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Special Stink Bug Issue, May 2011

Management Options for the Control of Brown Marmorated Stink Bug
A Pennsylvania Perspective

Dr. Greg Krawczyk and Dr. Larry Hull, Penn State FREC Entomologists

As the growing season progresses, we will **continue to "learn as we go" and continue to** provide the newest information to growers as fast as possible. Current and new updates and recommendations will be posted at the Penn State FREC web site (http://frec.cas.psu.edu/) as they become available.

As much as we do not want to admit it, the brown marmorated stink bug, (BMSB), *Halyomorpha halys* (Stål) (Heteroptera-Pentatomidae) has established itself in our surroundings and most likely this insect pest will continue to pose an extremely serious threat to our agricultural systems for years to come. During the last two years researchers and extension specialists from throughout the Mid-Atlantic states have documented the enormous potential of this insect to destroy the quality of various fruits, vegetables and some agronomic crops such as soybean and corn. According to information recently gathered by Mark Seetin, the U.S. Apple Association Director of Regulatory and Industry Affairs, the estimated losses during the 2010 season for this region's fruit growers exceeded $37million.

Brown marmorated stink bug (*aka Asian stink bug*) is not your usual insect pest

- **Plethora of available host plants**
- **Unrestricted movement ability**
- **Undefined biology/monitoring issues**
- **Inconspicuous initial injury on fruit**
- **Each instar (except eggs) can cause damage**
- **No effective biological control**

Damage on fruit caused by BMSB feeding can occur throughout the entire growing season. Although the mechanism by which BMSB feeds on fruit is similar throughout the season, the time of the season the feeding occurs can have a profound influence on the type and appearance of the injury. For example, early season feeding usually causes misshapen fruit, whereas late season feeding usually causes depressions on the fruit surface and the appearance of

BMSB, continued on page 2

Growing Season Models and Alerts:
http://frec.cas.psu.edu

Continued from page 1, BMSB

necrotic tissue (corking) just below the fruit surface. Late season feeding injury is often confused with the physiological disorder called "corking," which is caused by a calcium deficiency. Although the amount of damage varied significantly among various locations throughout the state in 2010, some stone or pome fruit orchards suffered more than 60 percent injured fruit by harvest.

The management options for BMSB populations are quite complicated and as observed last season by some growers dealing with this challenging pest, also quite frustrating. Despite using the best available practices to conserve our IPM program, utilizing the best recommended products and tactics that we knew last year to control BMSB, fruit injury levels in affected orchards ranged from low to extremely high and most well above acceptance levels for growers and costumers.

Before we suggest our current management recommendations, let's try to evaluate some of the possible reasons responsible for the observed problems in the management of BMSB:

Unique elements of BMSB biology: Although more and more observations suggest that this insect can survive the winter without the protection of man-made structures, at this time we still believe most BMSB adults overwinter inside some kind of dwelling, and most of the time outside of orchards or other agricultural settings. In the spring, adult BMSB move from their overwintering shelters, but not necessarily directly to the orchard. It appears that any green plant can support their feeding habits. The spring emergence of adult bugs from overwintering sites appears to be very extended, lasting from late April until early June. These differences in the starting point for overwintering adults likely create a situation that allows all possible BMSB nymphal and adult stages to be present in the orchard at the same time. Throughout the season, for reasons not yet well understood, BMSB at any point can start moving into orchards or between orchards. Feeding on stone fruits seems to be the preferred early season behavior, but these hosts are not exclusive and any green, growing plants (including pome fruit) are also possible hosts. Reports in the scientific literature estimate that BMSB can feed on 250 to 300 different host plants. Later in the season (i.e., late June, July, August and September) various instars of BMSB are frequently observed feeding on apple, pear, and small fruits including various berries and strawberries.

Suggested BMSB control timing/product options

Timing	**Other pests to remember**	**BMSB Product Options**	**Comments**
Before bloom/PF	Scale, RAA, mites, EAS, PB	Lorsban, Carzol (PF only)	To suppress early populations
After bloom (May – Mid-June)	CM, OFM, TABM, OBLR, PC, aphids, leafhoppers	Admire, Assail, Actara, Voliam flexi, Voliam Xpress	To suppress early populations
Mid summer	Aphids, JB, AM, mites, scales, leafhoppers,	Vydate, Actara, Leverage, Assail, Danitol, Belay, Admire	Control on stone fruit, suppression on pome fruit
Late summer	CM, OFM, TABM, leafhoppers,	Lannate, Danitol, Belay, Endigo, Warrior	Control on pome fruit
After harvest (stone fruit, early pome fruit)		Thionex	Control, suppression **DO NOT USE WHILE FRUIT ARE PRESENT**

Always read and follow product label

BMSB, continued on page 3

Continued from page 2, BMSB

BMSB behavior: Host choice is still not well understood. We still do not know exactly when, and more importantly why, BMSB moves from one host to another. Due to the very wide host range of this pest in our region, it is important to understand that BMSB can move to orchards at any time from May until October, including multiple, consecutive influxes from surrounding vegetation. Effective control of one wave of stink bugs in the orchard does not prevent another wave of BMSB from entering the orchard a short time later. And since BMSB is not a resident pest in the orchard, even the best management activities against BMSB in the spring will not prevent new stink bugs from invading again later in the season, even in October. Therefore, it is quite obvious that in addition to using effective insecticides, the most crucial, practical element for successful BMSB management is the development of a reliable pest detection and monitoring strategy.

Efficacy of insecticides: Our laboratory bioassays conducted during the fall, winter and spring of this past year evaluating the effectiveness of various insecticides against adult stink bugs demonstrated the availability of multiple active ingredients that are effective. These bioassays also identified a large group of currently registered products, which provided very minimal direct mortality of BMSB adults. Bioassays conducted by the USDA-ARS group in Kearneysville, WV and directed by Dr. Tracy Leskey concentrated on the assessment of activity of dried insecticide

Table 1. Efficacy of various insecticides against BMSB adults during direct contact laboratory bioassay. Penn State FREC, 2011.

Active ingredient	Product/rate tested	% direct mortality after 24/72 hr *	Number of applications /season **	Comments ***
acetamiprid *(IRAC 4A)*	Assail 6 oz	**87/87**	SF-4 app, PF-4 app	7 days PHI on SF and PF
clothianidin *(IRAC 4A)*	Belay 6 oz	**100/100**	Peach -2 app, PF-2 app	Not registered on nectarines
imidacloprid *(IRAC 4A)*	Admire Pro 7oz	**82/87**	SF-1 app, PF-1 app	21 days PHI on SF and PF
	Leverage 360 2.8 oz (mix)	**95/93**	SF-1 app, PF-1 app	7 days PHI on SF and PF, includes beta-cyfluthrin
thiacloprid *(IRAC 4A)*	Calypso 8 fl oz	**58/52**	PF-2 app	Not registered on stone fruit
thiamethoxam *(IRAC 4A)*	Actara 4.0oz	**92/97**	SF-2 app, PF-3 app	No more than 0.25 lb AI per season on pome fruit/ 0.17 lb AI on stone fruit
	Endigo 5 oz (mix)	**98/100**	SF-3 app, PF-4 app	See comments for Actara and Warrior
	Voliam Flexi 6 oz (mix)	**100/100**	SF-2 app, PF-2app	See comments for Actara
methomyl *(IRAC 1A)*	Lannate SP 16 oz	**92/98**	Peach-6 app, nectarine-3 app, Apple – 5 app	Strong rate response
	Lannate LV 3 pt	**87/92**	Peach-6 app, apple 5 app	Not registered on nectarines
oxamyl *(IRAC 1A)*	Vydate 6 pt	**68/73**	Apple 1 app	Thinning caution
fenpropathrin *(IRAC 3)*	Danitol 16 oz	**95/82**	SF-2 app, PF- 2 app	3 days PHI on SF, 14 day PHI on PF
lambda-cyhalothrin *(IRAC 3)*	Warrior II 2.5 oz	**73/72**	SF-4 app, PF-4app	No more than 0.16 lb AI per season
	Lambda-Cy 4.4 oz	**52/40**	SF-5 app, PF-5 app	No more than 0.16 lb AI per season
	Voliam Xpress 10 fl oz (mix)	**40/40**	SF-4 app, PF-4 app	See comments on Warrior
	Endigo 5 oz (mix)	**98/100**	SF-3 app, PF-4 app	See comments on Actara and Warrior
endosulfan *(IRAC 2A)*	Thionex 2 lb	**52/98**	SF- 2 app, PF- 3 app	Processing fruit restrictions!
dinotefuran *(IRAC 4A)*	*Scorpion 35 SL 5 oz*	**97/98**	*Section 18 emergency registration pending*	
	Venom 3 oz	**93/98**		

* - dead and moribund BMSB adults grouped as dead
** - SF- stone fruit, PF- pome fruit; Always read and follow the most current pesticide label.
*** Other tested products (rate) with adult BMSB direct mortality lower than 50 percent: Altacor @ 3 oz; Asana @ 14 oz; Avaunt @ 6 oz; Baythroid XL @ 2.8 oz; Beleaf @ 2.8 oz; Delegate @ 7 oz; Diazinon 50 W @ 3 lb; Esteem @ 5 oz; Guthion @ 2 lb; Imidan @ 4 lb; M-Pede @ 2 %; Neemix 4.5 @ 16 oz; Pounce 25 WP @ 16 oz; Rimon @ 30 oz; Sevin XLR Plus @3 pt; Stylet oil @ 2 %.

BMSB, continued on page 4

Continued from page 2, BMSB

residues while our Penn State bioassays evaluated the mortality of adult BMSB caused by the direct contact of insecticides. Bioassays conducted at Virginia Tech concentrated on the mortality caused by the direct feeding of BMSB on various active ingredients. Although all of these studies used different methods, the results when evaluated together provide a good complementary picture of what to expect from various products. The "Lethality index" developed by USDA researchers provides information on efficacy of products against adult BMSB after exposing them for 6 hours to a dry residue of insecticides, while the Penn State "Percent mortality" readings provide information on the toxicity of adult stink bugs after direct contact with a 2 μl of an insecticide solution applied directly to the dorsal part of the insect abdomen. Both methods utilized long-term observations (up to 120 hours after treatment) to develop the final results.

Suggestions for BMSB Management in PA fruit orchards

The laboratory bioassays conducted this past winter demonstrated various efficacies of currently registered insecticides against BMSB adults (Table 1). With 10 various active ingredients (from four different Insecticide Resistance Action Committee [IRAC] Groups) causing above 50 percent mortality during the direct contact bioassays, it appears we have enough products to control BMSB populations that enter orchards throughout the entire growing season. The challenge with this seasonal approach is to manage the usage of these various products so they provide not only the best control for all injury causing stages of stink bug, but also all other pests present in orchard throughout the season. These available products are not equal in their efficacy against stink bugs and they are also not equal in their activity against other pests at the time when insecticide applications might be needed. A grower can choose to ignore these other pests and concentrate only on the management of BMSB, but based on our experience from the era "before the stink bug," it might not be the best option especially with known pressures in our orchards from such pests as codling moth, oriental fruit moth, and leafrollers, etc.

When developing a seasonal strategy to manage BMSB at any particular location, the following factors need to be considered during the planning process:

Insecticides: The efficacy ratings either for direct contact or residual toxicity against BMSB are two of the most important factors in choosing the best product(s), but growers should also consider the time of the season and what other pests are likely active in the orchard. Also, factors such as an insecticide's pre-harvest intervals, the number of available applications per season, and the amount of an insecticide active ingredient that can be used for the entire season (please be aware of multiple products with the same active ingredients) need to be critically assessed. While it may be wise on stone fruit to use the more effective products earlier in the season, the same products on apples may be much more valuable for BMSB control in August, September or October. Since all products have a limited number of applications and active ingredients that can be used during a season, utilizing the most effective insecticides before they are essentially needed, will likely leave us with only less effective alternatives later in the season.

Expected sources of BMSB influx: Population pressure from BMSB is not uniform from outside or within any particular orchard, but it also fluctuates during various times of the season. Some orchard blocks located next to woods may not have to deal with stink bugs until later in the summer, blocks next to various kinds of dwellings most likely will be affected earlier in the season, while blocks located inside other large groups of orchards may experience only low pest pressure throughout the season. However, in every orchard, due to the ability of adult BMSB to move quickly among various hosts, a constant and vigilant monitoring program is the very basis for successful management.

Crop/block specific characteristics: Factors such as different harvest dates for fruit, the mixture of cultivars, surrounding vegetation as a possible source or barrier for BMSB populations during the season and the attractiveness of the crop to BMSB mandate individual treatment strategies for each separate orchard or block within the orchard. While some fruit blocks might require seasonal, intensive management options against BMSB, other blocks might require a less intensive program. Unfortunately, there is no "one size fits all" recipe for successful management in dealing with this pest.

Necessity of controlling other pests: In orchards that experience continuous, seasonal pressure from BMSB, seasonal control options must be carefully selected. In selecting these control options, growers should also consider what other fruit pests and beneficial natural enemies may be affected by their selection of products used against BMSB. Detailed monitoring of all pests will be crucial in order to prevent additional crop losses caused by the "normal pests."

Planning for a seasonal insect control program: Since we currently cannot predict when BMSB will move into orchards and how intensive their populations and feeding will be this season, we should prepare ourselves for a season-long monitoring and management program. Also, the results of our early season management activities will likely not minimize the pest pressure that fruits experience in late summer and early fall. While BMSB can cause fruit damage at any point during the season, maturing fruit likely represent the most attractive and most likely available source of nutrients for this insect and therefore pest pressure may be the strongest as we move into the late summer and early fall period.

The brown marmorated stink bug is here and most likely will be an important and serious threat to our fruit system for a long time. Over time, we will learn how to manage this pest more effectively. New tools such as insect behavior modifying materials (e.g., a sex pheromone, an attractant, repellent or deterrent) will likely be required to successfully control and minimize the threat from this pest. In the meantime, with the knowledge we have and the tools that are available, we need to try to "outsmart" this pest in order to continue to produce the best quality fruits. This new, exotic pest will require new management approaches, but until we can field test some of our BMSB management hypotheses, these ideas will remain just "concepts" which may prove attractive in theory but difficult or even impractical to implement. As the growing season progresses, we will continue to "learn as we go" and continue to provide the newest information to growers as fast as possible.

Current and new updates and recommendations will be posted at the Penn State FREC web site (http://frec.cas.psu.edu/) as they become available.

Alternative BMSB Management/Control Options

Border applications
- Surround, Surround plus other insecticides
- Use strong residual products; sprays directed at fencerows, ditches, borders etc.

Treatments of surrounding vegetation
- Products registered for ground cover treatments
- Talk to your neighbor, monitor surrounding vegetation/fields, especially late season

Alternative crop plantings
- Possible trap crops (e.g., soybean, Paulownia trees)
- Others to be determined; spray these trap crops when necessary

BMSB behavior vs. pesticide application

Observe spatial and temporal distribution of targeted stink bugs during insecticide applications

Monitor, scout, check, observe….

See the results of BMSB adults direct contact bioassays at:

http://frec.cas.psu.edu/pdf/BMSB-management-suggestions%20.pdf

Growers Encouraged to Use New Online Stink Bug Monitoring Tool

Dr. Katie Ellis, Penn State Ag Innovations for Specialty Crops Extension Educator

Faced with uncertainty about the future of brown marmorated stink bug populations and their impact on crop production, researchers at Penn State recently launched a stink bug mapping tool in collaboration with the PA Department of Agriculture. John Tooker, assistant professor of entomology in the College of Agricultural Sciences developed the tool with Douglas Miller, associate professor of geography and director of the Center for Environmental Informatics in the College of Earth and Mineral Sciences.

The tool, housed at http://stinkbug-info.org, will help the researchers gather widespread data to study brown marmorated stink bug (BMSB) population dynamics. The BMSB is an invasive pest discovered in Pennsylvania in the late 1990's. Although native stink bug species exist in the state, they have largely had a minimal impact on crop production. However, population explosions of the BMSB in southern Pennsylvania in 2010 caught many growers off guard, leading to questions about the biology and behavior of the pest. The researchers hope statewide tracking efforts will help them develop better management recommendations, as well as warn crop growers of impending damage.

The web site directs users to a mapping tool that allows fruit and vegetable growers, field crop growers, nursery operators and homeowners to enter the location and size of stink bug infestations, as well as any damage (estimated dollar value) caused by the pest. The site also acts as an online clearinghouse for descriptions and management information for the BMSB. This monitoring tool takes the unique approach of soliciting help from homeowners, whose properties are seen as possible point sources for infestations affecting agricultural crops.

To use the tool, participants must first create a username and password and log in. The user then may enter data as a "farmer", "nursery owner" or "homeowner". After logging in, a series of drop-down menus zoom in to the user's map location, which can be saved for future reporting sessions. Alternatively, latitude/longitude numbers may be entered for specific locations. The "farmer" user then enters the date of infestation, average number of stink bugs per plant (apple, cherry, peach, plum, grape or other available field and small fruit crops) and percent damage. The tool allows reporting of organic blocks, as well as other insects: multi-colored Asian lady beetles, boxelder bugs and leaf-footed bugs. If historic data (from 2009 or 2010) are available, users can enter those too.

Growers are strongly encouraged to report their infestations; the tool's benefit will increase as more people enter data. In the short term, the data could be used to warn growers of impending stink bug activity in order to enact appropriate control measures for crop protection. Increased knowledge surrounding pest behavior, movement and population development will also help the researchers improve long-term management strategies for growers and homeowners. Better yet, growers and property owners will know that they are directly contributing to research that will combat this destructive, invasive pest.

Maintaining the Integrity of IPM in Pennsylvania While Battling the Brown Marmorated Stink Bug

Dr. Larry Hull, Emeritus Professor of Entomology,
Dr. Greg Krawczyk, Extension Entomologist
Penn State Fruit Research and Extension Center

Pennsylvania tree fruit growers have embraced the principles of Integrated Pest Management (IPM) since the late 1960s and early 1970s. By one definition, IPM is the "utilization of all suitable techniques and methods in as compatible manner as possible and maintains the pest populations at levels below those causing economic injury." The goal of IPM is to minimize the number and severity of perturbations in the agro-ecosystem while reducing the economic, environmental, and human health costs associated with the particular management option(s). Pennsylvania was one of the first states in the country to adopt the principles and practices of IPM in orchards by integrating the use of the black lady beetle *Stethorus punctum* —commonly referred to by most growers as the "black beetle"—for the biological control of spider mites (e.g., European red mite and two-spotted spider mite). This program over the last 40 years was responsible for significantly reducing the number and amount of miticides used by fruit growers and reducing the severity of miticide resistance. More recently (2004 to present), the predatory mite, *Typhlodromus pyri*, has replaced *Stethorus* in many grower orchards as the principle biological control agent for spider mites in Pennsylvania.

When the IPM program in Pennsylvania was developed and used by growers during the late 1960s through the mid-1990s, the majority of insecticides registered were primarily organophosphate (e.g., azinphosmethyl, phosmet, etc.) and carbamate (e.g., carbaryl, methomyl, etc.) chemistries—all of which were considered broad-spectrum insecticides, in that they killed many different species of pests as well as the natural enemies (i.e., beneficial predators and parasites) of the pests. Faced with these broad-spectrum insecticides, researchers at Penn State had to learn how to develop an IPM program for tree fruit crops using these types of materials. The selectivity of insecticide chemistries is divided into two categories, viz. physiological and ecological selectivity. Physiological selectivity is the property of a compound that discriminates in terms of mortality between two taxa (i.e., pest groups for example codling moth versus aphids) when applied at comparable rates of active ingredient. Over the past 15 years, growers have started to use many products (e.g., Confirm®, Intrepid®, Altacor®, Delegate®, Cyd-X®, etc.) for insect control in tree fruit that are defined as physiological selective insecticides. The majority of these products are relatively safe to many natural enemies inhabiting orchards. Ecological selectivity is the judicious use of pesticides, based on critical selection, timing, dosage, placement, and formulation of broad-spectrum pesticides (i.e., organophosphates, carbamates, pyrethroids, etc). Its goal is to maximize pest mortality while minimizing beneficial mortality and to alter the predator to prey ratio in favor of the former.

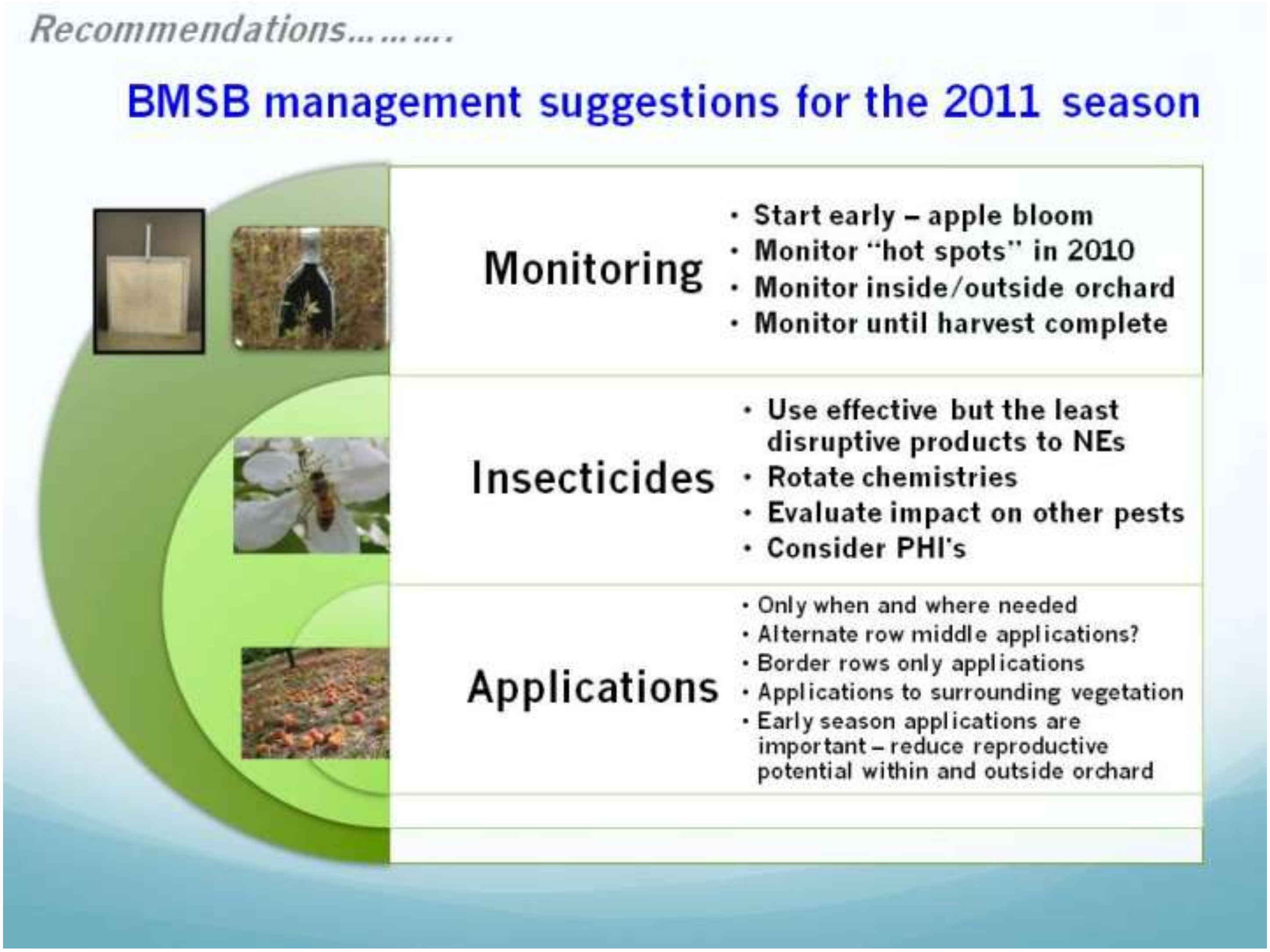
The IPM program in Pennsylvania has had to change and survive the challenges from many pest perturbations down through the years. For example, the tufted apple bud moth, once considered the number one direct feeding pest of apples from the 1970s through the late 1990s, quickly developed resistance to most of the organophosphate insecticides in the 1970s and 1980s and later developed resistance to methomyl in the 1990s. Brood X of the periodical cicada, which occurs every 17 years, had outbreaks in 1970, 1987, and 2004. Many of the insecticides used to control this pest were very harmful to the many natural enemies that inhabit orchards. The codling moth and oriental fruit moth developed resistance to a number of organophosphate, carbamate, and pyrethroid insecticides in the 1990s, which eventually led to the rejection and loss of thousands of loads of apples and peaches throughout Pennsylvania. Despite all of these perturbations over the past 40 years, the IPM program has withstood fairly well the majority of these challenges.

Fruit growers in Pennsylvania are now faced with the next major perturbation and challenge to their crops and their IPM program—the invasion of the brown marmorated stink bug (BMSB), *Halyomorpha halys*. As all of you are so keenly aware, BMSB was found in the Allentown area in the late 1990s and was occasionally found in other areas of the state over the past 10 years, but rarely causing any economic damage. However, in 2010 BMSB populations exploded on many fruit farms and other crops, especially in counties across the southern part of the state, causing damage to many peaches and apples with some growers losing over 50 to 60% of their peach crop to the ravages of BMSB, while some apple growers experienced damage to over 20% of their crop.

How are we going to control this pest in 2011? Many of you have heard us speak at the winter educational meetings about the prospects of controlling this pest, what products to use, and certainly what future research needs to be done. As you have heard, the near term solutions for BMSB will involve many different types of insecticides. Unfortunately, based on the excellent and recent laboratory data generated by Dr. Tracy Leskey and her research team at the USDA lab in Kearneysville, WV using a dry-film residual assay and the laboratory data that we generated at FREC this past winter and spring using a direct contact topical assay, the most effective insecticides for BMSB control belong primarily to the chemistries of the synthetic pyrethroids, the carbamate group – methomyl, the chlorinated hydrocarbon – endosulfan (i.e., Thionex®), and a couple of the neo-nicotinoids. As previously stated, the pyrethroids and methomyl are considered broad-spectrum insecticides that are highly toxic to many, if not all, of the natural enemies found in tree fruit. Because of this toxicity to natural enemies, Penn State entomologists have only recommended the pyrethroids before bloom on apple to minimize their toxicity. Growers who have used these products post-bloom on apples in the past have seen many flare-ups from European red mites, woolly apple aphids, San Jose Scale, etc.

Given the seriousness of the BMSB situation, the very high overwintering populations, its potential to possibly cause even higher levels of fruit damage in 2011, and given the fact that the most effective products for BMSB control are methomyl, pyrethroids, some of the neo-nicotinoid products (i.e., Actara®), how can growers successfully control BMSB and not completely destroy all natural enemies and the integrity of the IPM program in Pennsylvania? Growers need to only look back to what they did in the late 1900 era, when the only products available to them were primarily broad-spectrum insecticides. They will need to understand and employ all of the tactics used in applying the principles of ecological selectivity to this group of broad-spectrum insecticides. Listed below are some tactics growers can use to minimize the toxicity of these products to natural enemies while still controlling BMSB.

Selection of an insecticide – all insecticides are not equal in their toxicity to natural enemies. When selecting an effective product for BMSB control, always refer to Table 4-4 in the Penn State *Tree Fruit Production Guide* and determine its toxicity for the various natural enemies that may also be present. Choose the product that is the least harmful to the natural enemies.



Timing of an insecticide – proper timing is often the most effective and economical method of achieving differential insecticide selectivity for the pest/natural enemy complex. Only apply a highly effective insecticide for BMSB when they are in your orchards; therefore, growers must be very, very vigilant to monitor their blocks and surroundings and only apply these highly toxic insecticides when BMSB is present and a threat to their crops.

Dosage – the toxicity of any chemical compound is directly related to its dose. When using one of these broad-spectrum insecticides for BMSB control, always apply the lowest effective dose possible. Not only will the lowest dose likely conserve some of the natural enemies, but it will also save you some money.

Application techniques and methods – the only purpose in applying an insecticide is to kill the intended pest(s). Many growers in Pennsylvania have used the alternate row middle (ARM) technique of spraying to apply pesticides to their crops for over 40 years. We know from many years of research that this technique will provide effective pest control if done properly, but at the same time will allow for the survival of many natural enemies. Given the likelihood that the most effective control of BMSB will occur through the direct contact of the insecticide to this pest, the ARM method of spraying may be the best method to apply these broad-spectrum insecticides. By integrating low rates and frequent applications of insecticides (i.e., the original idea behind using the ARM method), better control of BMSB will likely be achieved while causing less harm to natural enemies.

Selective placement – restricting an insecticide to a specific part of the tree or location within an orchard is another method to minimize the impact of toxic insecticides to natural enemies. Since BMSB is highly likely to move into orchards from the outside (e.g., woods, neighboring crops [soybeans, corn, vegetables], buildings, etc.), restricting the application of these broad-spectrum insecticides to border rows, etc., will likely conserve many natural enemies.

Overcoming the challenges of effective and sustainable BMSB control will not be an easy task in the near term. Much research needs to be done in order for us to develop the most effective management program for the long-term control of this pest. In the meantime, however, I also encourage growers to not lose sight of our current IPM program in Pennsylvania. We have achieved so much over the years and we have learned

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