Commodity Report:

A summary of what we've learned about BMSB in specialty crops

Commodity Team Leaders

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Orchard Crops	C. Bergh
Grapes	A. Nielsen
Small Fruit	C. Rodriguez
Ornamentals	P. Shrewsbury

Funding

USDA United States Department of Agriculture | National Institute of Food and Agriculture | Specialty Crop Research Initiative

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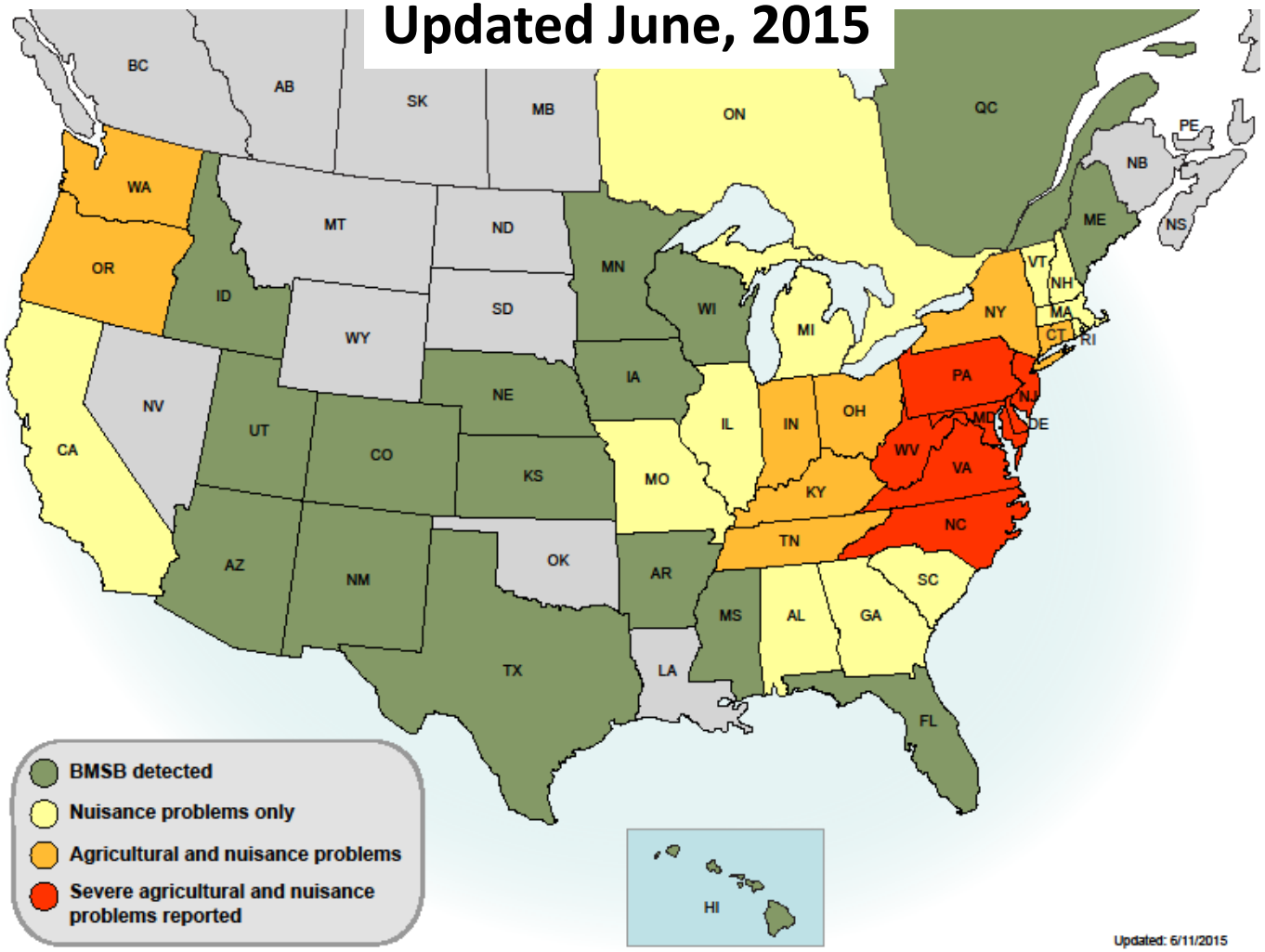
Collaborating Institutions

University of Delaware | ars | Penn State | Rutgers | Northeastern IPM Center | Washington State University | Cornell University | University of Maryland | Virginia Tech | OSU Oregon State University | NC State University

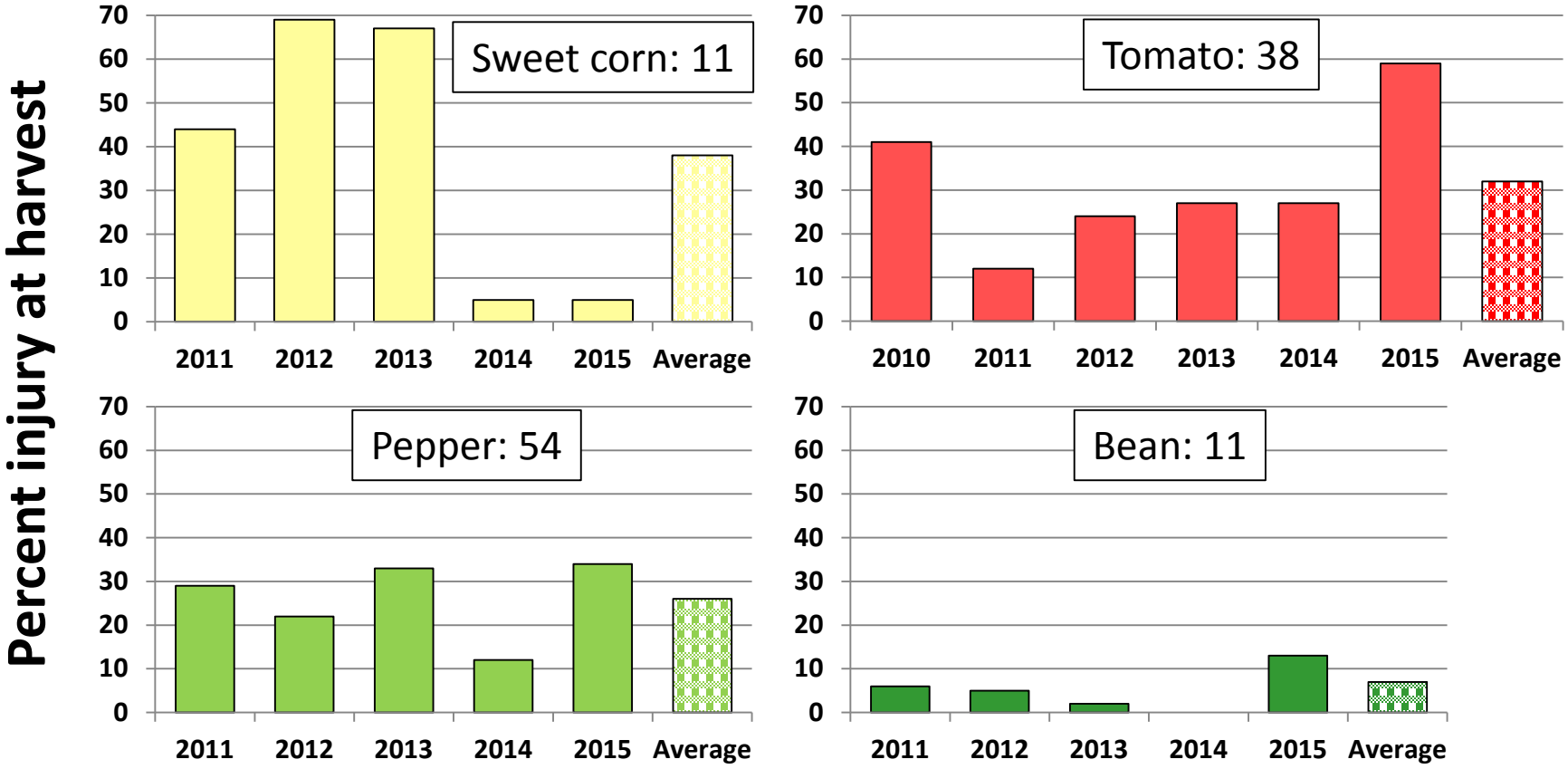
SCRI Stakeholder Advisory Panel Meeting
USDA AFRS, Kearneysville, WV
December 1, 2015,

Stop BMSB.org



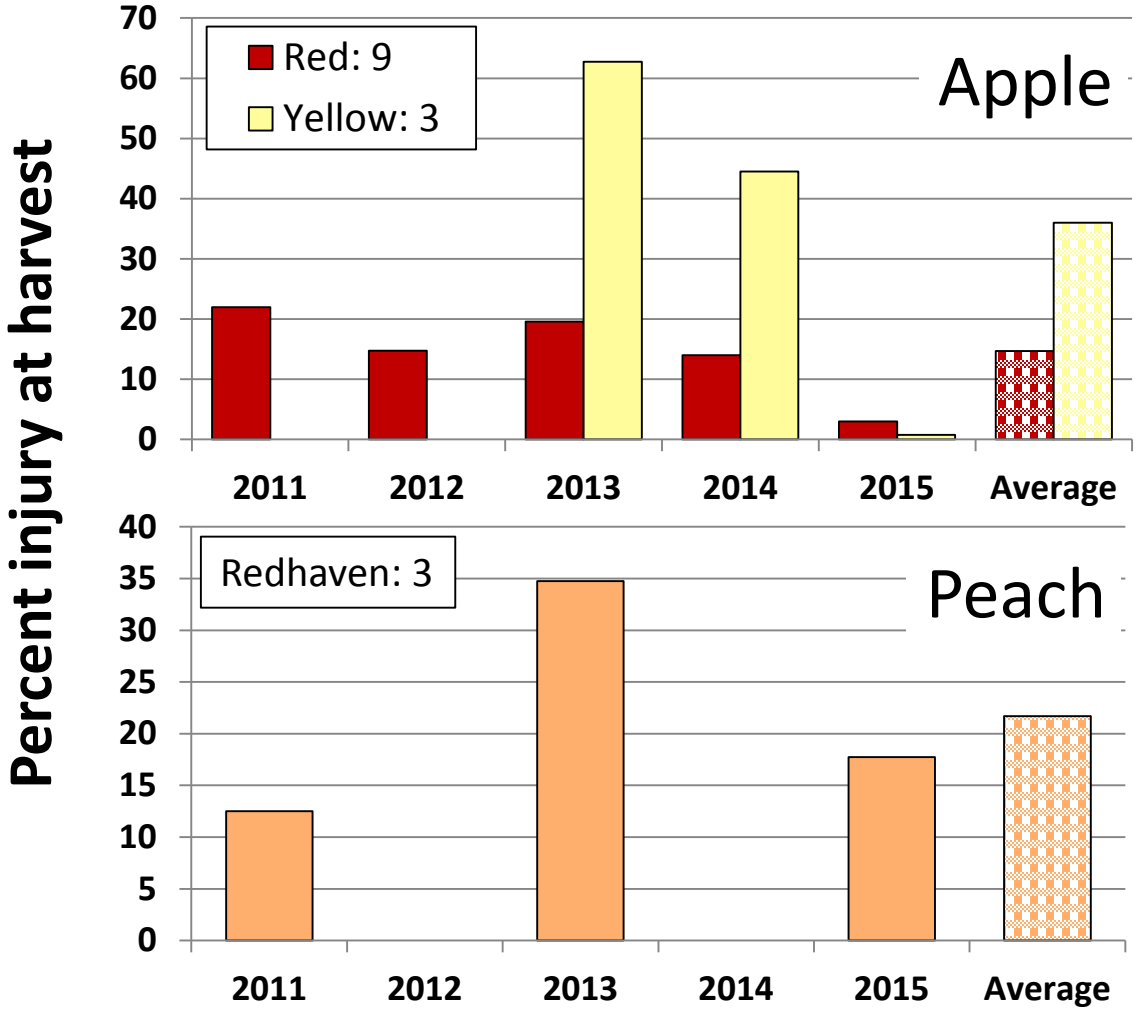
- Status based largely on size of peak populations & observed effects
- Size of peak populations has varied annually
- Many caveats with respect to crop-specific and regional effects

BMSB injury at harvest in unsprayed control plots: **Vegetables**



Trials conducted in DE, MD, NJ, NC and VA

BMSB injury at harvest in unsprayed control plots: **Tree fruit**



Relative BMSB importance or risk from a management or injury perspective

(researcher perceptions of BMSB based on top 5 pests by crop)

Vegetables[1]

Crop	Rank
Pepper	1
Tomato	2
Sweet corn	3
Bean	4
Okra	4

Eastern orchards

Crop	Rank
Peach	1-3
Pear	2-3
Apple	1-4
Cherry	<5

Western orchards[2]

Crop	Rank
Hazelnut	3
Peach	<5
Pear	<5
Apple	<5
Cherry	<5

Small fruit and grape[3]

Crop	Rank
Caneberry	<5
Blueberry	<5
Strawberry	<5
Grape	≤5

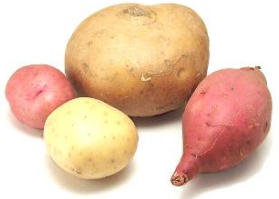
Ornamentals: All <5

[1] In production areas with BMSB pressure. Most production in areas with low pressure.

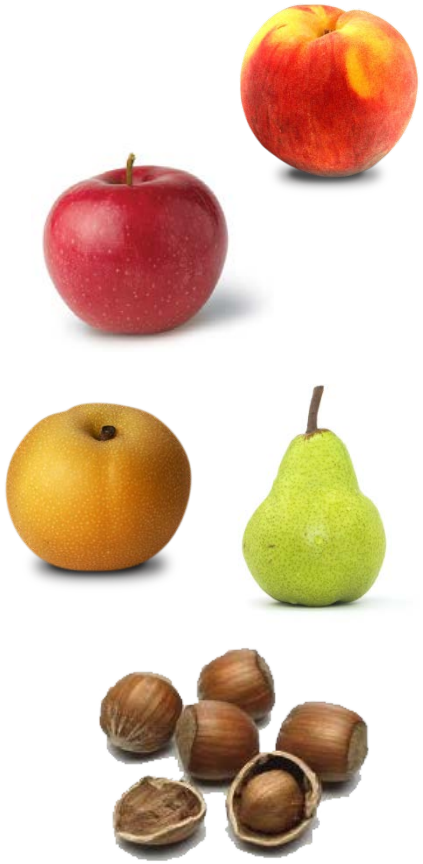
[2] Pressure still relatively low in production regions. Growers consider BMSB a significant threat due to potential for spray program effects on 2^{o} pests.

[3] Producers most concerned about taint from crushed bugs. Nuisance issue in tasting rooms.

Relative susceptibility to injury from BMSB: **Vegetables**

High	Moderate	Low
		
		
		
		
		
		
		
		
		

Relative susceptibility to injury from BMSB:
Orchard crops

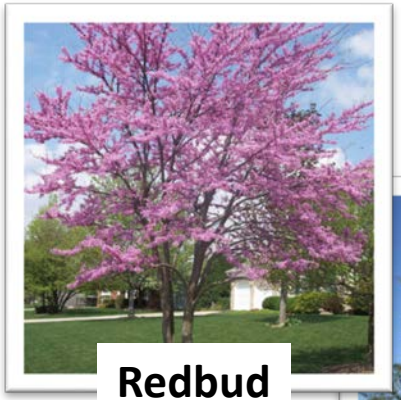
High	Moderate	Low
		

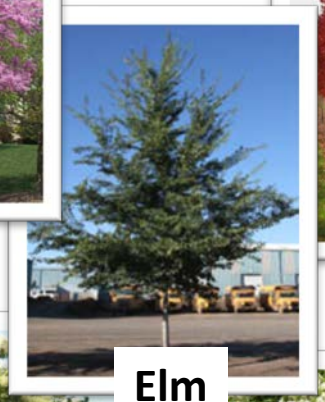
Relative susceptibility to injury from BMSB:
Small fruit and grape

High	Moderate	Low
		

Relative abundance of BMSB:
Ornamentals

High


Redbud


Elm


Red maple


Peking lilac


Japanese Pagoda tree

Low


Katsura


Needled evergreens


Japanese maple


Kousa dogwood


Horse chestnut

Specialty Crops at Risk to BMSB Damage

HIGH RISK	apple, Asian pear, beans (green, pole, snap), bee-bee tree, edamame, eggplant, European pear, grape[1], hazelnut, Japanese pagoda tree, nectarine, okra, peach[2], Peking tree lilac, pepper, redbud, sweet corn, Swiss chard, tomato	
MODERATE RISK	apricot, asparagus, blueberries[1,3], broccoli, cauliflower, cherry[2], collard, cucumber, flowering dogwood, horseradish, lima bean, littleleaf linden, serviceberry, tomatillo	
LOW RISK	blackgum, carrot, cranberries, garlic, ginkgo, greens, Japanese maple, kohlrabi, kousa dogwood, leeks, lettuce, many gymnosperms, onion, potato, spinach, sweet potato, turnip	
UNKNOWN ?	almond, citrus, hops, kiwi, olive, pistachio, plum, strawberries, walnut	
HOSTS — Non-Specialty Crop BMSB Hosts Contributing to Specialty Crops Risk	field corn, soybean	

1—Potential risk of taint/contamination. 2—Additional risk potential due to bark feeding. 3—Considered moderate-high risk.

USDA

Funded by USDA-NIFA SCRI Coordinated Agricultural Project, grant #2011-51181-30937. Image credits—sweet corn: Joe Zlomek; eggplant: Howard F. Schwartz, Colorado State University, Bugwood.org; apple, carrots: morguefile.com/creative/bekahboo42; flowering dogwood: Richard Floyd, Creative Ideas LLC, Bugwood.org; blueberries, cauliflower: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org; ginkgo: Jan Samanek, State Phytosanitary Administration, Bugwood.org; cranberries: Cjboffoli (CC-BY-3.0). Printed May 2015.

About BMSB

The brown marmorated stink bug, *Halyomorpha halys* (Stål), is a voracious eater that damages fruit, vegetable, and ornamental crops in North America. With funding from USDA's Specialty Crop Research Initiative, our team of more than 50 researchers is uncovering the pest's secrets to find management solutions that will protect our food, our environment, and our farms.

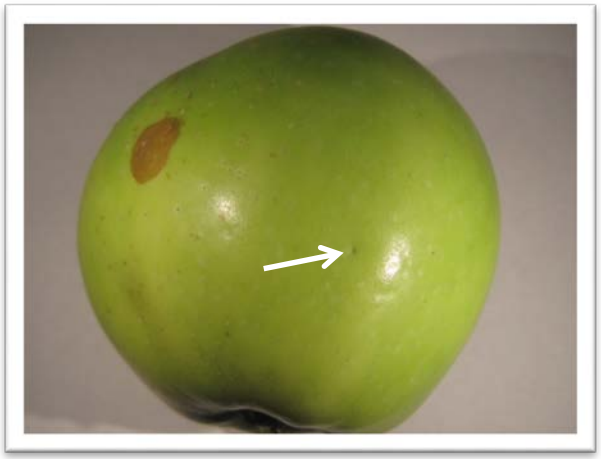
Learn more at **StopBMSB.org**.

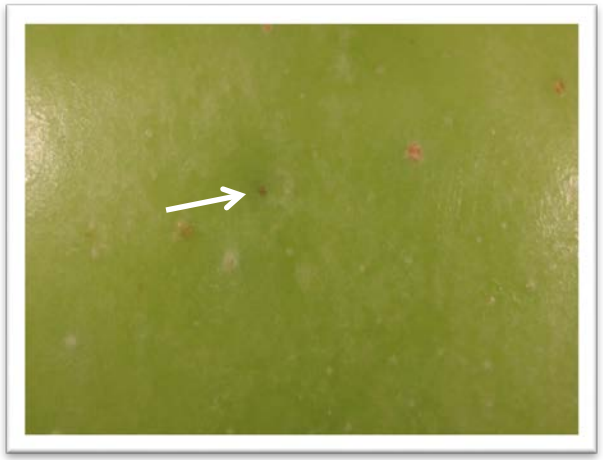
Stop BMSB

Injury diagnostics: **Vegetables**

Necrotic or clorotic areas, distortion, or kernel loss/injury

Injury diagnostics: **Apple**





Stylet insertion point

Stylet sheath (early season)

Stylet sheath (mid-season)

Injury diagnostics: **Apple**

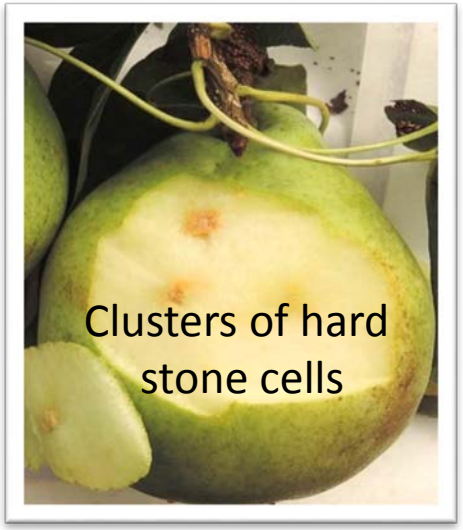
Discolored depressions

Internal necrosis

BMSB versus bitter pit and cork spot?

- Tends to be about 1:1 relationship between external & internal injuries at harvest
- Additional injury can be expressed during post-harvest cold storage
- Apples not a particularly suitable host for BMSB nymphal development

Injury diagnostics: **Pear**



Caged BMSB at “turn-down” stage (4 June) ……..and at ~ 3 wk before harvest

BMSB feeding close to harvest not expressed as external injury at harvest, but caused internal necrosis

Injury diagnostics: **Peach**

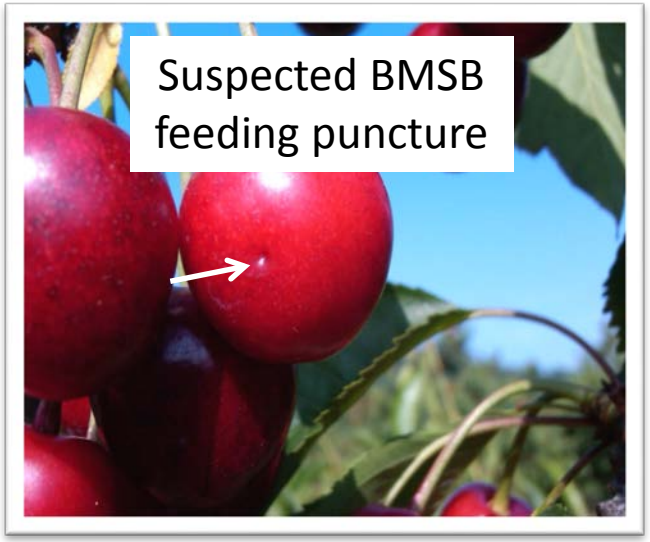
Gummosis on young peaches

Internal necrosis in young peaches

Deformation & internal necrosis

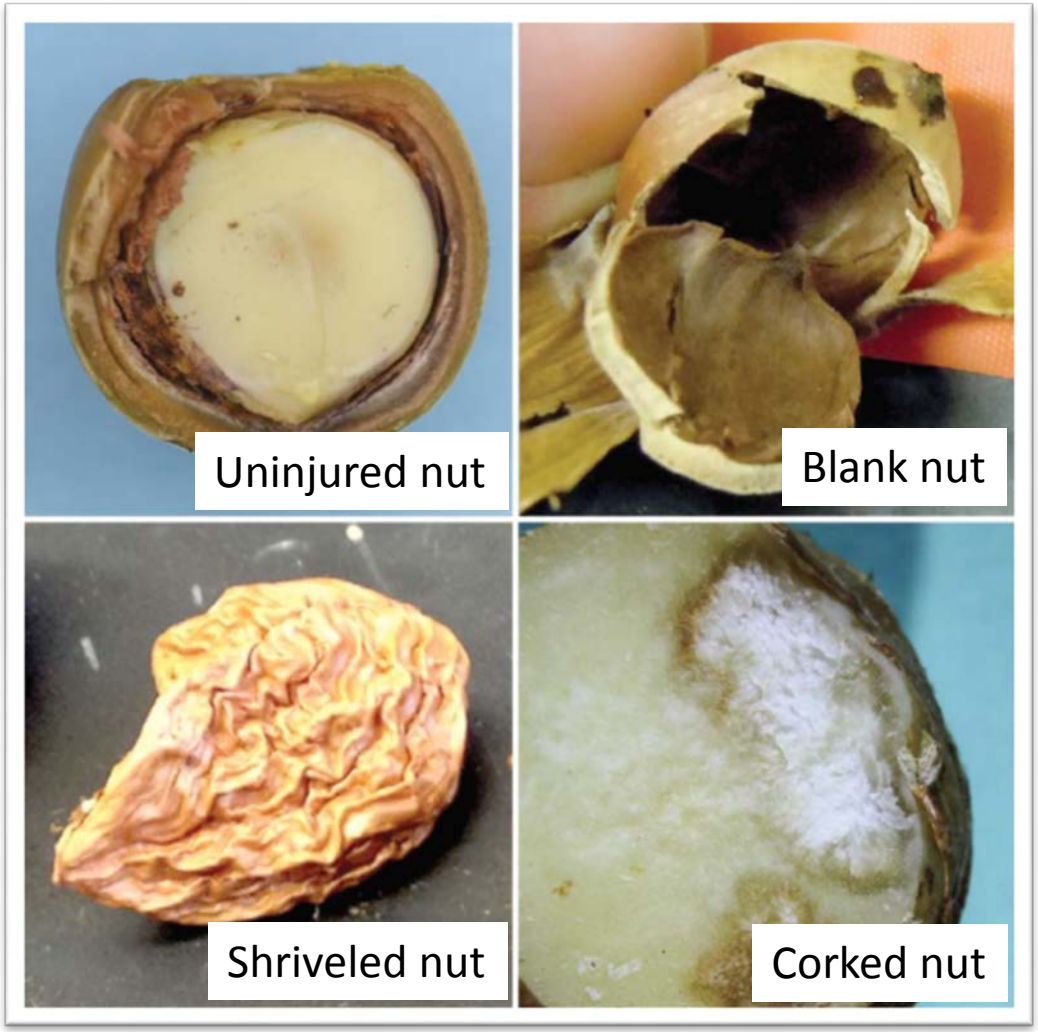
- Peaches with no external injury at harvest can show internal injury
- Need to cut fruit to evaluate injury
- Peaches highly suitable for BMSB nymphal development

Injury diagnostics: **Cherry**

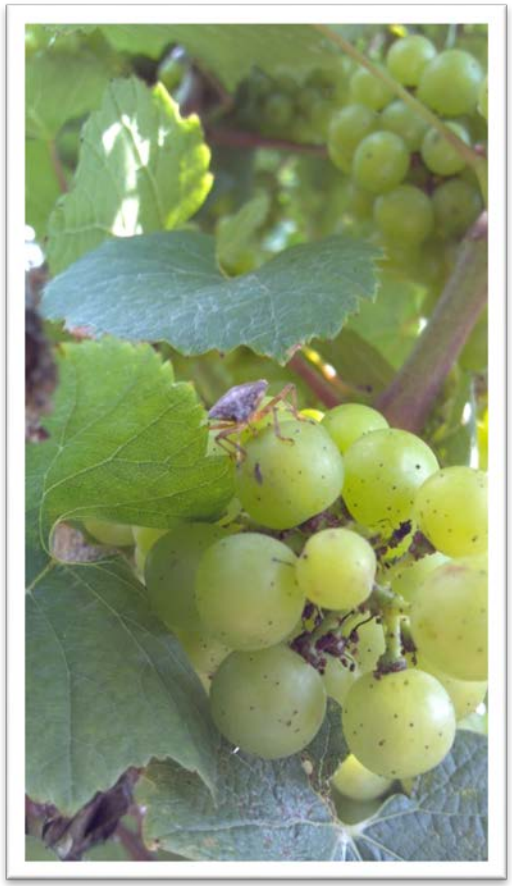


Cherries exposed to BMSB on 4 June

Injury diagnostics: **Hazelnut**



Injury diagnostics: **Small fruit & grape**



- Injury not characterized on some small fruits & grape as well as on some other crops
- Likely affects development of caneberry druplets

Injury Diagnostics: **Ornamentals**

Inclusion cage

Stippling on crabapple foliage

Stippling on serviceberry fruit

<u>Preliminary Results</u>:

- Minor damage apparent on leaves & fruits
- May be negligible compared to other pests (*e.g.*, Japanese beetles)

Injury Diagnostics: **Ornamentals**

BMSB known to feed through the bark of some hosts

Does this cause economic injury or promote fungal growth?

Results forthcoming:

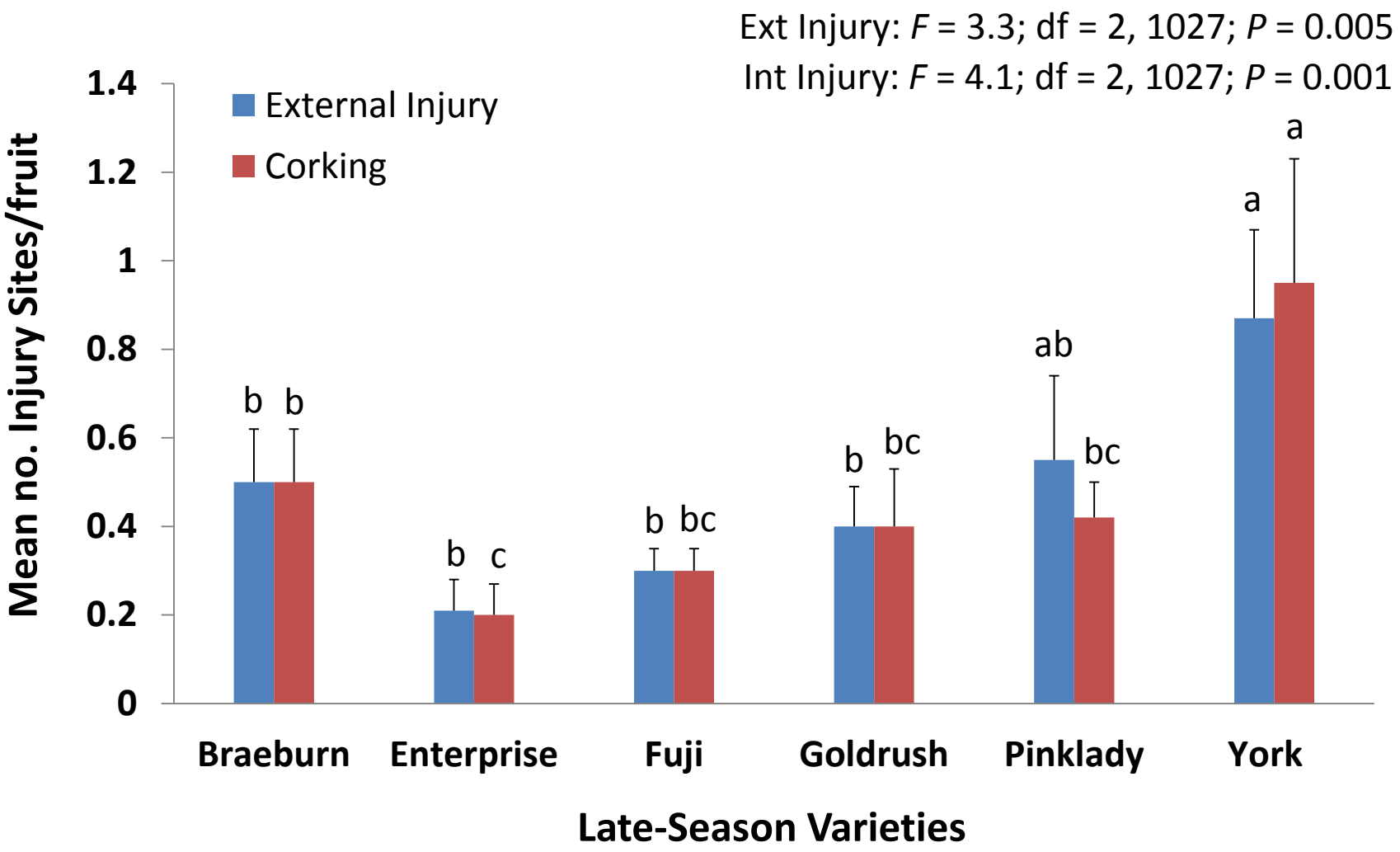
- Fungal growth from exposure to different numbers of BMSB
- Incremental growth, DBH, visual feeding damage
- Minimal visual damage by bark-feeding

Varietal Differences in Susceptibility

Crop group	Crop	Comments
Vegetables	all crops	• None detected • VERY hot peppers not susceptible
Orchard crops	apple	• Not well understood • Anecdotal reports of some differences
	peach	• Not well understood
	pear	• Bosc more than d'Anjou • Asian pears possibly more than European
	hazelnut	• Thick- and thinner-shelled varieties equal
Small fruit	all crops	• None detected
Grape		• White varietals (*e.g.* Chardonnay, Traminette) more susceptible than reds • Harvest date effects? • Taint more evident in delicate wines (flavor profile, fermentation process)
Ornamentals		• Major differences in abundance among families, genera, species and cultivars • Seasonal differences in abundance

Apple variety screening 2011

Apple variety screening 2011





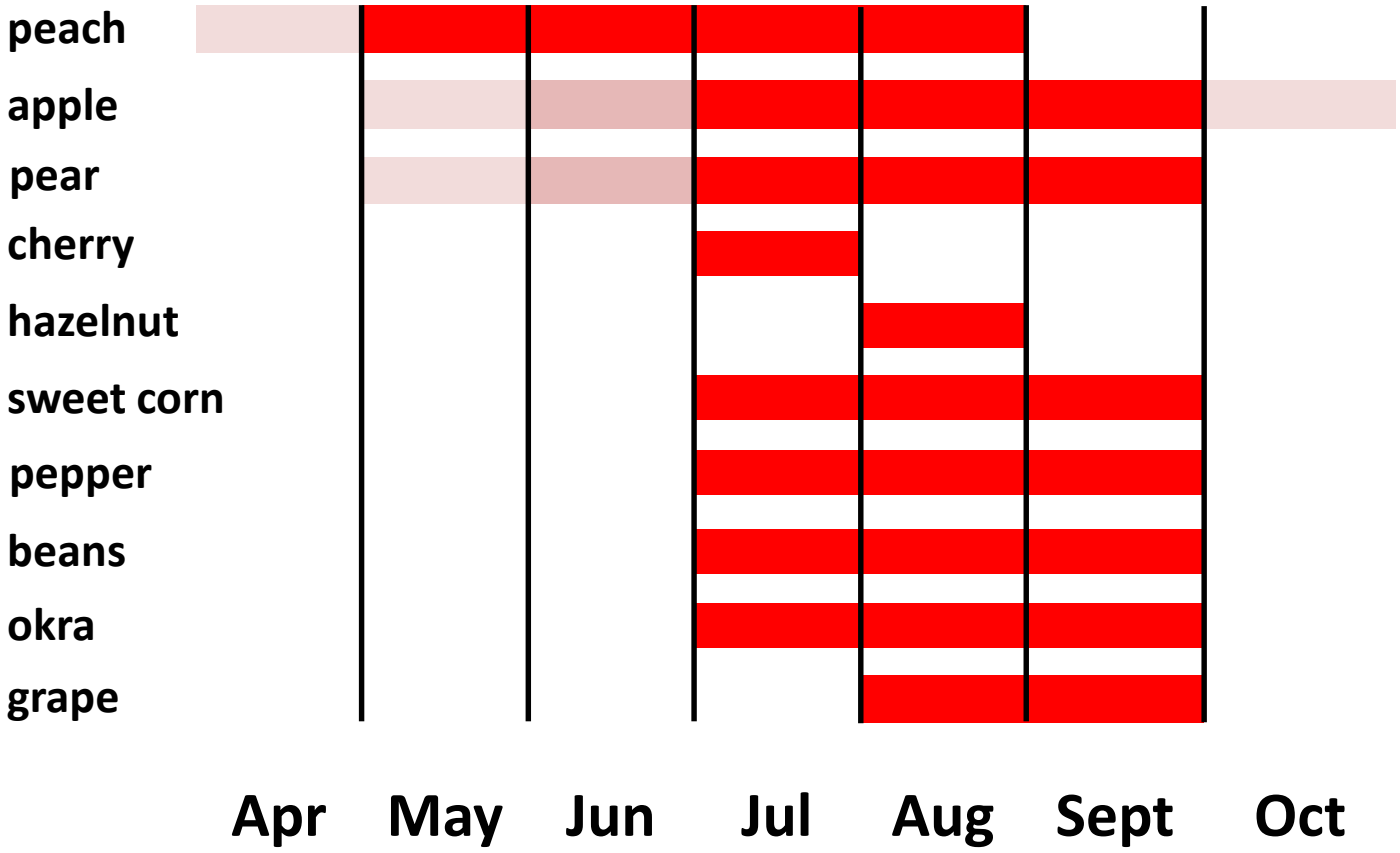
Commonalities and Differences



Impact on Management Programs

Crop Group	Significant to moderate	Minimal	None
Vegetables	pepper beans okra	sweet corn tomato	
Orchard crops	peach apple pear hazelnut	cherry	
Small fruit, grape		caneberry grape	blueberry strawberry
Ornamentals			all hosts

Seasonal timing of injury/intervention



Potential for Yield Loss

Crop group	High	Moderate	Low	None
Vegetables	sweet corn pepper okra tomato	bean		
Orchard crops	peach apple* pear hazelnut		cherry	
Small fruit, grape			blueberry caneberry grape	strawberry
Ornamentals				all hosts

* Depends on market destination

Potential for Quality Loss
(marketability and/or downgrading)

Crop group	High	Moderate	Low
Vegetables	sweet corn pepper beans okra		
Orchard crops	peach apple* pears hazelnut		cherry
Small fruit, grape		blueberry grape (taint)	caneberry strawberry
Ornamentals			all hosts

* Depends on market destination

Commonly used insecticides for BMSB

Crop group	Crop(s)	Insecticide	Chemical class
Vegetables	sweet corn, pepper, etc.	1) bifenthrin 2) λ-cyhalothrin 3) beta-cyfluthrin	all pyrethroids
Orchard crops	apple and pear	1) Endigo 2) Lannate 3) bifenthrin	pyrethroid + neonic carbamate pyrethroid
	peach	1) permethrin 2) bifenthrin 3) Endigo	pyrethroid pyrethroid pyrethroid + neonic
	hazelnut	1) esfenvalerate 2) Doubletake	pyrethroid diflubenzuron + pyrethroid

- BMSB rarely targeted specifically in small fruit, grape & ornamentals
- In tree fruits, insecticide use/selection depends to some degree on annual BMSB pressure (personal observations, researchers/extension)
- ARM sprays quite widely adopted by tree fruit growers
- Pyrethroid use has created 2^{o} pest issues in fruit orchards & vegetables

Monitoring/scouting for BMSB

Vegetables

- Some use of pheromone-baited pyramid traps, but minimal monitoring overall
- Visual scouting in 50% of tomatoes & sweet corn

Orchard Crops

- Some adoption of pyramid traps in tree fruit & hazelnut

Small fruit and grape

- Minimal monitoring in small fruit
- Some pheromone trapping & beating/shaking in grape

Ornamentals

- Some scouting at edges near other hosts & on fruiting ornamental hosts

Secondary pest issues ascribed to BMSB management programs

Vegetables

- Reports of green peach aphid (peppers) & corn leaf aphid (corn)

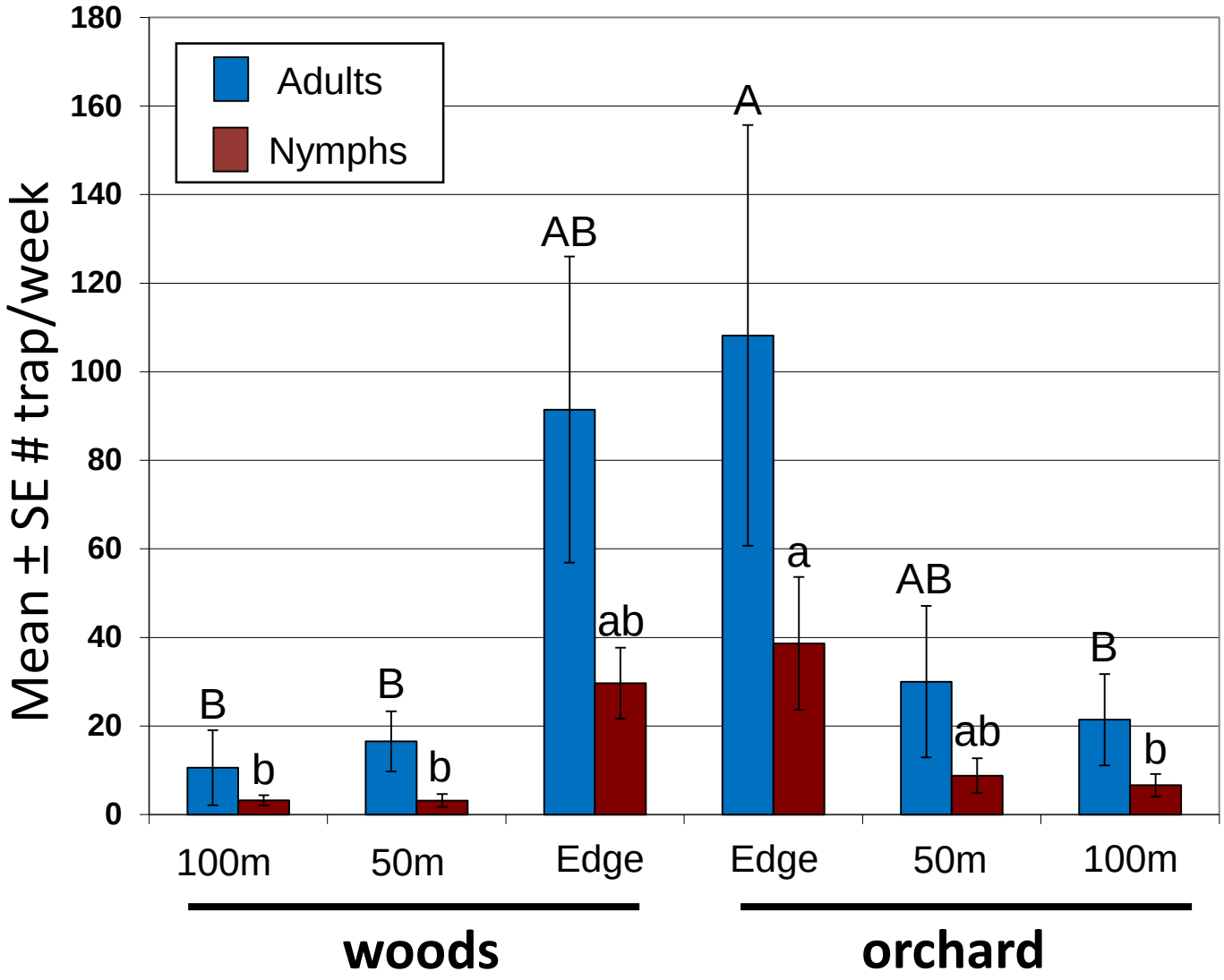
Orchards

- Woolly apple aphid outbreaks common in several Mid-Atlantic states (significant management issue)
- Scale and spider mite outbreaks also reported
- None detected in OR hazelnuts

Small fruit, grape and ornamentals

- None detected

Pyramid trap transects in commercial apple orchards , 2014



Miscellaneous recent data

- Feeding by 2nd & 3rd instar BMSB nymphs on apples and pears did not cause as much injury as feeding by 4th & 5th instars or adults
- BMSB abundance on fruiting ornamentals tracked seasonal availability of fruit. De-fruiting trees caused pronounced reduction in BMSB abundance
- Initial indications that feeding by BMSB on Chardonnay and Pinot Noir grapes tended to make them more vulnerable to SWD infestation

- Damage on Bosc more severe than on d'Anjou pears from same exposure to BMSB just before harvest
- BMSB feeding injury increased ethylene production and respiration rate in Bosc but not d'Anjou pears during cold storage

Wang and Shearer: 2015

Key next steps

Vegetables

- Sampling threshold for management decisions for each high-risk vegetable crop
- Timing of risk (complicated by staggered planting dates for corn and beans)

Orchard Crops

- Perimeter-driven management tactics
- Border sprays, A&K alone or in conjunction with trap-based thresholds)
- Effective strategies that do not incite 2^{o} pests
- Refined & optimized monitoring tools
- OR hazelnut growers very interested in biocontrol

Key next steps

Small fruit & grape

- May not be as much activity going forward in with respect to management in caneberries or blueberries
- Perimeter-driven management near harvest to reduce effects of BMSB in crush & wine taint

Ornamentals

- Reduce home invasion pressure in the fall via use of non-preferred or non-susceptible hosts in managed landscapes