Fruit Times

Events in the orchard that matter to you

Volume 29, Issue 7 July 2010

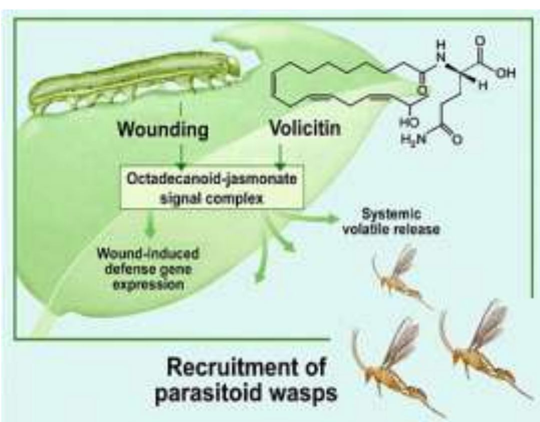
Eighty Years of Innovation in Crop Protection

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

In this Issue

Last month, DuPont Crop Protection researchers received the prestigious National Inventor of the Year Award from the Intellectual Property Owners Education Foundation. Previous winners include inventors of life-saving drugs, cancer treatments and an MRI machine. DuPont made the list after its development of chlorantraniliprole (Rynaxypyr®), an anthranilic diamide insecticide. Fifteen years earlier, Rohm and Haas produced an insecticide that also received the award; at that time, insect molting mimics were a hot topic.

Clearly, those outside the agrochemical industry can see the magnitude of innovation in pest control. Technological advancement isn't limited to NASA, hybrid cars or the iPhone. Over the past eighty years, pest control has achieved some phenomenal breakthroughs. Then again, as in the case of DDT, it has hit some major roadblocks.



An illustration that depicts the induction of volatile emissions in response to caterpillar feeding and the role of volicitin in this induction. Source: http://www.unine.ch/zool/leae/research3_part1.html

Innovations from "The Greatest Generation"

In the midst of the Great Depression and the Dust Bowl, product development was beginning to take off. Scientists discovered a number of diverse chemical structures that were effective for pest control. The diversity of these finds exhibited a random approach to product discovery. Researchers tried a variety of different chemicals, pursuing those that worked and abandoning those that didn't. Toward the end of the 1930s, though, researchers began a more systematic approach for pesticide development.

One would think that the roar of war birds and the cry for war bonds would have suppressed insecticide development in the 1940s. But that's not what happened; in fact, this was a time of radical innovation. The number of new products tripled compared to the previous decade, and some of these were among the most economically successful insecticides of all time. Even with the development of new chemistries (like organophosphates), however, the diversity of new chemical classes was fairly low.

Innovation, continued on page 2

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

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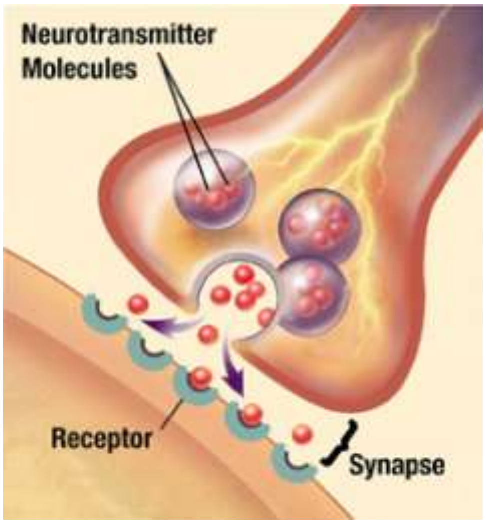
In the 1950s, just as many families of chemicals were developed as in the 1940s (this era ushered in the carbamates), but the number of new products increased drastically. After the 1950s, the number of new chemical families dropped off drastically, though the number of new trademarked products peaked and started to decline after the 1960s.

In the 1990s, we started to see more new chemical families in development. Many acted in a similar way to the older products, but at different binding sites. To fully appreciate the novelty of recent additions to our pesticide arsenal, it's helpful to look at some of the insecticidal modes of action.



Source: www.nia.nih.gov

Insecticidal Modes of Action

Of the 26 insecticidal target sites listed on the Insecticide Resistance Action Committee's (IRAC) current mode of action classification, nearly half are nerve or muscle targets. Insecticides can attack nerves in several ways. Some, like DDT, indoxacarb, or pyrethroids, bind to sodium channels along the neurons in the insect body. This activity causes a rush of sodium ions into the neurons and prevents them from returning to their normal resting state. The excessive neural excitation leads to tremors, paralysis and usually death.

Many products overexcite the nervous system not on the neuron axon itself, but at the connections with other neurons. Organophosphates and carbamates work by inhibiting acetylcholinesterase. As an impulse travels down a neuron, it must "jump" to the next neuron across a space called a synapse. The jump is initiated by the release of a neurotransmitter called acetylcholine. After the signal has jumped the gap, though, the continual presence of acetylcholine would keep the neuron firing. This is where acetylcholinesterase comes in – it's an enzyme that breaks down acetylcholine into the smaller, inactive molecules choline and acetic acid (which you would recognize in the grocery store as a B-vitamin and vinegar). By inhibiting acetylcholinesterase, the insecticide causes the neuron to get overexcited.

Other products cause the interruption of normal calcium channel activity. Calcium channels regulate nerve transmissions at the junction of motor neurons and muscles (e.g., leg). By activating the channels through ryanodine receptors, compounds such as flubendiamide (Belt®, Bayer CropScience) and chlorantraniliprole (Altacor®, DuPont Crop Protection) allow the continual release of calcium ions, initiating muscle contractions and eventual paralysis. These recently-developed chemicals are especially innovative due to their selectivity. Even though humans and other mammals also have ryanodine receptors, the researchers discovered that ours are slightly different and do not respond to these insecticides. Caffeine, interestingly enough, *does* affect human ryanodine receptors!

Some insecticides don't affect the nervous system at all. A few prevent the insect exoskeleton from forming properly, some block molting activity and others keep immature insects from developing into adults by mimicking a juvenile hormone. The bacterium *Bacillus thuringiensis* (Bt) produces a crystalline toxin that causes small pores to develop in cell membranes; this destroys the mid-gut and fatally alters the insect's pH. The cellular activity of other chemicals, such as azadirachtin, is still a mystery.

Looking to the Future

When developing new pesticide products, researchers need to strike the right balance between high efficacy and low toxicity. As it searches for control methods, the agrochemical industry itself is the focus of more control. Regulation suppresses the number of products developed, but some argue that it enhances innovation by encouraging development of products with lower toxicity.

Insecticide resistance is also a potential problem. The number of insect biochemical target sites for successful control is limited; in fact, compounds that bind to just four different target sites (all involved in neurotransmission) account for 80% of insecticide sales. Therefore, innovative products like spinetoram (Delegate®, Dow AgroSciences) that act on different binding sites than conventional chemistries are especially promising.

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Although the development of insecticides can be compared to product development in the pharmaceutical industry, they seem to be on different paths. David Lawrence, recently retired as Head of Research and Development at Syngenta, reported that the agrochemical industry has stepped up to the demand for new products even in the face of dropping investment (Copping, 2009). This contrasts with the pharmaceutical industry, which has significantly increased Research and Development investment despite falling numbers of approved drugs.

Some developers are trying out inventive biological methods inspired by natural processes. Chemical ecologists have found hope in various small molecules released by plants under insect attack. Some sucking insects, such as aphids, also release alarm pheromones that cause the group to disperse when attacked by a predator. Can we take advantage of these phenomena and simulate their activity using new products? We did it with sex pheromones, which have proved very successful. The future only knows!

Note: The inclusion of names *does not imply* endorsement of a product by The Pennsylvania State University.

Sources:

Achilladelis, B., A. Schwarzkopf, and M. Cines. 1987. A study of innovation in the pesticide industry: Analysis of the innovation record of an industrial sector. *Research Policy* 16: 175-212.

Copping, L. G. 2009. Innovation in crop production for productivity and biodiversity. *Outlooks on Pest Management* 20(5): 225-228.

Ollinger, M. and J. Fernandez-Cornejo. 1998. Innovation and regulation in the pesticide industry. *Agricultural and Resource Economics Review* 27(1): 15-27.

Yu., S. J. 2008. *The Toxicology and Biochemistry of Insecticides*. Boca Raton: CRC Press. 276 pp.

Managing Apple Fruit Maturity in an Early Growing Season

Dr. Jim Schupp, Penn State FREC Pomologist

As you can see in the SkyBit data below (provided by the FREC Entomology team), the 2010 growing season is running about 400 degree days ahead of the five-year average, both at Biglerville and at Rock Springs. Fruit maturity of stone fruit is also running about 10 days early in 2010. The forecast at the time this is written predicts that temperatures will continue to be at or above normal, suggesting no slowing of development in the near future.

Based on these observations it is likely that maturity of early-season apple varieties will also be advanced by a similar extent. Growers who intend to use ReTain sprays and/or Fruitone pre-loading sprays for harvest management of Gala or Honeycrisp should initiate these sprays earlier to account for the advanced 2010 season. See pages 62 to 64 in the *2010-2011 Pennsylvania Tree Fruit Production Guide* for more information.

Degree-Day Table

Accumulated degree-days base 43°F from Jan 01 for each reported year (courtesy of SkyBit, Inc.). The accumulated degree-days for the last date of the current year (Jul 28) mentioned in the table are based on the weather forecast.

Site/Date	7/01	7/08	7/14	7/21	7/28
Biglerville, 2010	2191	2432	2633	2892	3140
Biglerville, 2009	1879	2062	2223	2422	2638
Biglerville, 2008	1873	2083	2277	2515	2733
Biglerville, 2007	1930	2119	2307	2526	2732
Biglerville, 2006	1886	2095	2289	2542	2770
Biglerville, 2005	1782	1991	2183	2437	2676
Rock Spring, 2010	1878	2096	2284	2510	2723
Rock Spring, 2009	1569	1725	1862	2028	2219
Rock Spring, 2008	1553	1710	1916	2136	2327
Rock Spring, 2007	1663	1833	2001	2190	2369
Rock Spring, 2006	1592	1779	1953	2189	2389
Rock Spring, 2005	1515	1707	1886	2123	2331

Insect Bytes

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

Stink Bug Challenge

Various species of stink bugs (Heteroptera: Pentatomidae) were always a part of our fruit pest complex. The *2010-2011 Pennsylvania Tree Fruit Production Guide* (http://agsci.psu.edu/tfpg) lists stink bugs together with other plant bugs but does not consider them as major pests affecting all fruit orchards (http://agsci.psu.edu/tfpg/part2/insects-mites-web/tarnished-plant-bugs-other-plant-bugs-and-stink-bugs). The control measures suggested in the production guide are based mostly on recommendations from other regions/crops and our own indirect observations gained during controlling other orchard pests. Generally, growers who maintained a good ground cover management program (i.e., less broad-leaved weeds) and used broad-spectrum insecticides achieved adequate control of stink bugs. This situation has been altered dramatically with the recent arrival of brown marmorated stink bug (BMSB), *Hyalomorpha halys,* an exotic species that originated from Asia and was observed in Pennsylvania for the first time in the late 1990s. With its unique biology, which includes overwintering inside dwellings or houses and very polyphagous diet (i.e., many hosts) during the season, this species represents a new and unexpected set of challenges for Pennsylvania fruit growers. While our native stink bugs (e.g., green, brown and dusky spp.) usually do not cause damage until late in the growing season, the BMSB can invade orchards in high numbers right after leaving their overwintering sites (i.e., May and June). With both adults and nymphs feeding directly on fruit, the injury can become very significant. Additionally, our suggested integrated pest management program for pome and stone fruit that utilizes mating disruption and/or limited selective pesticide inputs in most cases, does not include products that are effective against stink bugs. What makes this situation even worse is the fact that hardly any orchard is monitored specifically for any of the plant bugs and none for the BMSB.

Brown marmorated stink bug nymphs. Source: S. Jacobs, PSU

This year, we have observed over the last few weeks a significant number of stone fruit orchards located mainly in the southern part of the state that are heavily infested with BMSB. All life stages of BMSB (i.e., eggs, nymphs and adult) were observed in a number of stone fruit orchards with fruit injury from BMSB already approaching 20 to 30 percent of the crop during mid to late June. In a quick attempt to save the rest of the fruit and to learn about possible chemical control of this pest, we evaluated compounds from various chemical groups for their effectiveness against BMSB. Our preliminary data gathered thus far suggest good efficacy with Lannate® 90SP at 12.0 oz/acre (carbamate, IRAC Group 1A), Danitol® at 12.0 oz/acre (pyrethroid, IRAC Group 3A) and Belay® at 6.0 oz/acre (neonicotinoid, IRAC Group 4A). Applications of Imidan® applied at 3.0 lb/acre (organo-phosphate, IRAC Group 1B) provided only limited control of BMSB adults and nymphs. Although other products may also prove to be effective against this pest(s), we have not been able to conduct any additional trials. We will keep you updated as new information becomes available.

We do not yet know the full extent of BMSB injury throughout Pennsylvania. It is very important that growers quickly examine their stone fruit crops to determine the presence of various BMSB life stages or injury from this pest (see pictures of the fruit injury on page 5). If you find any species of SB, there is still time to control this pest and the resulting injury, especially on later maturing varieties of stone fruit.

Stinkin' Up the Place (Reprint from Scaffold Fruit Journal, Vol. 19, No. 17)

Peter Jentsch, Department of Entomology, Cornell University, Hudson Valley, NY.

Stink bugs (Heteroptera: Pentatomidae) are generally native to our region and are notable examples of locally migratory insects that live on a broad complex of plant hosts. Principal hosts found along the orchard edge or resident within herbicide strips include mullein, mustard, dock, plantain, milkweed, mallow, morning glory, thistles, vetch and velvet grass. These adult "seed-feeders" most often enter our orchards during the dry periods of the season as host plants dry out. Irrigated tree fruit become very attractive to the stink bug complex during drought conditions, leading to late season feeding damage in pear, apple and peach orchards. Their mouthparts are designed to pierce the fruit skin and draw out the cellular contents of the fruit flesh, leaving behind dry cell walls that appear as corking when peeled.

The complex of stink bugs includes the green, brown and brown marmorated stink bug (*Acrosternumhilare*, *Euschistus servus* and *Halyomorpha halys*, respectively). The green and brown stink bugs are native to the region and are found throughout the state, while the brown marmorated stink bug is a newly emerging pest on fruit in the northern mid-Atlantic region and lower New York State. As you might suspect, stink bugs derive their name from the production of pungent and offensive chemicals released when they are disturbed. Relatively mild winters and reduced insecticide programs may help in fostering their overwintering success.

A recent addition to this complex, the brown marmorated stink bug, made its appearance in Highland, New York during the fall of 2008. A handful of specimens were brought into my office by a distraught gentleman looking for a way to rid them from his home. This species' native range is China, Japan, Korea and Taiwan; it evidently is a first class hitchhiking pest, observed in cargo containers from Asia, and is able to maintain its grip to automobile radio antennas racing along the Pennsylvania turnpike. It has now been identified in parts of New Jersey, Maryland, Delaware, Connecticut and the southern tier of New York.

Insect Bytes, continued on page 5

Continued from page 4, Insect Bytes


Adult brown marmorated stink bug.

The brown marmorated stink bug has distinct alternating light and dark bands on the antennae, and darker bands on the overlapping membranous area at the rear of the front pair of wings. It has copper, bluish-metallic tinted depressions on the head and pronotum not exhibited in other species of regional stink bugs. It is known to feed on a wide variety of host plants, including apple, peach, fig, mulberry, citrus fruit and persimmon, along with ornamental plants, weeds and soybeans. It has been observed feeding on tree fruit in the U.S., resulting in the characteristic "catfacing," on peaches, which renders fruit unmarketable. It also can be an urban nuisance pest, as it seeks protected overwintering sites in and around homes. Methods for scouting and managing the stink bug complex can be elusive, due to the lack of technical monitoring tools and the economic thresholds traditionally used in insect pest scouting and management. The first level of management for this pest is determining the level of damage your farm has experienced over the past five years. Drought conditions in the Hudson Valley during the latter part of the last few growing seasons have provided ideal conditions for adult stink bug migration and subsequent fruit injury. Weeds can play an important role in stink bug abundance, thus field proximity to weedy areas often results in higher populations and damage.


External (top two photos) and internal (lower two photos, same fruit) injury from BMSB.

It's important to note that stink bug feeding differs dramatically among stone fruit, apple and pear. "Catfacing" injury to peaches by stink bug is very similar to that of the plant bug complex. Stone cells naturally occurring in pears are more pronounced in fruit with stink bug feeding injury as cell contents are removed and the thickened cell walls of stone cells remain. However, on apple, fruit damage appears as shallow, circular, light brown to white spongy pockets in the fruit flesh, usually from 5–10 mm in circumference, and 5–8 mm in depth. Stink bug feeding can easily be mistaken for cork spot (bitter pit). Typical feeding injury tends to be on the stem end or sides of the fruit, as those parts of the fruit surface are easier for the insect to stand on, and most likely to be covered by foliage, which provides protection as the bug feeds. On apple, stink bug feeding and cork spot are distinguishable by several differences in the depressions on the apple surface. With stink bug feeding, the edge of the depression on the fruit surface is gradual instead of abrupt, as observed with cork spot. The corky flesh is always immediately beneath the skin in stink bug injury, and often separates from the skin. Stink bug injury always has a small puncture near the center of the feeding depression, requiring magnification to observe the feeding site. Occasionally, stink bug feeding may leave a "feeding sheath" within the flesh and protruding above the fruit surface. Mark Brown, research entomologist at the USDA Appalachian Fruit Research Station in Kearneysville, West Virginia, found that most stink bug damage occurs between 26 to 60 days before harvest. He has observed that 'Braeburn', 'Jonagold', 'Granny Smith' and 'Stayman' tend to have high stink bug injury levels at harvest, whereas 'Imperial Gala', 'Lawspur Rome' and 'Red Fuji' have been observed to have lower levels of stink bug injury.

Stink bugs are very difficult to manage for a number of reasons. They have a broad host range, including many crops and broadleaf weeds. They are highly mobile, frequently moving between weed hosts and fruit trees. They tend to be more active in the evening and during the night. Insecticide applications made during the day may not come in direct contact with the insect, subsequently reducing the effectiveness of the materials. Therefore, stink bugs are not continually exposed to insecticide residues for long periods of time, as are most other insect pests in managed orchards. Consequently, effective management of stink bug points toward repeated applications of insecticides, especially along the borders of orchards during the period of "adults in flight" late in the season. Hudson Valley Laboratory studies conducted on apple in 2006 demonstrated reductions in stink bug feeding damage with Thionex 50WP (endosulfan), Warrior 1CS (lambda-cyhalothrin) and Danitol 2.4EC (fenpropathrin) treatments at 2-week intervals. The use of Thionex against aphids and leafhoppers will provide incidental control of stink bug (which is not on the label). Thionex has a 21-day PHI, with a maximum of 2 applications during the fruiting season at a maximum labeled rate of 5.0 lbs/A and a maximum seasonal use limit of 6.0 lbs/A. Danitol has a 14-day PHI, does include stink bug on the label, and (in NY) has a 16.0 fl oz/A rate allowed for stink bug, with a maximum limit of 32 fl oz/A per season. Danitol will give some control of European red mite, apple maggot, the internal lep complex and the leafhopper complex. Warrior has a 21-day PHI, also includes stink bug on the label, with a 2.56–5.12 fl oz/A use range

Insect Bytes, continued on page 6

Continued from page 5, Insect Bytes

for stink bug, and a maximum use rate of 20.48 fl oz/A per year post-bloom. Warrior gives some control of apple maggot, the internal lep complex and the leafhopper complex. Pyrethroids in general are less effective in hot weather and may cause late season mite flare-up.

Late Summer Pest Control

The flight of second generation codling moth (CM) adults and third generation Oriental fruit moth (OFM) adults is underway in south-central Pennsylvania (week of July 18). Also, according to our pest monitoring program, tufted apple bud moth (TABM) and obliquebanded leafroller (OBLR) adults have started their second generation flight during the past week and will continue to fly and lay eggs until September. It is very important to closely monitor each pest population, especially in orchards with a previous history of CM, OFM, TABM or OBLR problems. Delegate® at rates ranging from 4.5-6.0 oz, Altacor® at the rate range of 2.5-3.0 oz and Belt® at the rate of 5.0 oz are highly active against CM, OFM and the two major leafrollers – TABM and OBLR. Since we want to delay the onset of resistance to either compound for many years, we highly suggest that they be used only against a specific generation of a pest(s) and then the grower should rotate to the other chemical classes of compounds to control the next generation of the targeted pest(s).

These new products are highly effective insecticides against this targeted group of pests, but they will not control all of the pests in the orchard (i.e., stink bugs, aphids, mites, borers, etc.) and additional management means may be needed to protect fruit from this latter group of pests.

If none of the above discussed products are planned for late season CM/OFM/LR management, then in orchards with high CM or OFM pressure higher rates of insecticides are recommended: azinphos-methyl 50W at 1.5-2.0 lb/A (14 day Pre-Harvest Interval [PHI] if less than 2 lb/acre applied), Imidan 70W at 3.0-4.0 lb/A (14 day PHI), Lannate 90SP at 0.75-1.0 lb/A (14 day PHI). If growers know that certain insecticides do not provide effective CM control (i.e., due to insecticide resistance), growers should consider the use of different compounds with CM activity, not previously used in the problem block (i.e., Assail™ 30SG at 6.0 – 8.0 oz/acre (7 day PHI), Avaunt™ at 6 oz/acre (14 day PHI), Calypso™ at 5-6 oz/acre (30 day PHI), Intrepid™ at 16 oz/acre (14 day PHI)), Rimon® at 20-30 fl oz/acre (14 day PHI), Cyd-X at 2-4 oz/acre or Carpovirusine at 6.8-13.5 oz/acre. If Rimon® 0.83 EC is the choice for CM or OFM control, please remember that due to its ovicidal activity this compound should be applied as soon as the egg deposition starts and repeated again in 14 days. Pyrethroid insecticides (i.e., Asana, Warrior, Danitol etc.) should also provide some control of OFM larvae, but this chemical group did not perform well in our research trials when tested for control of CM larvae during the latter part of the season.

If selective insecticides such as Intrepid or Rimon are used to control TABM and OBLR larvae, we recommend 1 to 2 complete applications of these compounds. If using Intrepid at the 12-16 fl oz/acre rate, or Rimon at 20-30 oz/acre only one application may be necessary. If using Intrepid at the 8 fl oz/acre two applications are recommended. The complete spray timings should correspond to 20 to 30% (2355-2435 DD base 45) and 60 to 70% (2665-2740 DD) egg hatch. Please also refer to the product label for rates and application timings. If the low rate of Intrepid (8 fl oz/acre) is used for leafroller control, please note that this compound will not provide adequate control of the internal fruit feeders, Oriental fruit moth (OFM) or codling moth (CM). Intrepid at the 12-16 fl oz/acre rate is more effective on the CM/OFM complex, but it is not as effective as a broad-spectrum insecticide (OPs, carbamates, pyrethroids, Assail, Calypso) especially where insect pressure is high.

Only complete (every row middle) sprays with adequate water volume are recommended to achieve good OFM and/or CM control from now until the end of the season, especially on trees greater than 8 to 10 feet in height. In order to prevent the larvae of these two pests from successfully entering the fruit, thorough coverage of the trees using an adequate water volume coupled with the correct insecticide is absolutely critical.

Pheromone Trap Counts:

2010 season - weekly capture of adult moths in pheromone traps located at Penn State FREC Biglerville, PA (Adams County):

Species	6/03	6/10	6/17	6/24	7/01	7/08	7/15	7/22
RBLR	4	11	40	56	37	7	4	13
STLM	328	136	129	95	85	144	177	243
OFM	12	4	6	6	13	3	31	29
CM	49	42	10	5	10	11	48	31
TABM	20	9	2	1	0	1	3	9
LPTB	4	1	2	2	0	0	1	1
OBLR	7	1	0	0	0	1	2	4
DWB	6	9	11	17	19	16	12	27
PTB	0	0	0	1	0	1	1	1

Key to acronyms: RBLR - redbanded leafroller; STLM - spotted tentiform leafminer; OFM - Oriental fruit moth; CM – codling moth; TABM – tufted apple bud moth; OBLR – obliquebanded leafroller; LPTB – lesser peach tree borer; DWB – dogwood borer; PTB – peach tree borer.

Peach Variety Showcase and Penn State FREC Open House

PENNSTATE

Thursday, August 26, 2010, 2:30—6:30 pm

Penn State Fruit Research and Extension Center, Biglerville, PA

Drop by whenever it fits your schedule that day!

- Showcase of Peach Varieties Under Trial in the Mid-Atlantic Region
- Advanced Peach Rootstock Selections
- Peach Systems Trials
- Advanced IPM/Bio-Rational Pest Management
- Engineering Solutions for Specialty Crops

Funding provided by PA Peach and Nectarine Board and USDA Specialty Crop Research Initiative. Special Guest—Jerry Frecon, Rutgers University

Featured Displays and Demonstrations

CA Building and Nearby Orchards, 2:30-6:30 pm

- Peach Varieties Under Trial in the Mid-Atlantic Region—Jerry Frecon, Rutgers Cooperative Extension
- Engineering Solutions for Specialty Crops—Matt Aasted, Carnegie Mellon University; Dr. Larry Hull, Dr. Paul Heinemann, Reuben Dise, Dr. Jim Schupp, Edwin Winzeler, Brian Lehman, Tom Kon, Dr. Katie Ellis, Dr. Tara Baugher
- Integrated Approaches to Peach Disease Management—Dr. Henry Ngugi, Dr. Noemi Halbrendt, Sarah Bardsley
- Innovative Energy Programming for Horticultural Enterprises—Dr. Katie Ellis, Dr. Dan Ciolkosz
- Native Pollinators—Dr. David Biddinger
- Student Projects on Crop Load Management, Increasing Efficiency in Peach Orchard Systems, Reducing Spray Drift and Energy Efficiency—Tom Kon, Jennifer Rouzer, Evan Moore, Celine Kuntz, Russell Rohrbaugh, Ryan Hilton, Amelia Jarvinen

Peach Rootstock, High Density Apple, and Grape Variety Plantings, 3:00-4:00 pm

- Peach Rootstock and Grape Variety Investigations—Dr. Jim Schupp, Dr. Rob Crassweller
- New Partnerships to Develop a Cost-Effective Harvest Assist System—Dr. Jim Schupp, DBR Conveyor Concepts
- Bio-Rational Pest Management—Dr. Greg Krawczyk, Dr. John Halbrendt
- Targeted Weed Sprayer Applications in High Density Commercial Pilot Orchards—Dr. Jim Schupp, Tom Kon, Dr. Tara Baugher

Peach Training Systems and Automated Thinning of Peach Blossoms, 4:15-5:15 pm

- Training Systems for Early Peach Production—Dr. Jim Schupp, Dr. Tara Baugher, Edwin Winzeler, Jim Remcheck
- Autonomous Sensing and Positioning of a String Blossom Thinner—Reuben Dise, Matt Aastad, Dr. Paul Heinemann
- Surveys to Increase Adoption of New Technologies—Dr. Katie Ellis

Special Thanks: Terry Salada, Jean Morris, Karen Weaver, Technical Support Staff, Summer Interns, Grower Cooperators!!

Orchard Meetings and Tours

Tuesday, August 3, Southeast Pennsylvania Vegetable Growers Field Day
Trauger's Farm, Kintnersville, PA. Contact Scott Guiser, 215-345-3283.

Saturday, August 14, Organic Vegetable Day
Vera Cruz, PA. For more information contact Tianna Dupont at 610-746-1970 or tdupont@psu.edu.

Tuesday, November 16, 2010, Western Pennsylvania Vegetable and Berry Seminar
Butler, PA. For more information contact Eric Oesterling at 724-837-1402 or reol@psu.edu, Lee Young at 724-228-6881 or ljs32@psu.edu or Bob Pollack at 724-465-3880 or rep32psu.edu.

Peach Variety Showcase and FREC Open House
Thursday, August 26, 2010, 2:30-6:30 p.m., Penn State FREC, Biglerville, PA. Showcase of peach varieties under trial in the Mid-Atlantic region, advanced peach rootstock selections, peach systems trials and innovative peach production technologies. Contact Tara Baugher, tab36@psu.edu or 717-334-6271, ext. 314.

Thursday, August 26, 6:30 pm
Young and beginning growers are invited to the Young Grower Alliance Dinner following the Peach Variety Showcase at the Fruit Research and Extension Center. We'll also have updates about the Chile fruit tour in January! Contact Katie Ellis, kag298@psu.edu or 717-334-6271, ext. 331.

View *Fruit Times* on the web at:
http://fruittimes.cas.psu.edu

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