

# **Impact of BMSB Control on Pennsylvania's Tree Fruit IPM Programs**

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The use of the synthetic pyrethroids and the carbamate – methomyl to control the Brown Marmorated Stink Bug (BMSB), *Halyomorpha halys*, in Pennsylvania apple and peach orchards could set back our IPM programs 40+ years. These sprays, especially the synthetic pyrethroid, will likely wipe out any biological control programs that have been in place and routinely followed by growers and could reverse the potential benefits of FQPA on IPM that we outlined in a position paper recently (See attached). Also, many growers in Pennsylvania have adopted the use of pheromone mating disruption (MD)) to control both the codling moth and oriental fruit moth on both apples and peaches, respectively, and reducing both the incidence of these two pests and allowing for the further reduction in the use of insecticides for their control. The repeated use of the synthetic pyrethroids and methomyl will likely force growers to curtail the use of MD in their orchards, another example of setting back our IPM program and increasing additional insecticide use. We have been reducing the number of insecticide sprays for pests like codling moth, oriental fruit moth, and leafrollers over the last four years or so, but BMSB will most likely reverse this trend with frequent late season sprays added for fruit protection close to harvest, which will increase pesticide residues on fruit. Flare-ups of secondary pests like mites, aphids, and leafrollers will increase, requiring an increase in the number of pesticide applications the following seasons. Environmental impacts on non-target organisms (i.e. pyrethroids are very toxic to fish, and methomyl is toxic to many mammals), as we have been measuring with Environmental Impact Quotients (EIQ) data, would greatly increase unless a reduced-risk product can be found that will provide sufficient control of BMSB. Border spraying of pyrethroids along the edges of woods and fencerows would also greatly impact the 50 species of wild bees we have found significantly contributing to pome and stone fruit pollination. Over 1/3<sup>rd</sup> of all 450+ species of bees in Pennsylvania have now been found along the borders of Pennsylvania fruit orchards and such sprays would impact them to varying degrees now as well.

## **Cost and pounds of active ingredients of acaricides if we eliminate *Stethorus* and other predatory mites with designated BMSB control**

The black lady beetle - *Stethorus punctum* - is no longer the principal agent for mite biological control in PA apples because a number of the new “reduced risk” insecticides that were registered in the late 1990’s and the early 2000-2004 period were moderately to highly

toxic to them (i.e., imidacloprid & novaluron). However, the switch to these reduced risk products allowed for the survival of predatory mites, which were much more tolerant to most of the new chemistries recently registered and the predatory mites were able to out-compete *Stethorus* for food. The phytoseiid predatory mite, *Typhlodromus pyri*, is now the predominant mite predator in PA orchards and is able to maintain pest mites at much lower levels. We also now observing high number of the stigmatiid predatory mite, *Zetzellia mali*, which feeds on mite eggs. Mites are not normally an annual problem in peaches and the current heavy pyrethroid use eliminates most predators.

- *Stethorus* reduced acaricide use by 50% from the early 1970's to the late 1990's saving growers an estimated \$20 million and reduced the need for two million lb product in PA. Some damage occurred even when *Stethorus* was active in the orchards, but this was never quantified. Acaricide resistance and an apple industry that was predominately processing which could tolerate some mite damage made *Stethorus* a viable option. Pest mite levels of 5-15 mites/leaf, which were common during this period, are no longer tolerated in fresh market apples that are less tolerant of mite damage. In addition, there are now many more effective acaricides to select if pest mites become a problem.
- We estimate that *T. pyri* is currently saving PA apple growers about \$1 million/year in acaricide costs and is reducing the amount of acaricide needed for control by approximately one ton of active ingredient/year. Where *T. pyri* is conserved, it will maintain mites below one mite/leaf with no appreciable damage. The use of dormant oil (55,000 gallons/yr) for early season mite control has also been discontinued mainly because of the effectiveness of biological mite control with *T. pyri*.

### Fig. 5 Bottom Line To PA Apple Growers

#### Presently w/o *T. pyri*

- Miticides and oil represent about 30% of arthropod control costs on 22,000 acres.
  - 2005 cost for miticides on 22,000 acres was about **\$561,000.**
  - 2005 cost for dormant & summer oil is about **\$125,000.**
- Over **1 ton of miticide AI/ year** & about **55,000 gallons of dormant & summer oil.**
- Resistance to most current miticides & non-target effects.

#### *T. pyri* Conserved/Introduced

- Only a dormant oil application is necessary to supplement *T. pyri* & scale control every other year.
  - total cost is **\$50,000/year.**
- **Almost no miticide AI** & only 10,000 gal of dormant oil.
- Sustainable long-term.
  - No resistance.
  - Basis for RR & organic IPM.
  - Applic. to stone/small fruits.

## **Biological Control of Woolly Apple Aphid**

Recent orchard studies by Biddinger & Hull has shown that control of the woolly apple aphid by the parasitoid, *Aphelinus mali*, and several species of syrphid fly larvae can reduce the need to control this pest by an estimated 75%. Currently, the most effective insecticide for WAA control is the organophosphate – diazinon. This pest is the only legal use for this product post-bloom remaining on its label. According to NASS, in 2005 Pennsylvania growers used 15,200 lb of diazinon worth approximately \$120,000 on apple. In 2007, however, the amount used was only 2,000 lb as the populations can fluctuate greatly from season to season. Recent introductions of more susceptible varieties on more susceptible dwarfing rootstocks as PA apple growers transition to more fresh market production as well as other pesticide impacts have increased the incidence and need for control of this pest over the last several years. Our best estimate of the annual value of biological control of WAA is probably closer to \$100,000/yr for PA apple growers. Use of the synthetic pyrethroids and methomyl for BMSB control will eliminate the parasitoid, *A. mali*, likely increasing our problems with WAA and requiring additional use of insecticides.

### **1) Reduction in pesticide active ingredient (AI) and acres at lower pesticide input that has been achieved by area-wide mating disruption or other IPM tools, which could be threatened if growers go back to spraying broad-spectrum materials and feel they can't afford separate CM/OFM treatment**

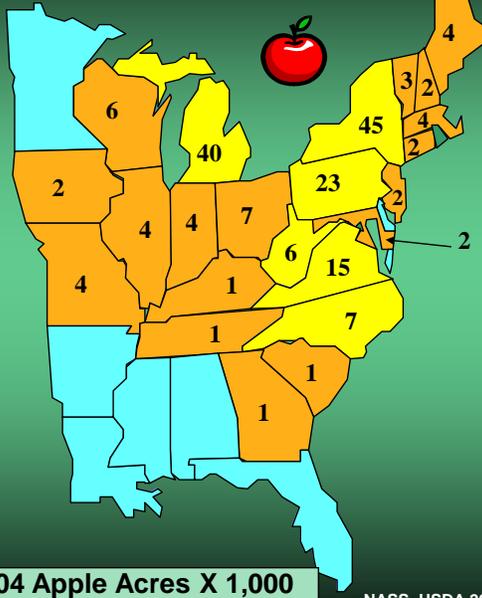
- Pesticide use data from the USDA-Risk Assessment and Mitigation Program in 2002-5 (PA was one of six states to participate in this research grant) where grower standard blocks (using predominantly broad-spectrum insecticides) were compared to grower blocks using only reduced risk (RR)/organophosphate (OP) replacement & mating disruption IPM programs in 65 apple and peach orchards demonstrated a 80-88% reduction in pesticide ai in apple and 59-79% less in peach over the 4 year period (Agnello et al. 2009). Extrapolating the pesticide use reductions for PA alone across all our apple and peach acreage give a reduction of 40.42 tons ai/yr in apples (80.4% reduction) and 12.31 tons ai/yr (81.9% reduction) in peaches when using RR-IPM vs. the grower standard OP programs. Numbers for our RAMP2 project from 2006-9 have not all been completely summarized, but in general, most growers have transitioned all of their orchards to the RR products, thus the reductions in AI are much lower since there is no standard grower OP dominated program anymore. This shift is due to pesticide resistance in key pests, FQPA driven regulations on non-RR products (which have greatly increased worker re-entry and pre-harvest intervals) and the viability of the RR IPM programs that we developed during the 2 RAMP grants.



## Risk Assessment & Mitigation Program 2002-5



- Represent 73% of Eastern apple acreage.
- Av. lb ai/A for all states 5.62 lb of which 85% are OPs.
- Av. ai/A reduction of 82.7%.
- Total tons ai/A for insecticides/miticides in East – **614 tons/yr.**
- Potential ai/A reduction of **381 tons in RAMP states**; potentially **513 tons in all Eastern states/yr.**



2004 Apple Acres X 1,000

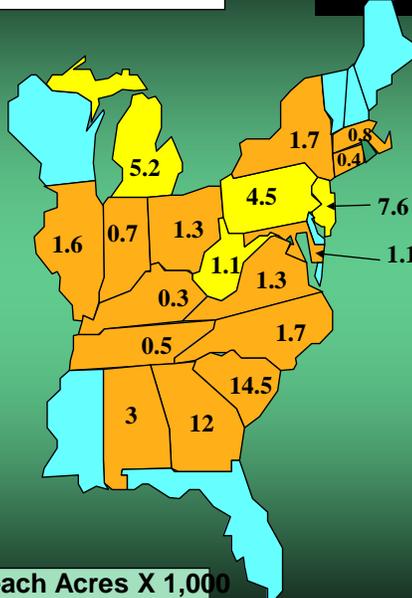
NASS, USDA 2005



## Risk Assessment & Mitigation Program 2002-5



- Represent 30% of Eastern peach acreage.
- Av. lb ai/A for all states 3.89 lb of which 79% are OPs.
- Av. ai/A reduction of 76.4%.
- Total tons ai/A for insecticides/miticides in East – **120 tons.**
- Potential ai/A reduction of **37 tons in RAMP states**; potentially **97 tons in all Eastern states.**



2004 Peach Acres X 1,000

NASS, USDA 2005

**Environmental Injury Quotient Values from the RAMP-1 Project 2002-5.**

The EIQ rating system was developed as a tool to assess the relative impact of various pesticides on the environment and farm worker safety (Kovach et al. 1992). The reduced-risk insecticides used in this study resulted in a major reduction in EIQ ratings in RR compared with STD treatments at virtually every apple and peach study site. Cumulative EIQ ratings were significantly lower in RR compared with STD treatments in all years for both crops.

**Apple EIQ 2002-2005: Means  $\pm$  SEM**

State	2002		2003		2004		2005	
	RAMP	STD	RAMP	STD	RAMP	STD	RAMP	STD
MI	37.0 $\pm$ 4.5	229.4 $\pm$ 61.7	43.5 $\pm$ 7.9	254.7 $\pm$ 35.6	36.9 $\pm$ 5.3	257.7 $\pm$ 44.6	29.6 $\pm$ 6.1	286.2 $\pm$ 39.0
NC	64.5 $\pm$ 15.2	308.9 $\pm$ 37.7	55.1 $\pm$ 29.0	278.8 $\pm$ 44.8	43.0 $\pm$ 17.3	321.3 $\pm$ 56.5	28.3 $\pm$ 5.5	203.0 $\pm$ 55.4
NY	39.8 $\pm$ 8.6	185.9 $\pm$ 21.7	44.8 $\pm$ 8.8	251.5 $\pm$ 26.0	39.4 $\pm$ 6.8	201.7 $\pm$ 19.0	21.1 $\pm$ 4.1	176.1 $\pm$ 21.4
PA	27.7 $\pm$ 1.7	145.1 $\pm$ 14.2	24.8 $\pm$ 2.3	182.0 $\pm$ 14.8	30.0 $\pm$ 2.7	175.6 $\pm$ 22.9	32.5 $\pm$ 2.7	128.4 $\pm$ 17.6
WV/VA	32.4 $\pm$ 4.8	197.2 $\pm$ 26.3	23.8 $\pm$ 4.3	218.4 $\pm$ 31.3	19.5 $\pm$ 1.9	255.3 $\pm$ 41.9	24.0 $\pm$ 4.4	225.9 $\pm$ 25.5

Year	Average		<i>F</i>	df	<i>P</i>
	RAMP	STD			
2002	40.9 $\pm$ 14.0	211.1 $\pm$ 47.7	135.73	1, 84	<0.0001
2003	39.6 $\pm$ 18.1	241.7 $\pm$ 45.2	140.10	1, 88	<0.0001
2004	34.8 $\pm$ 12.6	237.9 $\pm$ 53.4	123.24	1, 90	<0.0001
2005	25.9 $\pm$ 6.9	201.5 $\pm$ 48.9	109.01	1, 88	<0.0001

Apple State	Trmt	# of growers / year			
		2002	2003	2004	2005
MI	RAMP	6	9	9	9
MI	STD	6	9	9	9
NC	RAMP	9	8	9	8
NC	STD	9	8	9	8
NY	RAMP	17	17	17	17
NY	STD	17	17	17	17
PA	RAMP	7	7	7	7
PA	STD	7	7	7	7
WV/VA	RAMP	9	9	9	9
WV/VA	STD	7	7	7	7

### Peach EIQ summary: Means $\pm$ SEM

State	2002*		2003*		2004		2005	
	RAMP	STD	RAMP	STD	RAMP	STD	RAMP	STD
MI	16.7 $\pm$ 8.9	21.3 $\pm$ 3.4	16.8 $\pm$ 5.6	70.4 $\pm$ 19.3	14.9 $\pm$ 3.7	68.8 $\pm$ 22.2	13.3 $\pm$ 3.9	65.0 $\pm$ 29.6
NJ	107.2 $\pm$ 11.4	163.6 $\pm$ 15.6	31.6 $\pm$ 1.6	221.1 $\pm$ 9.2	25.4 $\pm$ 9.1	148.0 $\pm$ 12.0	47.3 $\pm$ 6.2	238.7 $\pm$ 20.8
PA/WV	46.2 $\pm$ 11.4	202.6 $\pm$ 25.5	10.8 $\pm$ 1.8	228.2 $\pm$ 41.6	31.7 $\pm$ 7.5	208.6 $\pm$ 29.7	27.5 $\pm$ 4.4	191.8 $\pm$ 36.9

Year	Average		<i>F</i>	df	<i>P</i>	* Significant interaction		
	RAMP	STD				<i>F</i>	df	<i>P</i>
2002*	69.7 $\pm$ 26.9	149.1 $\pm$ 45.1	18.57	1, 27	0.0002	3.47	1, 2	0.0456
2003*	20.9 $\pm$ 7.0	175.4 $\pm$ 52.3	155.17	1, 33	<.0001	6.29	1, 2	0.0049
2004	24.1 $\pm$ 11.5	139.0 $\pm$ 42.0	59.06	1, 33	<.0001			
2005	30.3 $\pm$ 10.9	167.8 $\pm$ 58.3	22.42	1, 31	<.0001			

Peach State	Trmt	# of growers / year			
		2002	2003	2004	2005
MI	RAMP	3	6	6	6
MI	STD	3	6	6	6
PA/WV	RAMP	6	6	6	6
PA/WV	STD	5	5	5	5
NJ	RAMP	8	8	8	7
NJ	STD	8	8	8	7

### Use of Pheromone Mating Disruption

- APPLE – Based on pesticide use data from the RAMP-1 project (4 year average) PA growers used an average of 4.44 lb ai/acre for standard apple pest management programs relying mostly on OP insecticides. The results from a 3 year Area-wide Mating Disruption (2006-2008 - Hull et al. 2009) indicate that mating disruption alone could reduce insecticide use in standard grower orchards by an average of 27%/yr (Penn State University MSU EPA SAI report): <http://www.aftresearch.org/sai/reports/detail.php?id=2da03ba91a6cd97ddccbe827c072ed42> ). Based on an estimated 6,000 acres of apple 2010 under MD, extrapolation of these data would translate to an approximate reduction of 7,100 lb pesticide active ingredient/yr. While currently leafrollers are not a problem, parasitoid biodiversity and abundance was higher in apple orchards using MD than in conventional orchards (Biddinger et. al. 1994).
- PEACH – Based on the pesticide use data from the RAMP-1 project (4 year average), growers used an average of 6.67 lb ai/acre for standard peach pest management programs relying mostly on OP insecticides. The results from the 3 year Area-wide Mating Disruption (2006-2008 - Hull et al. 2009) indicate that mating disruption alone could reduce insecticide use in standard grower orchards by an average of 58%/yr. Based on an estimated use of MD on 2,500 acres of peach in 2010, extrapolation of these data would translate to an approximate reduction of 9,700 lb pesticide active ingredient/yr. Recent studies on first generation Oriental fruit moth that attack the

shoots in apple and peach orchards show over 50% levels of parasitism in orchards under mating disruption which could significantly reduced pre-bloom insecticide sprays in peach, which, in turn, could conserve solitary bees and increase pollination.

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