BMSB Impact, Phenology, and Management in Vegetables

Funding

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National Institute of Food and Agriculture

Specialty Crop Research Initiative
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Collaborating Institutions

University of Delaware

ARS

Penn State

The State University of New Jersey Rutgers

Northeastern IPM Center

Washington State University

Cornell University

University of Maryland

Virginia Tech

OSU Oregon State University

NC State University

StopBMSB.org

Vegetable Crop Team Members

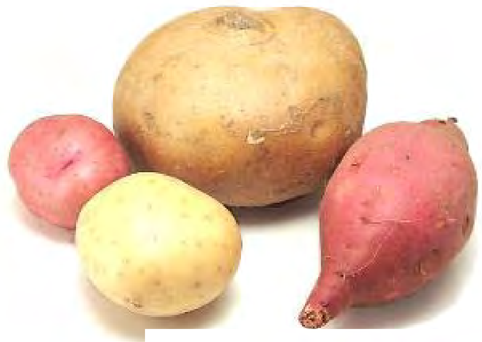
- Tom Kuhar & John D. Aigner (student)
- Galen Dively, Cerruti Hooks, Gerald Brust, Emily Zobel (student)
- Joanne Whalen, Bill Cissel (student)
- Jim Walgenbach, Mark Abney, Amanda Bakken (student)
- Shelby Fleischer, Kevin Rice (student)

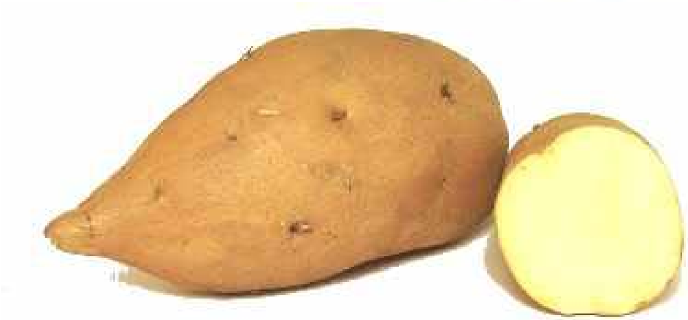
Impact of BMSB on Vegetable Crops

- T.P. Kuhar, K.L. Kamminga, J. Whalen, G.P. Dively, G. Brust, C.R.R. Hooks, G. Hamilton, and D.A. Herbert. 2012 The Pest Potential of Brown Marmorated Stink Bug on Vegetable Crops. *Plant Health Progress*. May 2012. doi:10.1094/PHP-2012-0523-01-BR.
- Sweet corn, peppers, tomatoes, beans, eggplant, and okra are preferred

Crops less preferred by BMSB than other vegetables

Vegetable crops that are probably not suitable host plants by BMSB

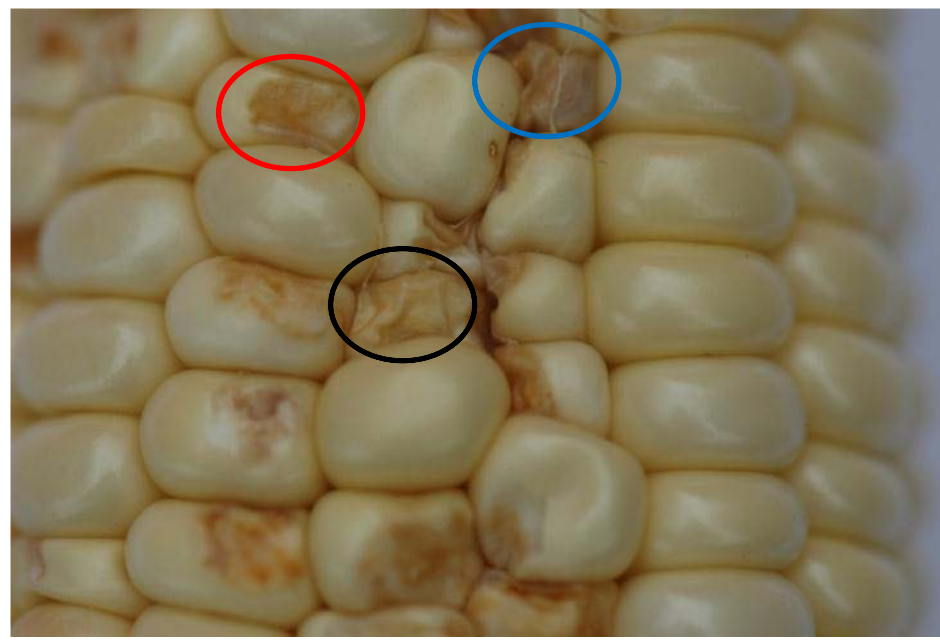


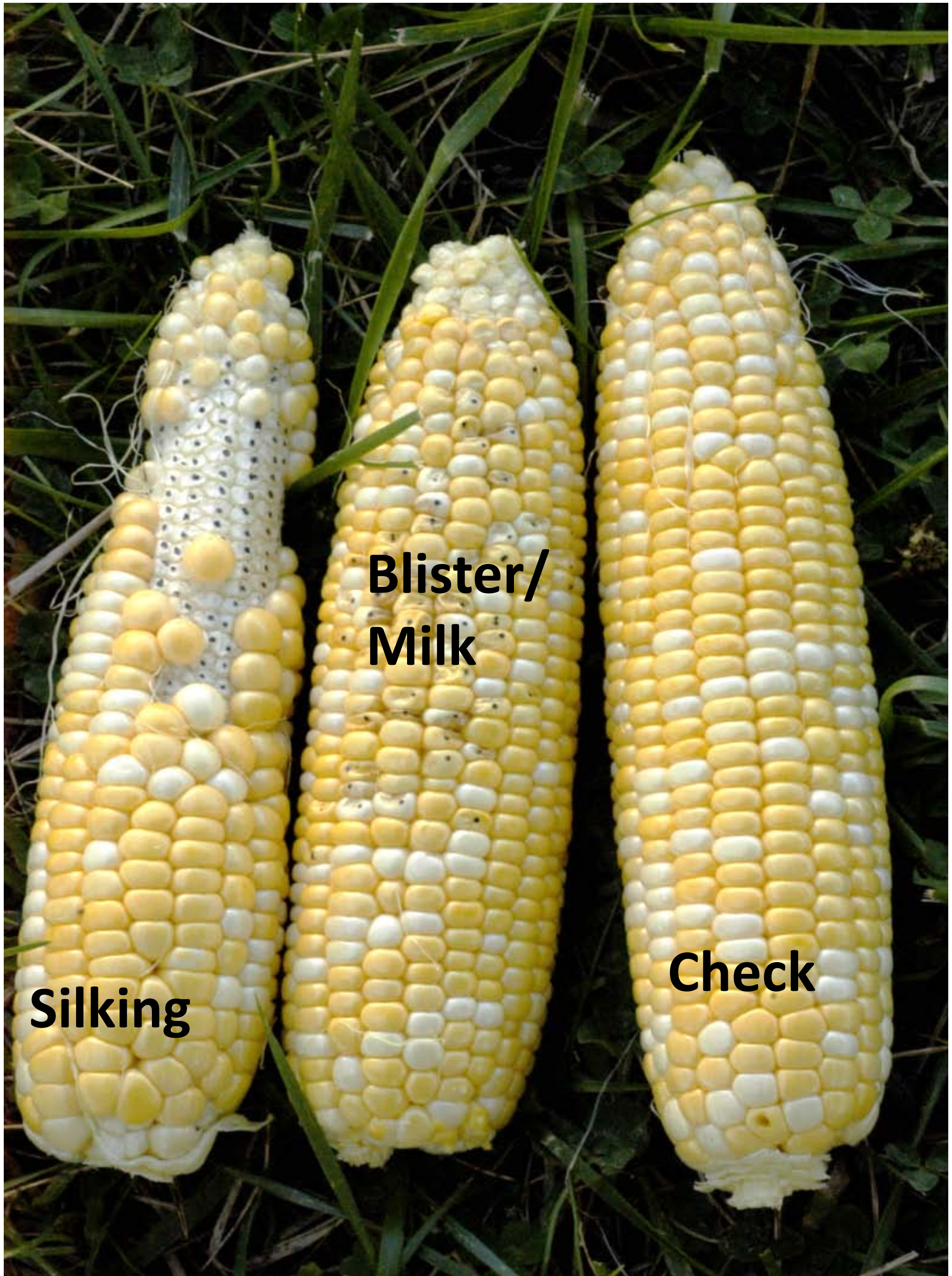


BMSB Damage to Sweet Corn

Evaluations in Delaware (Whalen & Cissell)

- Discolored Kernels
- Sunken Kernels
- Blasted Kernels
  - Collapsed
  - Aborted





Conclusions

- Infestations occurring prior to pollination may result in incomplete kernel fill
- BMSB must be managed from ear shank emergence to harvest

Peppers

Bagged Pepper Plant Study MD - 2011

Control Plants

Infested Plants

Tomatoes

Yeasts transmitted by BMSB
Jerry Brust and Karen Rane (U. MD)

Edible-podded beans

Okra

BMSB phenology and damage risk to each vegetable crop

BMSB begin their life cycle each year on trees

Paulownia

Tree of Heaven

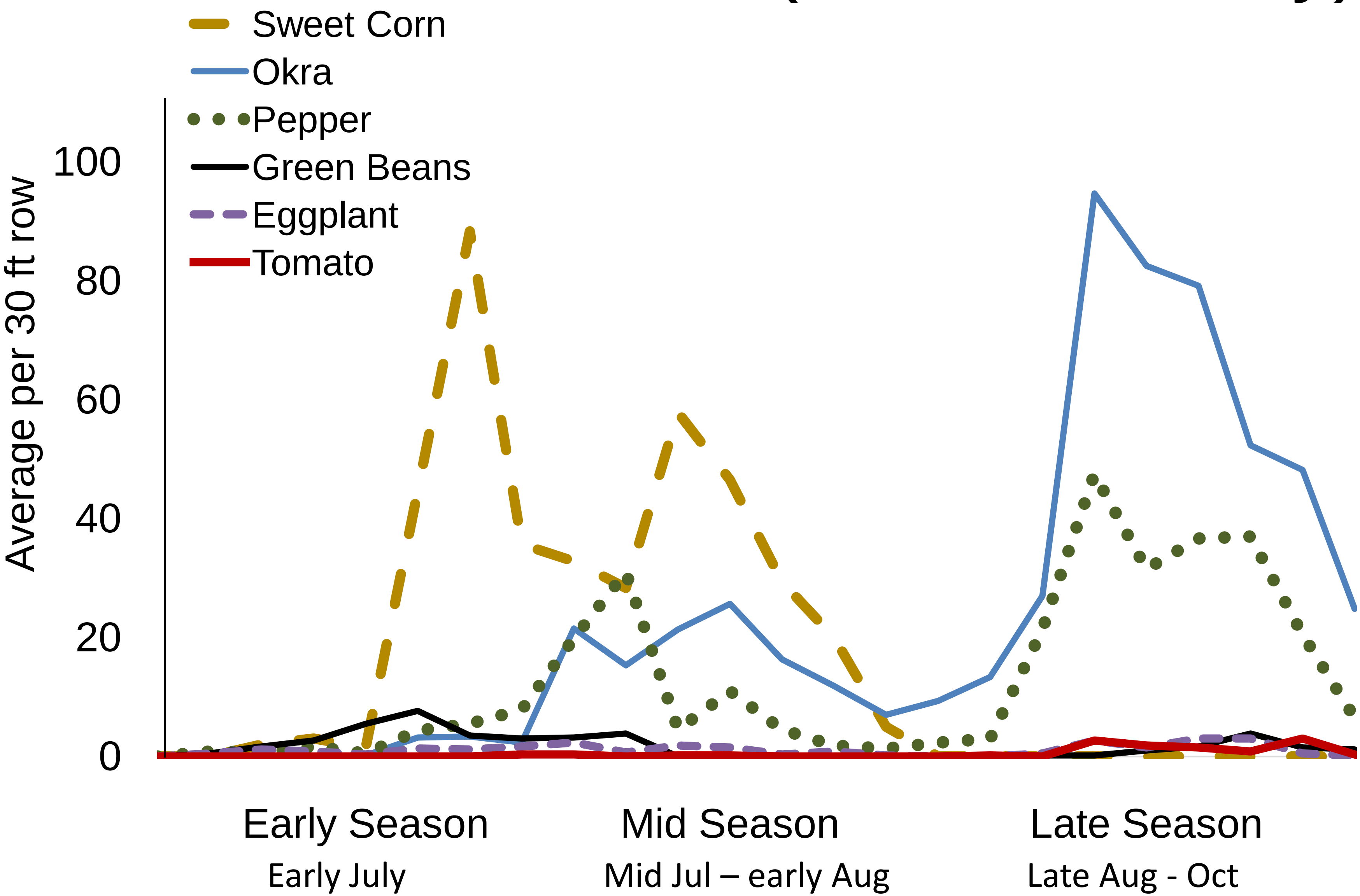
Catalpa

Peach

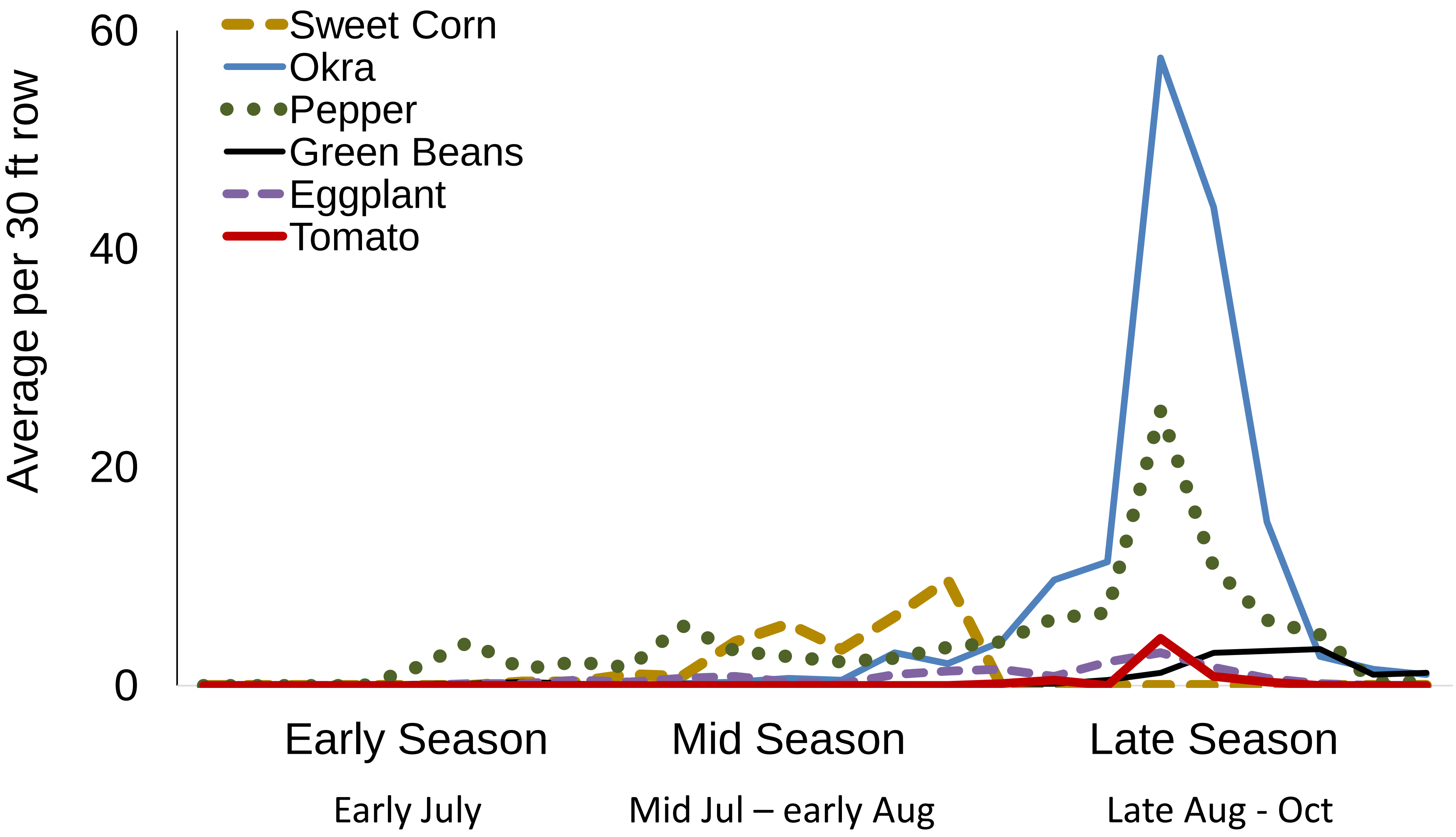
Mulberry

Wild cherry

BMSB Adults – MD (Zobel & Dively)



Nymphs (2nd – 5th instars)



BMSB feeding damage 2013 - MD

	Mean Percent Damage (fruit)	Standard Error (+ / - %)
Sweet Corn	97.0%	2.2
Pepper	39.7%	4.2
Tomato	33.9%	3.0
Okra	19.4 %	2.1
Eggplant	5.0%	1.1
Green Beans	1.8 %	0.2

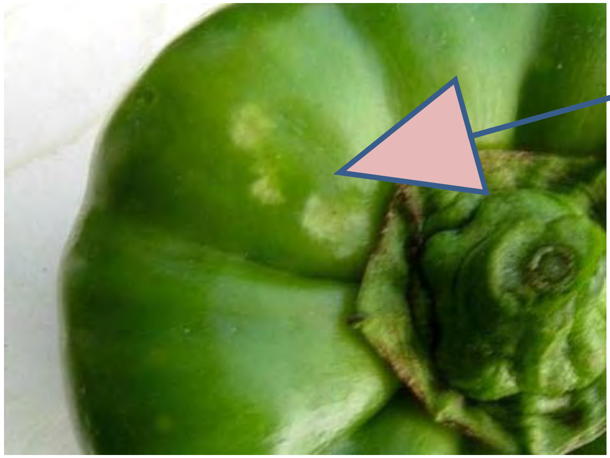
From 2010 to 2013, the percentage of harvested fruit with stink bug damage was recorded from various vegetable crops that were not treated with insecticides. Data are comprised of 130 harvests of either pepper, sweet corn, tomato, snap bean, eggplant or okra planted in DE, MD, NJ, or VA.

	n	2010	2011	2012	2013	Average
Sweet corn:	9		44%	69%	67%	60%
Pepper:	44		29%	22%	33%	28%
Tomato:	29	41%	12%	24%	27%	26%
Okra:	20		39%	10%	16%	22%
Eggplant:	17			6%	4%	5%
Bean:	11		6%	5%	2%	5%

Pest management recommendations for BMSB on vegetables

Insecticide field efficacy trials on peppers, tomatoes, sweet corn and beans in VA, 2011 -13

- Bell peppers (‘Aristotle’) on plastic mulch at Virginia Tech Kentland Research Farm (Blacksburg, VA)
- Tested over 50 different insecticide treatments
- RCBD small-plot experiments (4 reps)
- Plot = one row (20 ft)
- CO_2 backpack sprayer w/ 3-nozzle drop down boom



Stink bug injury

Performance of insecticides on BMSB

Product	Rate oz/Acre	% mortality in bean dip bioassays*		% control in pepper field tests**		Avg. % control from all four experiments
		Nymphs	Adults	2011	2012	
Scorpion 3.24	7.7	76.7	90.0	85.4	67.0	79.8
Permethrin 3.2EC	8	97.5	98.8	60.6	58.4	78.8
Baythroid XL	2.8	92.5	88.2	52.8	67.8	75.3
Endigo ZC	4.5	75.0	98.7	49.2	78.3	75.3
Bifenture 10DF	12.8	100.0	81.9	56.3	60.3	74.6
Belay	4	75.0	67.5	66.7	78.3	71.9
Lannate LV	40	66.7	75.3	79.8	62.2	71.0
Leverage 360	2.8	97.3	74.5	49.9	60.2	70.5
Hero EC	10.3	91.7	50.0	72.8	66.6	70.3
Brigadier	9.85	76.7	70.0	69.9	62.8	69.9
Venom 70	4	100.0	80.0	46.0	52.8	69.7
MustangMAX	4	100.0	35.0	72.8	69.2	69.2
Acephate 97UP	16	100.0	51.8	70.4	52.8	68.7
Trebon	8	100.0	100.0	36.5	34.9	67.9
Vydate L	48	85.0	47.0	79.7	47.1	64.7
Assail 30 G	4	90.0	32.8	70.4	NA	64.4
Warrior II	2.5	100.0	72.8	38.0	42.5	63.3
Danitol	16	93.3	42.5	60.3	55.6	62.9
Actara 50 WG	5.5	66.7	81.0	60.3	42.5	62.6
Lambda-cy	3.84	86.0	32.3	62.0	NA	60.1
Asana XL	9	35.0	27.5	76.4	NA	46.3
Beleaf 50SG	2.8	28.5	17.5	27.2	71.8	36.3

* Mortality refers to the percentage of dead + moribund individuals after 72 hrs of exposure.

** Based on reduction in stink bug injury to pepper fruit from three harvests.

Chemical control of BMSB in vegetables

- Several pyrethroids and neonicotinoids as well as products containing both active ingredients provide effective (>60%) control of BMSB on vegetables
- The only other efficacious insecticides on vegetables are the OP/carbamates:
  acephate, methomyl, and oxamyl
- Though also effective, endosulfan will no longer be registered on vegetables in the future and should not be considered.
- All of the aforementioned insecticides are disruptive to natural enemies and can undermine IPM programs

Trial # 1 – Bell Peppers , Blacksburg, VA (4 weekly sprays)

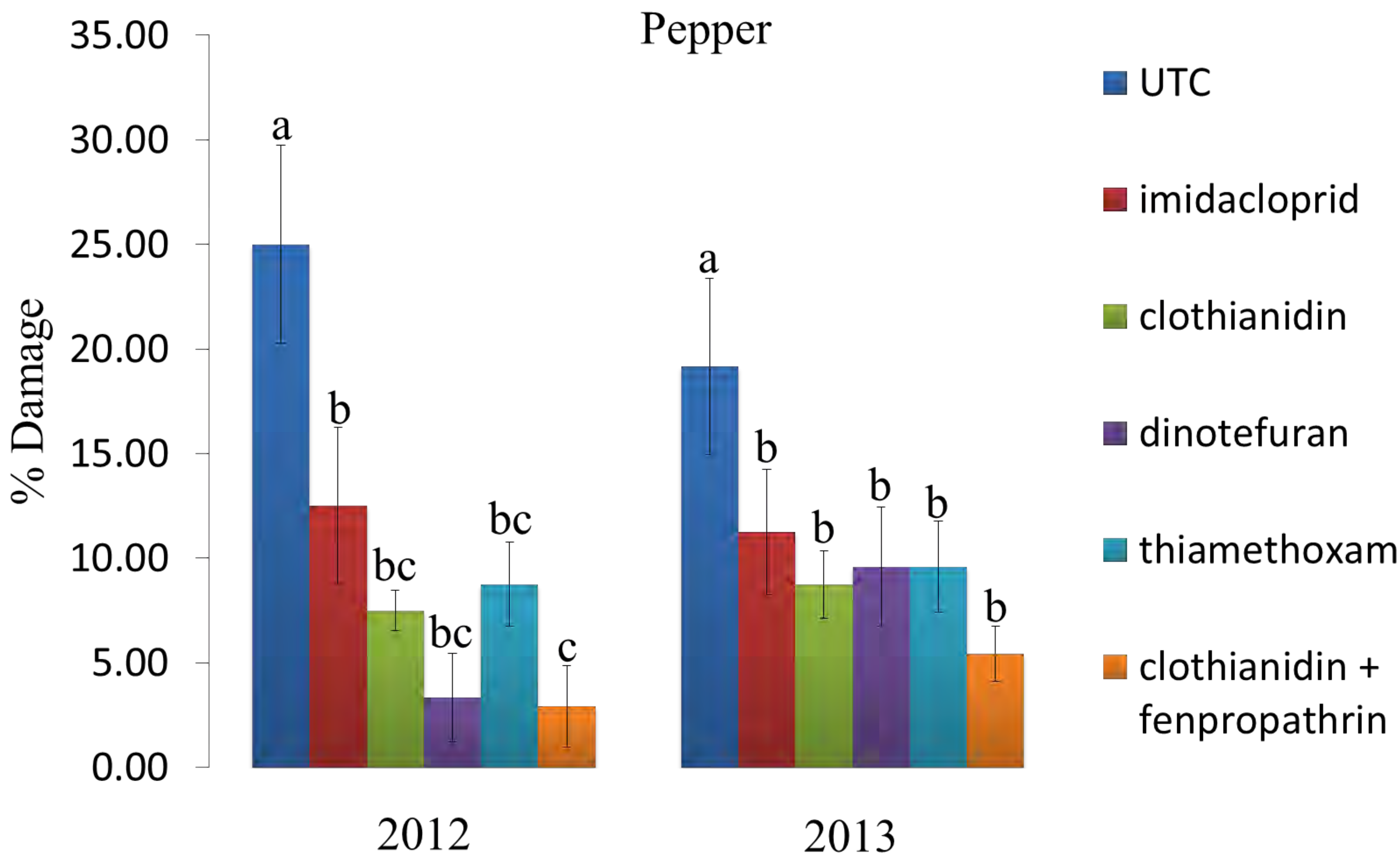
Treatment	Rate / acre	% stink bug damage			% control (dmg reduction)	Mean no. green peach aphids / 20 leaves
		8-Aug	19-Aug	30-Aug		
Untr. Control		32.0	26.7	28.8		10.3
Acephate 97UP	16 oz	7.5	11.3	7.5	70.4	0.0
Assail 30G	4 oz	8.0	6.7	11.3	70.4	1.5
Bifenture 2EC	6.4 fl. oz	13.8	5.0	12.5	64.8	765.5
Lambda-Cy 1EC	3.84 fl. oz	12.5	10.0	11.3	62.0	850.8
Perm-up 3.2EC	8 fl. oz	8.8	7.5	18.8	60.6	539.0

Trial # 2 – Bell Peppers, Blacksburg, VA (4 weekly sprays)

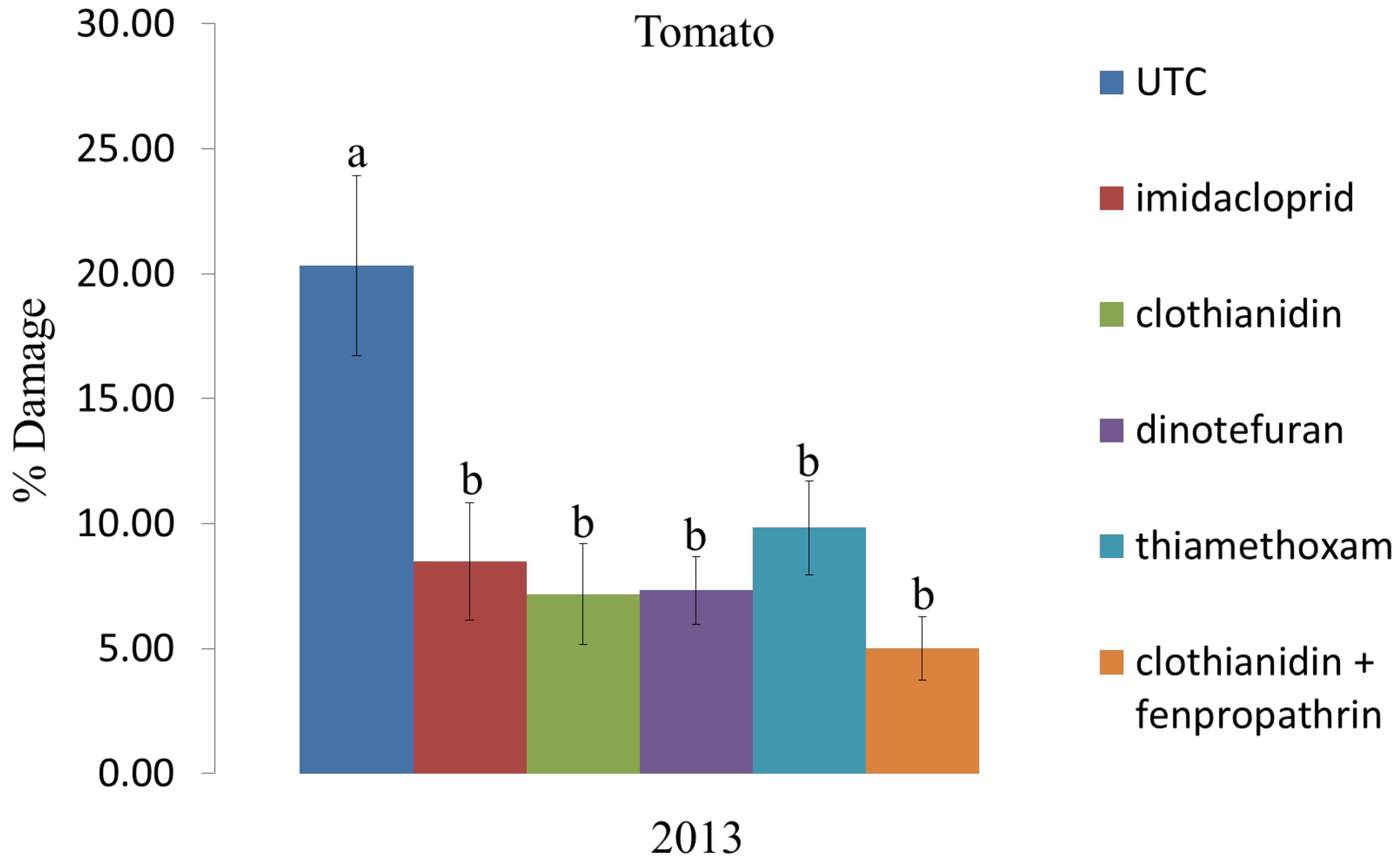
Treatment	Rate / acre	% stink bug fruit damage, VA			% control (dmg reduction)	Mean no. green peach aphids / 20 leaves
		8-Aug	19-Aug	30-Aug		
Untr. Control		31.3 a	26.3	21.3		6.0
Belay 2.13SC	4 fl. oz	10.0 b	3.8	12.5	66.7	0.5
Danitol 2.4SC	10.67 fl. oz	10.0 b	10.0	11.3	60.3	120.0
Actara 25WG	5.5 oz	12.5 b	7.5	11.3	60.3	2.5
Endigo ZC	5.5 fl. oz	17.5 ab	8.8	13.8	49.2	1.3
Venom 70SG	4 oz	17.5 ab	13.8	11.3	46.0	2.5
Warrior II	1.92 fl. oz	31.3 a	11.3	6.3	38.0	498.5

Neonicotinoid insecticides applied via drip irrigation or drench treatment

Soil-applied neonicotinoids on pepper



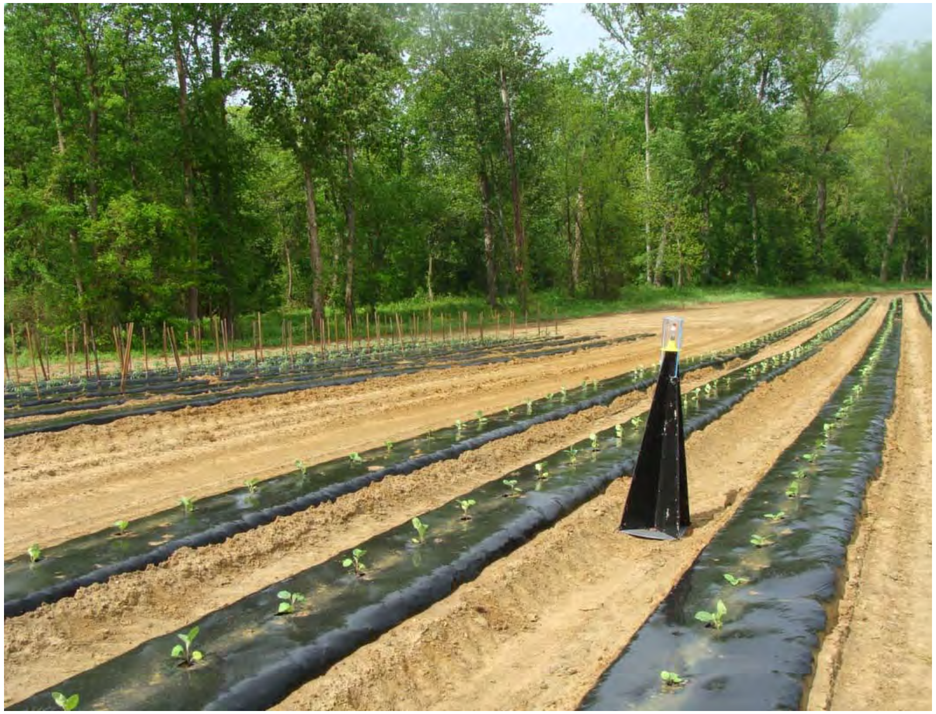
Soil-applied neonicotinoids on tomato



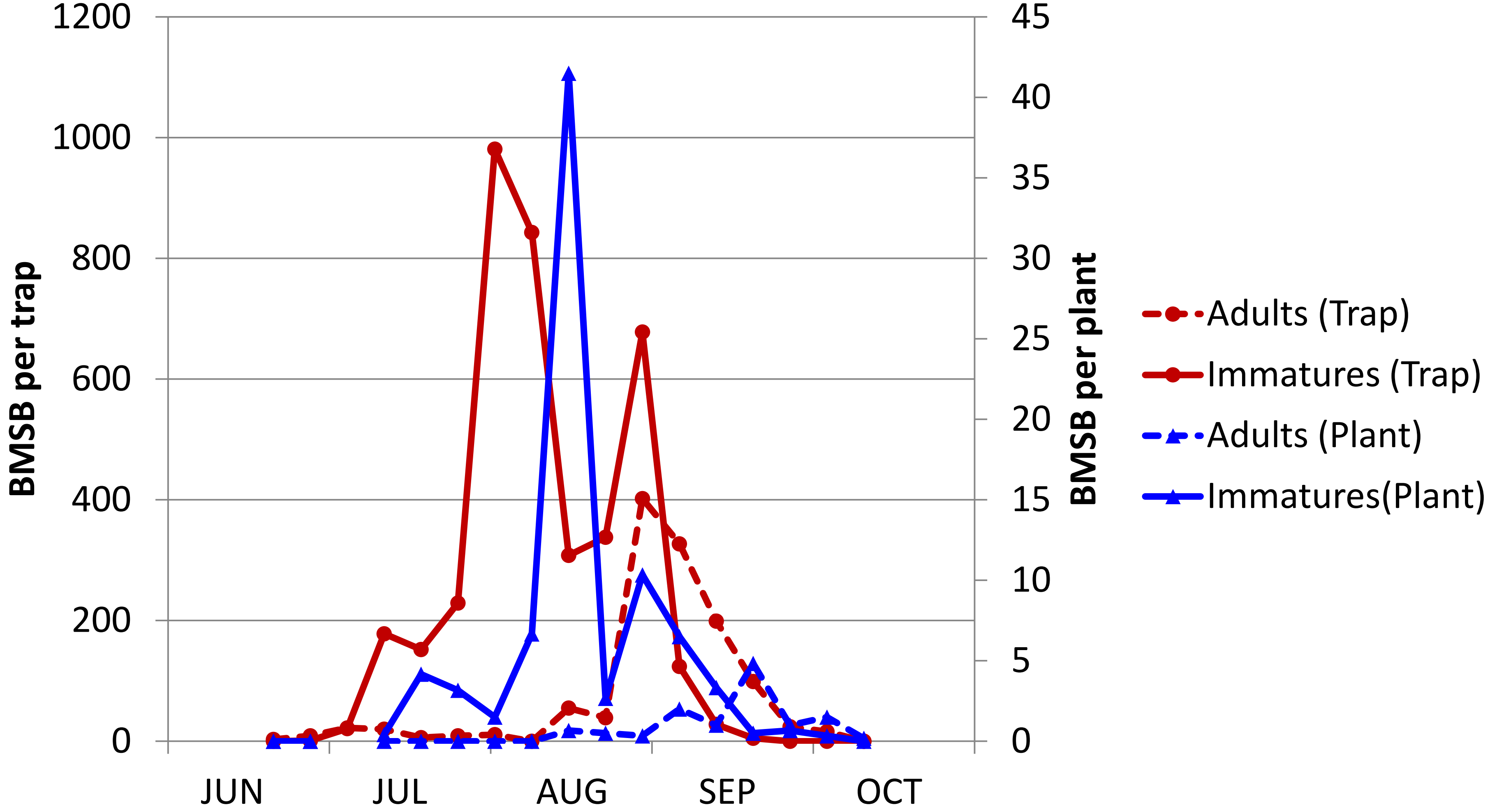
Scouting for BMSB before spraying

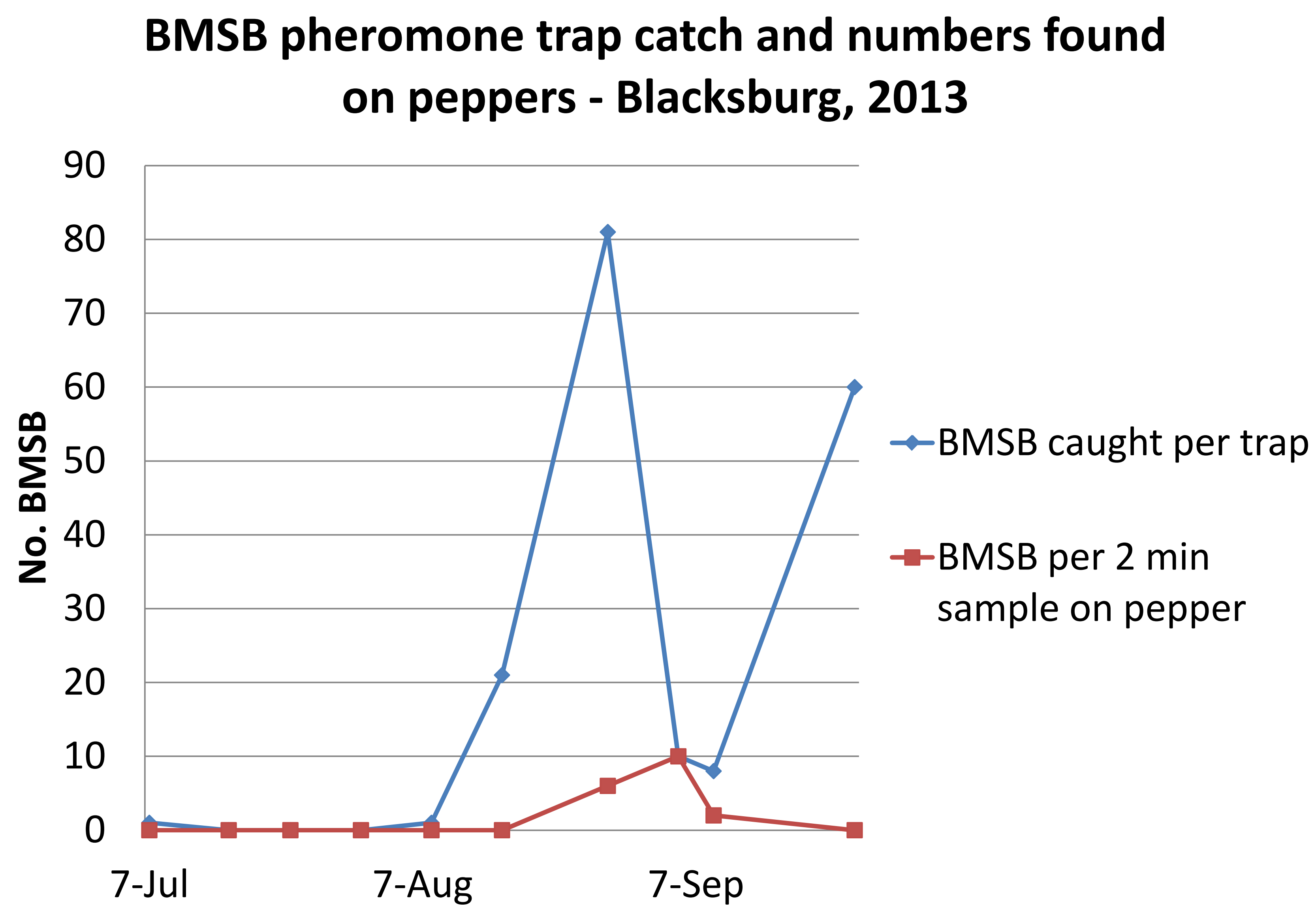
Pheromone traps

- We now have the two component BMSB lure
- Various trap designs are effective
- How can we use the trap catch data?



BMSB Pheromone Trap Captures and Timed Counts on Pepper – Organic Farm, NC (Walgenbach)




BMSB pheromone trap catch and numbers found on peppers - Blacksburg, 2013
No. BMSB
90
80
70
60
50
40
30
20
10
0
7-Jul
7-Aug
7-Sep
BMSB caught per trap
BMSB per 2 min sample on pepper

Integrated Pest Management recommendations for BMSB on Vegetables

- ❑ Not there yet, no real action thresholds.
- ❑ Check field margins next to woodlots for the first sign of BMSB activity.
- ❑ Pheromone traps should aid in pest management decisions
- ❑ Multiple foliar applications spaced 5-7 days apart may be necessary, if re-invasion occurs.
- ❑ Soil-applied neonics may be an option for some crops.
- ❑ Treating areas 30-50 ft from field edges next to woodlots may stop invasion (research in soybeans)

Expected outcomes by end of 2014

- **We will develop sound crop-specific IPM programs for sweet corn, fruiting vegetables, and beans.**
- **Develop BMSB management extension bulletins for each vegetable crop.**