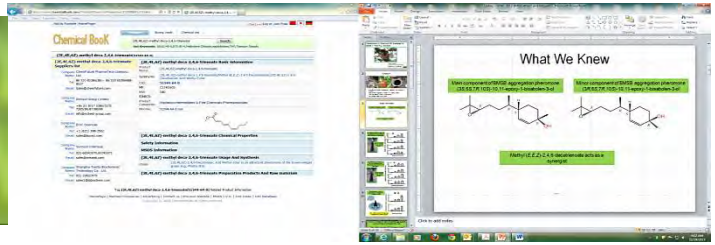
MDT





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Synergism

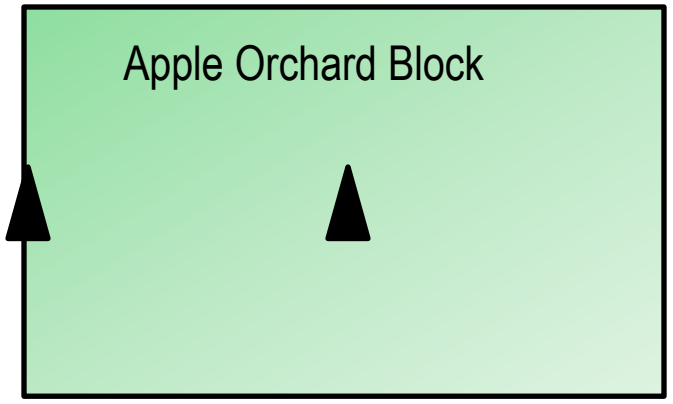
Weber DC, Leskey TC, Cabrera-Walsh GJ, Khrimian A (2014) Synergy of aggregation pheromone with methyl (E,E,Z)-2,4,6-decatrienoate in attraction of brown marmorated stink bug, Halyomorpha halys. J Econ Entomol 107:1061-1068

Effective Trap & Lure (USDA-ARS)

- Black pyramid traps (4 ft tall)
- Traps are deployed between wild host habitat and agricultural production area.

Can we use BMSB trap catch to guide IPM decisions?

- Apple blocks. monitored with two baited traps - checked weekly.
- When catch of adults in either trap reached a set threshold, the block was treated with insecticides (ARM).
- Block treated again 7-d later. Threshold was then reset.

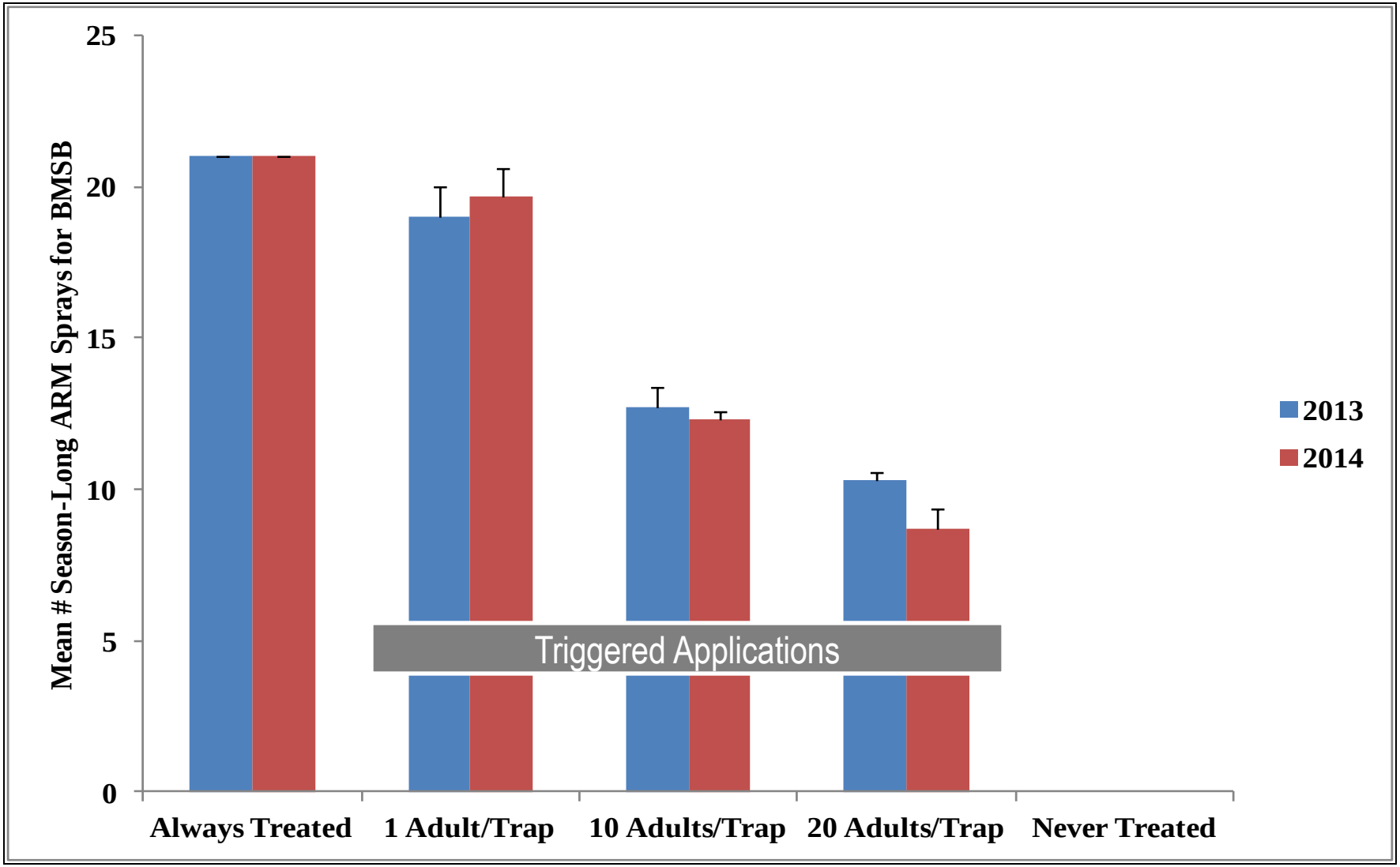


Sprays Triggered at:
1) 1 Adult / Trap
2) 10 Adults / Trap
3) 20 Adults / Trap

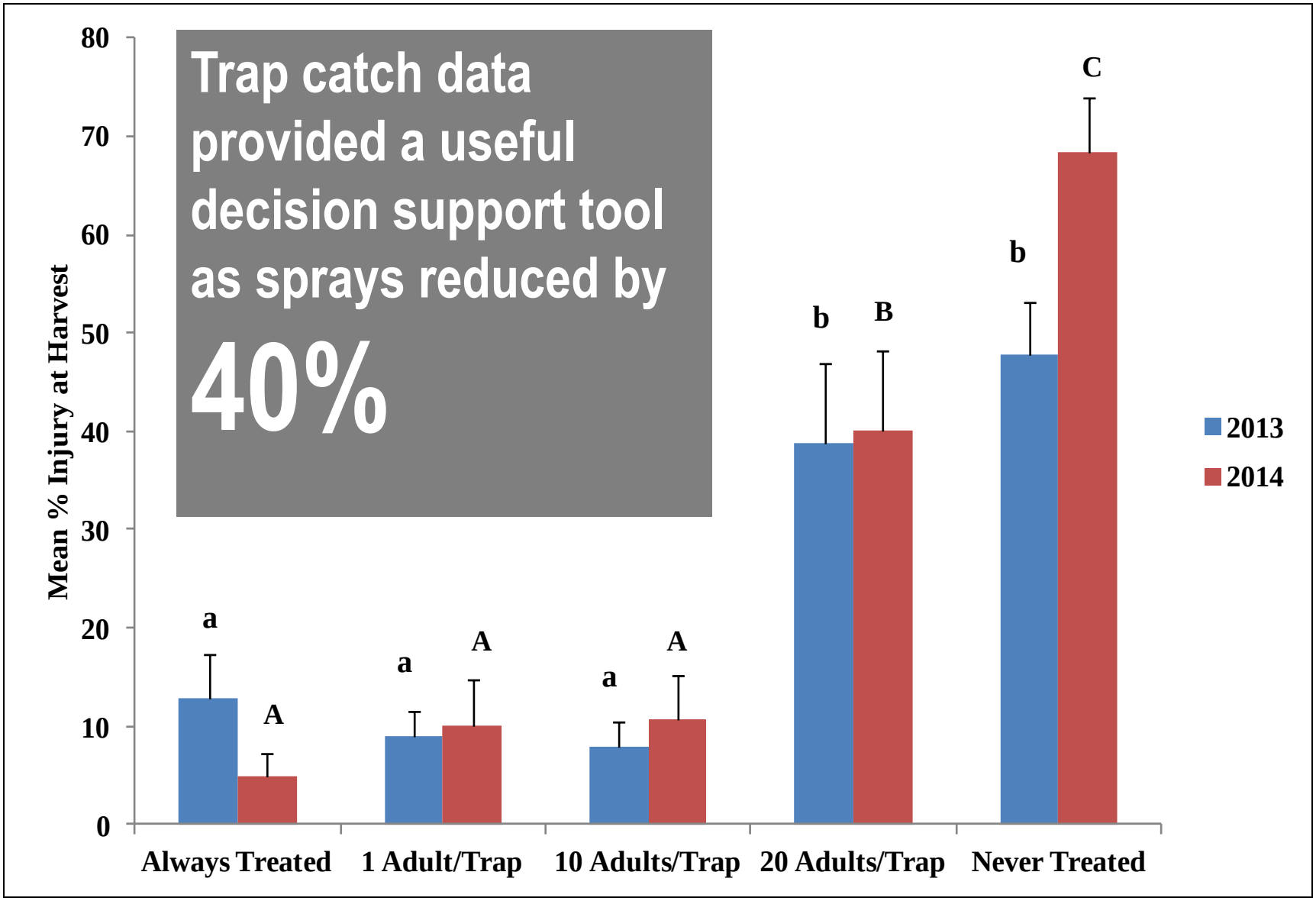
4) Treated Every 7 d

5) No Spray (Control)

Season-Long Insecticide Applications Made Against BMSB



BMSB Injury at Harvest



Tentative Conclusions

- Trap captures reflected relative, local densities of BMSB.
- Threshold = 10 adults per trap resulted in a 40% reduction in insecticide applications with injury at harvest statistically equivalent to blocks treated weekly.
- Baited traps can be used to guide management decisions in apple orchards.
- Future steps include recalibration with simpler trap designs and optimized commercial lures.

BMSB pheromone traps on vegetable farms

- Large black pyramid traps placed on outside of fields
- Each baited with the two-component BMSB aggregation pheromone + the synergist (MDT)
- Traps checked weekly for BMSB

Can we utilize other trap styles?

Experimental Standard Wooden Pyramid	Coroplast Pyramid	Small Pyramid (Ground)	Small Pyramid (Limb)	Small Pyramid (Hanging)	Rescue (Hanging/ Foilage)





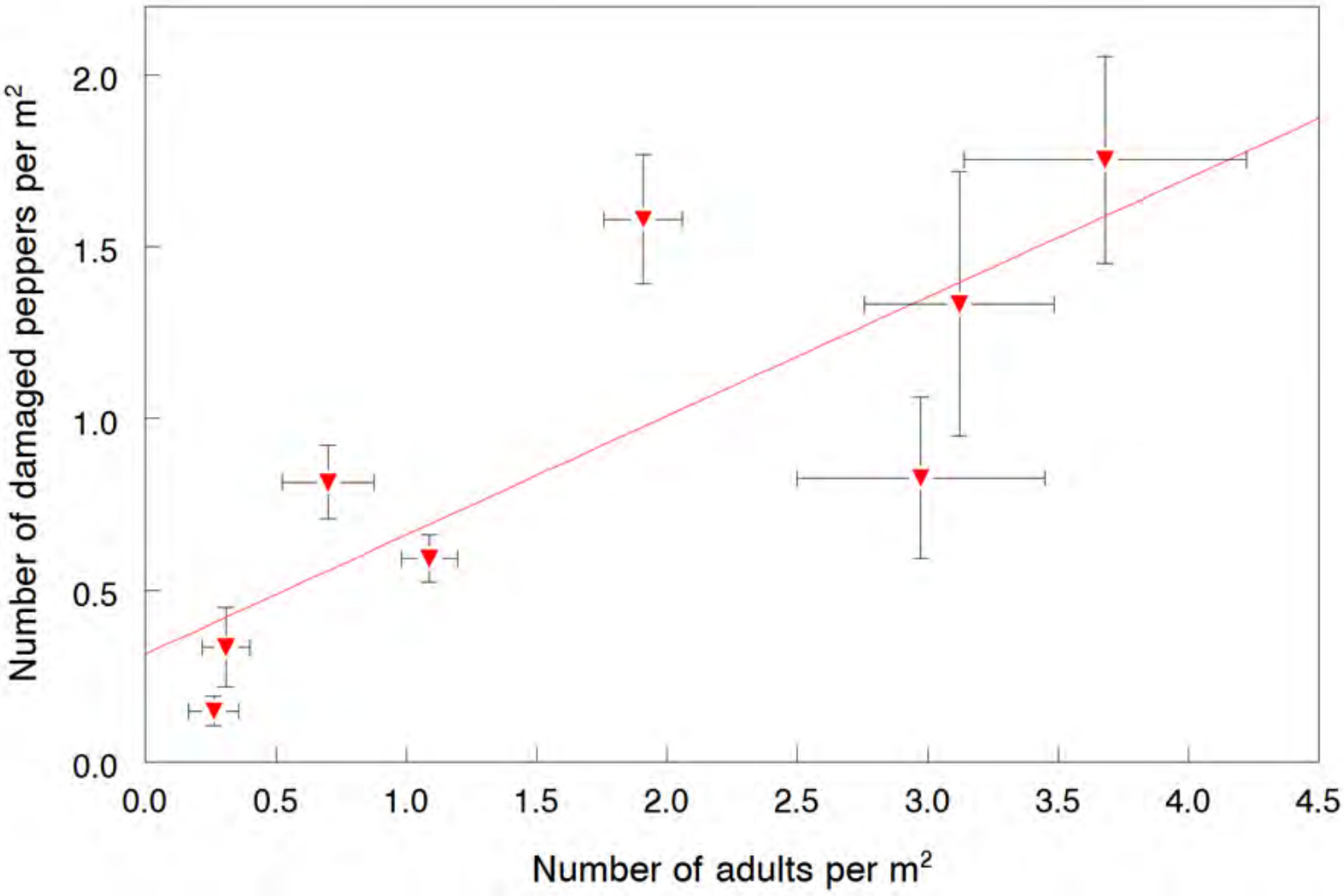

- Are captures similar among other trap types and deployment strategies compared with our experimental standard?

- Baited with 10 mg BMSB Pheromone + 66 mg MDT. Two years of data from commercial orchards.

(Morrison et al. 2015)

Visual plant inspections may be the easiest sampling method for vegetables

Relationship btw direct counts of BMSB on peppers and damage (Univ. MD data)

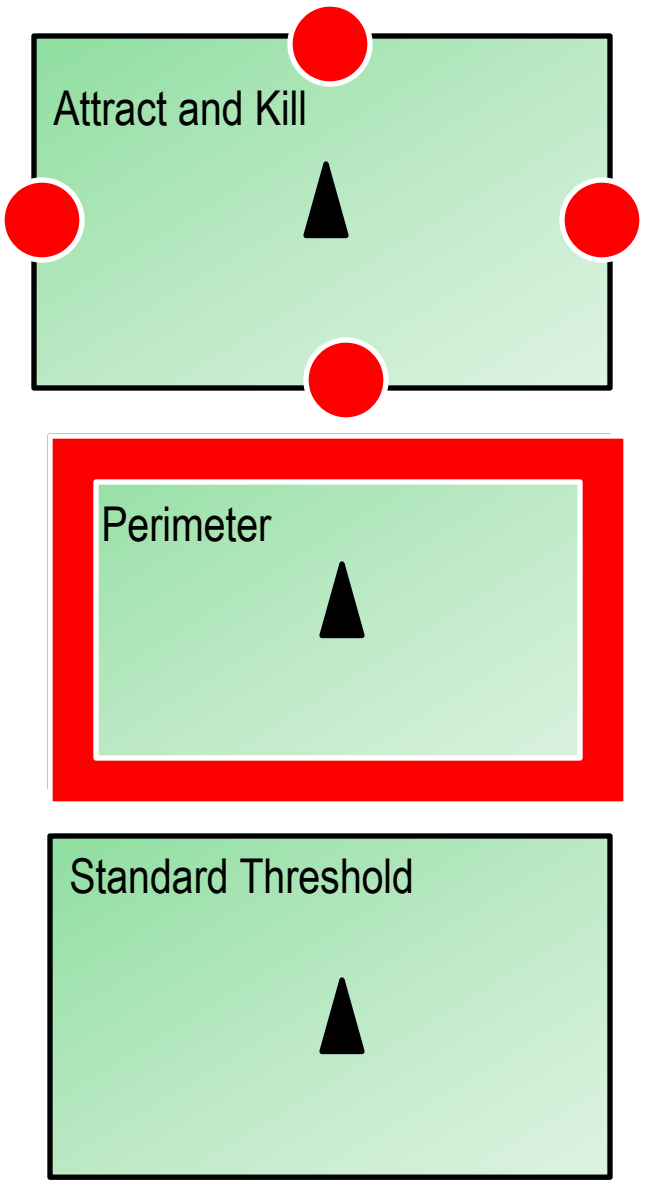


Can we use refined border-based management in tree fruit?

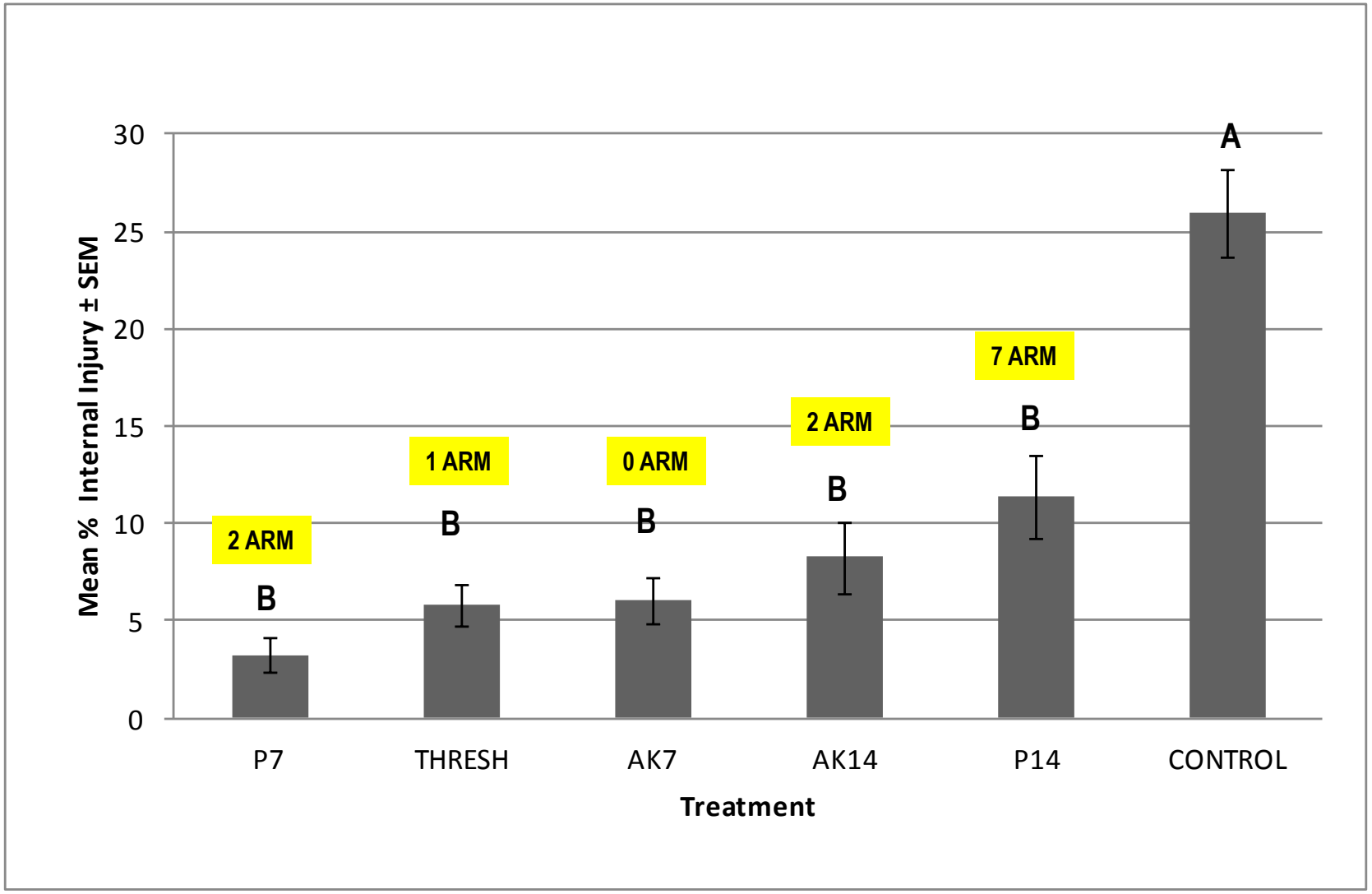
- Apple blocks protected by the following border-based management regimes and compared with standard threshold:

1) AK treated every 14d
2) AK treated every 7d
3) Perimeter treated every 14d
4) Perimeter treated every 7d
5) Standard Threshold
6) No Spray (Control)

- All blocks monitored at center with baited trap. If threshold reached, ARM sprays triggered.



First Year Results: USDA-ARS



Attract & Kill plots of sorghum and sunflower

Moving Toward IPM

maximize the use of non-chemical controls: cultural tactics

Types of Net Structures

Multiple Functions

- ✓ Hail
- ✓ Sunburn
- ✓ Heat stress
- ✓ Eliminate overhead cooling
- ✓ Improve fruit size, skin color
- ✓ Reduce worker exposure to UV
- ✓ Reduce worker heat stress
- ✓ Exclude birds
- ✓ Exclude deer
- ✓ Exclude insects

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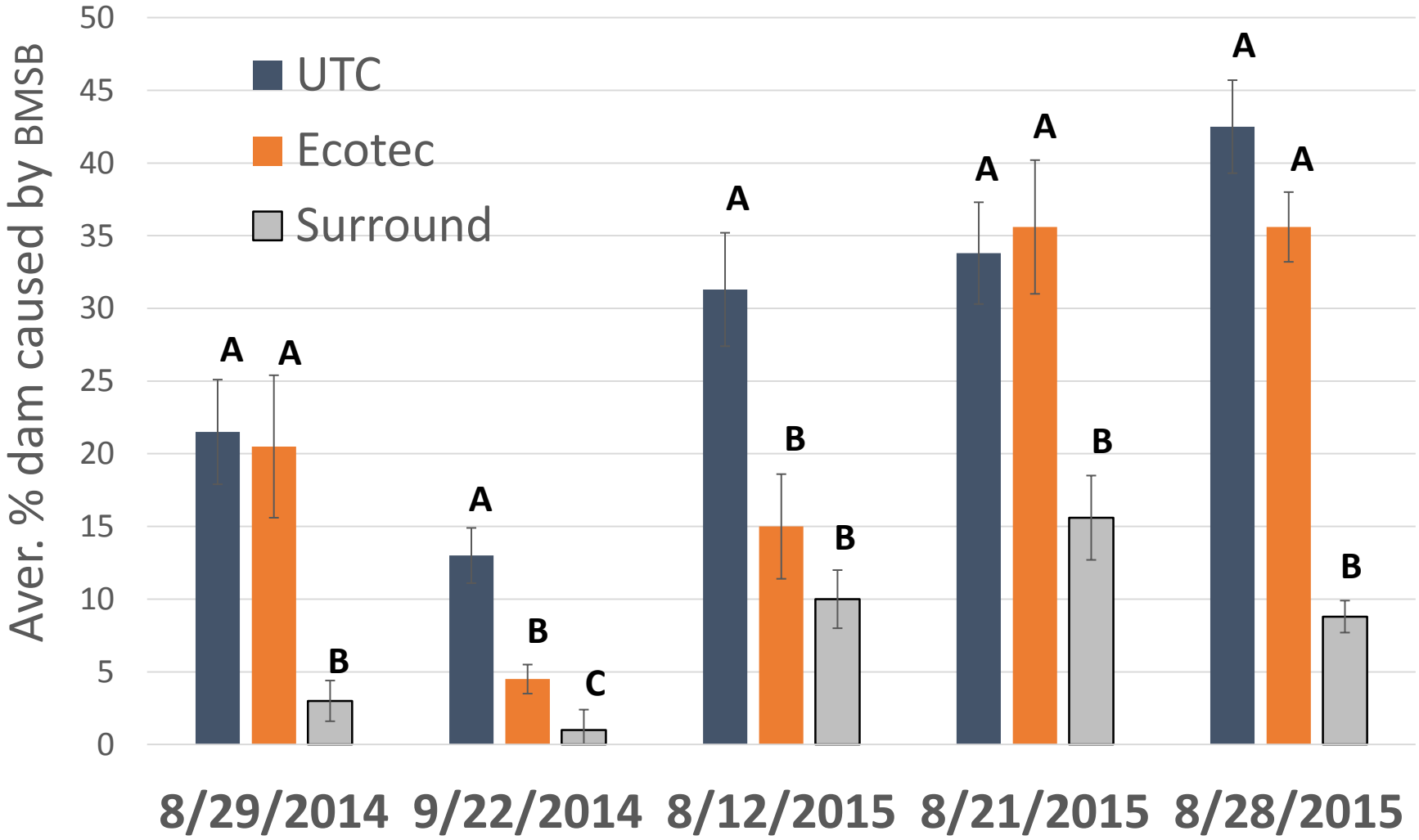
Crop Protectant

Surround WP crop protectant forms a barrier film, which acts as a broad spectrum agricultural crop protectant for controlling damage from various insect and disease pests, a growth enhancer, and as a protectant against sunburn and heat stress.

ACTIVE INGREDIENT:	
Kaolin	95.0%
OTHER INGREDIENTS:	5.0%
TOTAL:	100.0%

Results of Field Efficacy on Peppers in Virginia, 2014-15



Moving Toward IPM

The role of chemical control – rescue sprays

Insecticide efficacy test peppers , Blacksburg, VA (4 weekly sprays)

Treatment	Rate / acre	% stink bug damage			% control (...ng ...tion)	Mean no. green peach aphids / 20 leaves (Sept)
Untr. Control						10.3
Bifenture 2EC					8	765.5
Lambda-Cy 1EC					0	850.8
Perm-up 3.2EC					6	539.0

Moving Toward IPM

1) apply controls when they are most effective
2) use pesticides with reduced risk to beneficial organisms

Efficacy of foliar-applied insecticides for the control of BMSB in bell peppers, Blacksburg, VA 2015.

Insecticides were applied 27 July, 3, 10 and 17 Aug (Kuhar data)

% fruit with stink bug damage

		% stink bug damaged fruit	
Treatment	Rate / acre	13-Aug (3 DAT3)	24-Aug (7 DAT4)
Untreated Control		18.0	31.0 a
Cyclaniliprole 50SL	16.4 fl. oz	16.0	13.0 ab
Cyclaniliprole 50SL	22 fl. oz	10.0	16.0 ab
Cyclaniliprole 50SL	44 fl. oz	18.0	13.0 ab
Closer SC (sulfoxaflor)	5 fl. oz	13.0	7.0 ab
Closer SC	7 fl. oz	12.0	6.0 ab
Beleaf 50SG (flonicamid)	2.8 oz	19.0	24.0 ab
Bifenture 2EC (bifenthrin)	6.4 fl. oz	6.0	2.0 b

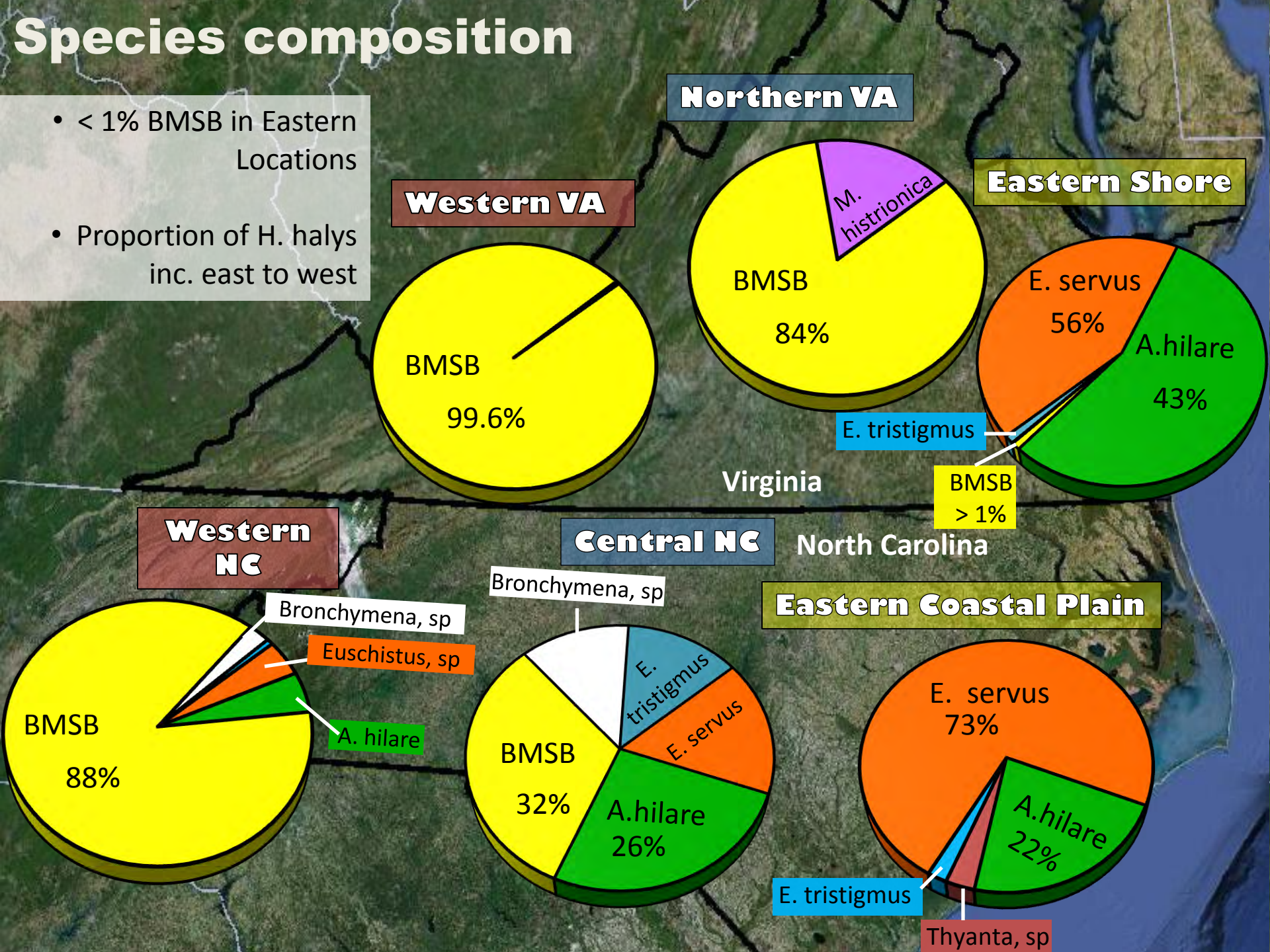
Cyclaniliprole reduced BMSB damage, but not as well as bifenthrin.

Moving Toward IPM

Calculating regional, commodity, and field risk

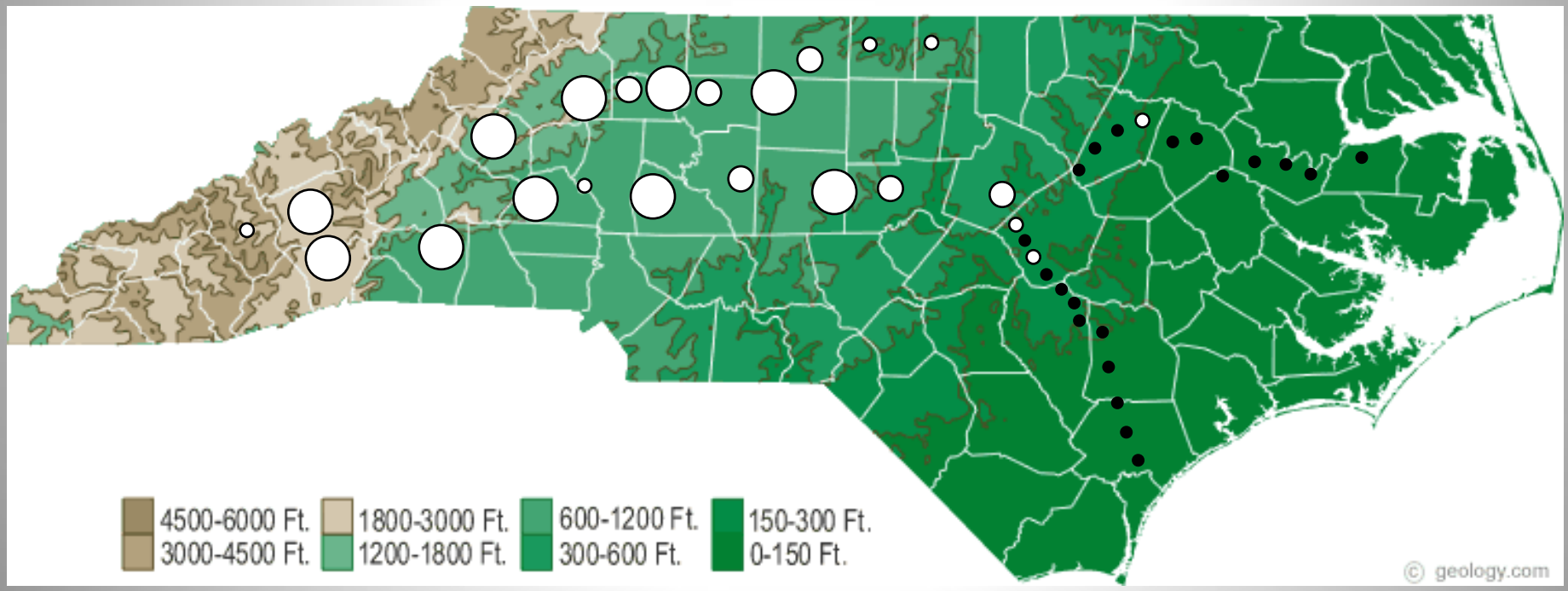
Species composition

- < 1% BMSB in Eastern Locations
- Proportion of H. halys inc. east to west



Brown Marmorated Stink Bugs in NC Soybeans – September 2014

No. per 40 sweeps	
• 0	○ >5 adults + nymphs
○ <2 adults and nymphs	◯ >10 adults + nymphs



Where do we go from here?

- Continue to evaluate the best use of pheromone trap catch information
  - validate and refine action thresholds
  - further evaluate Attract & Kill strategies
  - evaluate more user-friendly traps

- Continue to monitor the impact of biological control, particularly changes in egg parasitism

Where do we go from here?

- Explore integrating control tactics (i.e., Push-Pull Strategy - use Attract & Kill plots & kaolin on the cash crop)

- Need to develop predictive models for BMSB infestations – in particular, tease out the critical variables explaining why BMSB is not an important pest in certain regions of the mid-Atlantic, but seems to always show up on certain farms each year.