January 29, 2010 | Volume 14 | Issue 2

Ohio Fruit ICM News

Supreme Court Review Sought By NPDES Permits

Joanne Kick-Raack, Program Director, Entomology, Ohio State University Extension

CropLife America, the American Farm Bureau Federation and other groups have filed a petition with the U.S. Supreme Court to review an appeals court ruling that a permit would be required for pesticides applied into, over or near waters of the United States. The court is not expected to decide on the petition until late in 2010.

The controversy stems from the U.S. Court of Appeals for the 6th District ruling that a National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act (CWA) is required for any pesticides applied to water bodies or if pesticides could possibly enter the water body after application. This would apply even if the pesticide label was approved by EPA for aquatic use or for use near water bodies.

EPA is planning to follow the current appeals court decision and is working on the permitting process that will be implemented in April, 2011. One element of the proposed permit process that has stirred up controversy is the requirement of Best Management Practices (BMP), or an Integrated Pest Management (IPM) plan, in the application.

NPDES permits usually require monitoring, reporting and recordkeeping. The controversy is the definition of IPM that will be used EPA. Stakeholders are concerned that the permitting process would be based on sound science and the product would be allowed to be used at a rate that still provides efficacy for the targeted pest.

(Sources: Southeast Farm Press, December 18, 2009; American Farm Bureau Federation Newsline, November 3, 2009, Daily Environment Report, Bureau of National Affairs, Inc., October 15, 2009; Pesticide & Toxic Chemical News, Vol. 37, No. 49)

EPA Proposes To Disclose Pesticide Inert Ingredients

Joanne Kick-Raack, Program Director, Entomology, Ohio State University Extension

EPA is proposing to disclose inert ingredients in pesticides, which are part of the end use product formulation, but not the active ingredient. Currently, these are considered proprietary product information and only disclosed to EPA through the registration process. They are currently considering regulatory and voluntary steps to achieve this broader disclosure.

The comment period is open until February 22. More information about the disclosure options is available at: http://www.epa.gov/opprd001/inerts/index.htm Instructions for submitting comments is available at: http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480a706af
(Source: EPA Office of Pesticide Programs, Dec. 12, 2009)

Pesticide Crop Watch: Insecticides

Joanne Kick-Raack, Program Director, Entomology, Ohio State University Extension

Carbofuran - EPA has denied a request by FMC Corporation, National Corn Growers Association, National Sunflower Association and National Potato Council for a hearing on the final revocation rule. In May, the EPA issued a final order that revoked all U.S. tolerances of carbofuran by December 31, 2009, even though carbofuran is still a registered pesticide. The revocation was on domestic tolerances of corn (excluding popcorn), potatoes, and milk, pumpkin and sunflower seeds.

FMC Corp. is planning to file suit in federal court to challenge the EPA decision to deny an administrative hearing regarding the food tolerance revocation. More information is available at http://www.epa.gov/pesticides/reregistration/carbofuran/carbofuran_noic.htm
(Source: EPA Office of Pesticide Programs; Pesticide & Toxic Chemical News, Vol 37, No. 52)

Pesticide Crop Watch: Insecticides

Joanne Kick-Raack, Program Director, Entomology,
Ohio State University Extension

UPCOMING EVENTS
More information about these events at http://pested.osu.edu/

NEW APPLICATOR CORE AND TRAINED SERVICEPERSON TRAINING
All classes taught at Ohio Department of Agriculture, Reynoldsburg
February 3, 2010
March 31, 2010
April 28, 2010
May 19, 2010
August 25, 2010
September 22, 2010

COMMERCIAL APPLICATOR RECERTIFICATION CONFERENCES
Field Crop Conference
March 9, 2010 - Columbus Convention Center

General Conference
February 17, 2010 - Sandusky, Kalahari Conference Center
March 3, 2010 - Akron, John S. Knight Center
March 9, 2010 - Columbus Convention Center

Upcoming Program in Knox County:

February 18 & 25, March 4, 2010:
2010 DK Fruit and Vegetable School, Ostrander, Ohio.
Topics Include: Sweet Corn, Vegetables, Brambles, Strawberries, Pumpkins, and High Tunnel Products
RSVP by Feb. 16 to 740-833-2030. For an informational flyer click on following link: http://delaware.osu.edu/topics/agriculture-and-natural-resources/fruit%20and%20veg%20school%20flyer.pdf

Upcoming Webinar Series & Conference Information

February 3, 2010: NE IPM Berry Webcast Series #11: **Bramble Disease Management: root and crown diseases, viruses.** More information: Laura McDermott, lgm4@cornell.edu , 518-746-2562, **http://www.fruit.cornell.edu/Berries/webinarindex.htm** . (New York Berry News)

February 17, 2010: NE IPM Berry Webcast Series #12: **Bramble Insect Management: crown/cane borers, TBA.** More information: Laura McDermott, lgm4@cornell.edu , 518-746-2562, **http://www.fruit.cornell.edu/Berries/webinarindex.htm** . (New York Berry News)

February 24-26, 2010: **North American Raspberry & Blackberry Conference, Holiday Inn, Kingston, NY.** More information call Peggy, 518-828-3346. (New York Berry News)

If you have articles for the newsletter that you would like to have considered to be included in upcoming issues, please submit to either Howard Siegrist at siegrist.1@cfaes.osu.edu or Melissa Swearingen at swearingen.34@cfaes.osu.edu

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We gratefully acknowledge the continued help and financial support of our local county commissioners. We appreciate their input and participation in our programming efforts.

Scientist Sequence Genome Of The woodland Strawberry, A Model System For Rosaceae Plants

Stephanie Yao, USDA ARS Public Affairs Specialist

The genome of a model plant related to peach, cherry and cultivated strawberry has been sequenced by a consortium of international researchers that includes scientists with the Agricultural Research Service (ARS).

The scientists announced the sequencing of the genome of woodland strawberry over the weekend at the Plant and Animal Genome Conference in San Diego, Ca. The project was funded by Roche Diagnostics.

Fragaria vesca, commonly known as the woodland or alpine strawberry, is a member of the Rosaceae family, which consists of more than 100 genera and 3,000 species. This large family includes many economically important and popular fruit, nut, ornamental and woody crops, such as almond, apple, peach, cherry, raspberry, strawberry and rose.

F. vesca has many traits that make it an attractive model system for functional genomics studies. Its small size and rapid life cycle enable researchers to conduct genetic analyses with great efficiency and low cost. To determine the importance of a gene of interest, *F. vesca* can be transformed in order to modulate the activity of that gene in the plant. Most importantly, *F. vesca* has a relatively small genome, yet shares most gene sequences with other members of the Rosaceae family, making it an important tool for addressing questions regarding gene function.

ARS molecular biologist Janet Slovin, with the Genetic Improvement of Fruits and Vegetables Laboratory in Beltsville, Md., created the nearly inbred line used in the *F. vesca* genome sequencing project. Named “Hawaii 4,” this line allowed the researchers to more easily program a computer to piece the genome together from the relatively short lengths of sequence data generated by modern sequencing machines.

Although the *F. vesca* genome is a model genome for the Rosaceae group, critical regulatory gene functions will probably differ, hypothesizes Slovin. Scientists can use the genome sequence to identify these genes, to test their function in *F. vesca*, and to develop molecular genetic markers for more rapid breeding of crops belonging to the Rosaceae group. Slovin will use the
genome to study and improve heat tolerance during fruit production in
strawberry.

ARS is the principal intramural scientific research agency of the U.S. Department of Agriculture. The research supports the USDA priorities of promoting international food security and responding to climate change.

The genome of the woodland strawberry, also called the alpine strawberry, has now been sequenced. This strawberry can serve an excellent research model for other plants in the same Rosaceae family, which includes many economically important crops such as almond, apple, and peach.
(Photo courtesy of Janet Slovin, ARS.)

USDA-NRCS HIGH TUNNELS GRANTS AVAILABLE

The USDA Natural Resources Conservation Service (NRCS) has announced a new pilot project under the "Know Your Farmer, Know Your Food" initiative for farmers to establish high tunnels to increase the availability of locally grown produce in a conservation-friendly way.

Local farmers who would like to sign-up for the high tunnel pilot should call or visit the NRCS office at a local USDA service center. USDA service center locations are listed on-line at http://offices.usda.gov/ or in the phone book under Federal Government, U.S. Department of Agriculture. General program information is available on the NRCS Massachusetts website at www.ma.nrcs.usda.gov . Participating farms can receive funding for one high tunnel.

Participating states are: Alabama, Alaska, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Pacific Islands, Illinois, Iowa, Kansas, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, NEW YORK, North Dakota, **Ohio**, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

NRCS will provide financial assistance for the project through the Environmental Quality Incentives Program (EQIP), the EQIP Organic Initiative and the Agricultural Management Assistance program.

Recognize These Postharvest Disorders of Honeycrisp?
Here Are Some New Resources On Storage Of Fruit

Michigan State University recently published *A summary of Honeycrisp storage recommendations across North America*. This article includes storage recommendations for Honeycrisp in all growing regions of the United States:

http://postharvest.tfrec.wsu.edu/REP2010A.pdf .

The University of Minnesota has an excellent web resource for Honeycrisp to help growers and researchers re-solve production and postharvest issues with the variety: http://smfarm.cfans.umn.edu/Honeycrisp.htm .

University of California, Davis recently added *Small Scale Postharvest Practices: A Manual for Horticultural Crops* to their web site. This is an excellent (and now free) resource that covers all aspects of fruit and vegetable postharvest practices from harvest through transportation and storage: http://postharvest.ucdavis.edu/datastorefiles/234-1450.pdf .

Source – Chris Sater, WSU-TFREC January 2010 Postharvest Newsletter

Soggy breakdown of Honeycrisp (left). Internal injury can extend to the surface in severe cases (right), leading to surface browning that differs from the clean, sharp edges of soft scald.

Soft scald on Honeycrisp. Injury begins as a ribbon-like light brown lesion with well-defined edges (left) and over time becomes dark brown as tissues degrade and decay begins (right). It may or may not be associated with soggy break down.

Source: Beaudry and Contreras, Michigan State University, Report to the 2009 Great Lakes Fruit Expo

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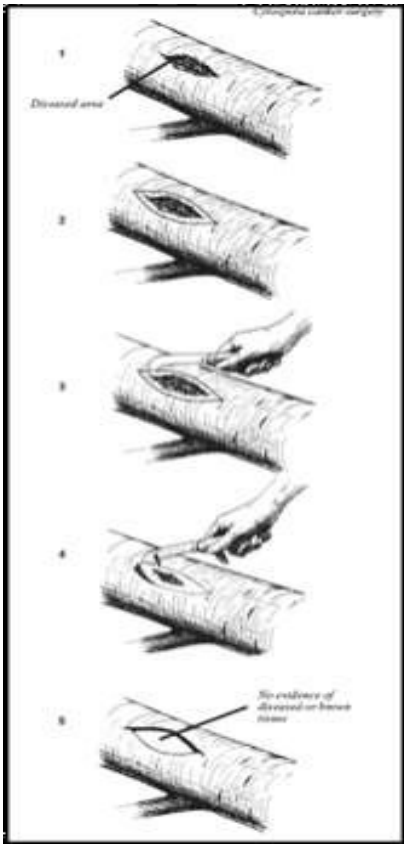
Looking Back on 29 Years at Penn state and Ahead to a New Venture as a Grower

By Dr. Jim Travis, who recently retired from his position as Penn State Plant Pathologist
and Director of the Fruit Research and Extension Center, Biglerville, PA



Peach canker surgery. For details from Dr. Travis' work, visit http://tfpg.cas.psu.edu/230.htm .

I retired from Penn State as an Extension Fruit Specialist, Professor of Plant Pathology, and Director of the Fruit Research and Extension Center in December 2009 after 29 years of service. I thoroughly enjoyed all aspects of my employment at Penn State and especially my time working with fruit growers across Pennsylvania. My primary responsibility was for disease management recommendations, education, and research. I had the two best research assistants and colleagues anyone could hope for in Jo Rytter and Dr. Noemi Halbrendt. Noemi will continue to provide critical support to the fruit industry in tree fruit and grape disease management research and education. Dr. Ken Hickey was both my mentor and collaborator over the years. Dr. John Halbrendt has always been willing to listen to an idea and provide insightful feedback. I am very pleased that the Fruit Center and the growers have Dr. Henry Ngugi to provide the leadership for the fruit pathology efforts. I anticipate great accomplishments for the good of the Pennsylvania fruit industry and the science of plant pathology from Henry.

Over the years I can remember many problem areas that fruit growers and I worked on to improve fruit production in Pennsylvania. Many of my research and educational programs were funded through the State Horticultural Association research and extension boards. When I started my job in January 1981, peach canker was a serious problem destroying young and mature stone fruit orchards. Growers and I put out demonstration trials across the state to "cut out" cankers in an effort to save trees after several topical fungicide applications proved to be completely ineffective. Due to milder winters over the last few years, peach canker isn't the problem it once was but cutting out cankers still remains the only truly effective eradication tool for growers. Some of the other disease management projects I have worked on over the 29 years with growers have included: apple rootstock susceptibility to fire blight, apple fruit rots, apple wood cankers, apple scab fungicide resistance, peach tree decline, compost use in orchards, fungicide effectiveness, weather monitoring and orchard weather collection devices, expert systems, SkyBit, Plum Pox Virus, disease resistant apple cultivars, and organic apple production.

Of course, the results of these research trials and demonstration plots were presented at regional grower educational meetings, statewide educational meetings, the Hershey meetings and grower workshops and field days. The year I started at Penn State, Dr. Marshall Ritter had set up 39 winter educational meetings across Pennsylvania. It seems that nearly every county in PA had some fruit production in 1981. In April we started the spring pruning meetings. Regional extension meetings have been a big improvement. Reflecting on county meetings, I could fill many pages with accounts of good times, great interactions with growers, and "hair-raising" travel stories with Rob Crassweller and in the first years with Ed Rajotte. Ask Rob.

Students kept things alive and exciting. I enjoyed mentoring them and seeing them grow into professionals. Some of my past students you know, others have moved on to work on fruit or vegetable crops in other areas: Debbie Breth (NY), Bill Kleiner (PA), Dr. Greg Clarke (PA), Dr. Phil Northover (Canada), Fritz Westover (Texas), Andy Muza (PA), and Dr. Beth Gugino (PA).

My future includes growing wine grapes and organic tree fruit with my son Mike in Adams County. My wife and I are renovating a late 1800's farm house and looking forward to more time together and some time to visit grandchildren and do some travelling.

I'd like to thank the fruit growers of the state for many years of professional support and friendship. However, this isn't the end. Now that I am a fruit grower, you'll see plenty of me in the future.

The PPV Success Story and How to Maintain Our Quarantine-Fee Status

Dr. John Halbrendt, Penn State FREC Nematologist

Ding Dong the Witch is Dead. In the Wizard of OZ, the townspeople were jubilant when they learned the wicked witch was dead and no longer to be feared. Similarly, there was cause for celebration on October 29, 2009 when Secretary of Agriculture Russell Redding officially announced that the Plum Pox Virus (PPV) had been eradicated from Pennsylvania. This announcement came almost exactly ten years after PPV was discovered in North America.

The Plum Pox Virus (a.k.a. Sharka) is considered one of the most economically important virus diseases of stone fruit worldwide. Many varieties of peach, plum, apricot, and nectarine produce unmarketable fruit or prematurely lose their crop when infected with PPV. Aphids are the natural vectors of the virus and it also is transmitted through infected propagation material. Commercial stone fruit is the host of primary economic importance but a number of alternate hosts have also been reported including ornamental *Prunus* and some herbaceous weeds and garden plants.

The first discovery of PPV in North America was from a peach orchard in south central Pennsylvania in October of 1999. Because of the potential damage this virus poses to the stone fruit industry, an aggressive eradication program was implemented. The eradication program utilized intensive surveys of commercial orchards, residential properties, woodlands, and fields to identify infected plants. Over the past ten years more than 2 million plant samples have been tested for PPV.

Whenever a positive sample was confirmed, destruction orders were issued for the infected plant and all susceptible hosts within a 500 meter buffer zone to curtail spread of the virus. In all, some 1,675 acres of commercial stone fruit were bulldozed and burned during the eradication program. This amounted to approximately 20% of Pennsylvania's stone fruit industry. The price tag to compensate growers for destroyed trees was over $32 million.

Infested sites were placed under a quarantine that prohibited planting stone fruit. Guidelines established by a scientific panel of experts determined that the quarantine should remain in effect until three consecutive years of negative data had been collected. This would provide a reasonable level of assurance that eradication had been achieved. In Pennsylvania, the last PPV infected trees were found in 2006 thus allowing a declaration of eradication in 2009 and removal of all quarantines on commercial and homeowner plantings.

However it should be noted that experience with PPV in Pennsylvania and elsewhere has shown that the virus is elusive and can be difficult to detect. Therefore, the guidelines also recommend that an ongoing, albeit smaller but focused, PPV survey should continue for up to ten years after the quarantine has been lifted on commercial orchards. This monitoring program is considered an essential follow-up to safeguard the Pennsylvania stone fruit industry against a second round of infection on the chance that an unknown reservoir of PPV escaped detection. As an additional layer of protection, it also is recommended that a quarantine should remain in effect for an additional three years on nursery plantings to ensure that PPV infected plants are not inadvertently distributed to growers.

Once an introduced disease has become established in a new location it is extremely difficult to eradicate. The successful eradication of PPV from Pennsylvania is hailed as a great accomplishment and could not have been achieved without the cooperation of many different groups including fruit growers, PDA, USDA/APHIS, USDA/ARS, Penn State University, and homeowners.

Lessons Learned

The appearance of Plum Pox Virus in Pennsylvania highlights the ever-present risks posed by plant virus diseases. Orchard, landscape, and nursery sanitation and good cultural practices are key issues in the prevention of virus introductions. Start with a clean planting site, purchase clean planting material and be conscientious about keeping virus reservoirs and vectors under control.

State and federal agencies have initiated clean plant programs to prevent the introduction and spread of foreign pathogens. Best management practices require growers to be familiar with common disease problems and their control. It also is important to remain vigilant for anything unusual and bring it to the attention of experts who can identify the problem.

Penn State has a web site that provides cultural and pest control information for *Prunus* ornamental and fruit producers. Visit http://sharka.cas.psu.edu/ to read about "Lessons Learned from Plum Pox Virus—Preventing the Introduction of Exotic Plant Pests," "Re-Inventing Our Peach Industry—A Chance to do Everything Right," "Replanting *Prunus* in Sites Previously Affected by Plum Pox," and "Introducing New Plants—Not Pests—to Your Orchard."

Secretary of Agriculture Russell Redding declares Plum Pox Virus eradicated at a ceremony held at the Penn State Fruit Research and Extension Center in Biglerville.

Fruit Production and Pest Management: Insecticide Mixtures and Rotations for Resistance Management in Tree Fruits

Rick Weinzierl, Editor of the Illinois Fruit and Vegetable News
University Of Illinois Extension

Earlier this month at the Illinois Specialty Crops, Agritourism, and Organic Conference in Springfield I provided a summary on insecticide mixtures and rotations for resistance management in tree fruits. The article that follows is an attempt to get the same ideas down in writing.

Let's start with a reminder of the meaning of the term insecticide resistance. Insecticide resistance is a population trait that develops over time as a result of insecticide use that "selects" individuals with the greatest ability to survive insecticide exposure. Those insects are the ones that reproduce, and the ability to survive the particular insecticide becomes more widespread in subsequent generations. In resistant populations, a higher dose or concentration of an insecticide is required to kill a given portion (50 percent or 95 percent). Pre-existing mechanisms for survival are selected by insecticide use ... this means that individuals are born "resistant;" immunity does not develop in an individual after exposure to a spray.

Delaying the evolution of resistance almost always depends upon minimizing selection pressure (so reducing pesticide use). In crops such as apples and peaches where tolerances for cosmetic damage and insect contamination are extremely low, minimizing insecticide use can be difficult or impractical. Instead, repeated cover sprays are applied, selection pressure is high, and resistance to one or more insecticides has developed in codling moth, oriental fruit moth, white apple leafhopper, San Jose scale, European red mite, and other species.

Resistance management -- a term we often hear in discussions of fruit insect control -- tries to (1) delay resistance development and maintain the usefulness of an insecticide or (2) attempts to manage target pests after resistance has led to control failures. The importance of this second aspect of resistance management -- coping with pests already resistant to one or more insecticides-- is an unfortunate reality in tree fruit insect management.

Managing resistance by minimizing insecticide use should always be part of tree fruit insect management efforts. In general this means spraying only when necessary, treating only blocks or areas that need to be treated, etc. Where repeated and widespread use of insecticides is needed, resistance management recommendations may call for high doses, mixtures, or rotations. Let's look at each of these approaches.

High-dose management tactics are based on the ideas

that resistance genes are rare in the target pest population and that resistance is usually a recessive trait (or incompletely recessive). Insects with two genes for resistance (homozygous *rr*) should be VERY rare, and a particularly high dose or rate would kill heterozygotes (*Sr*), preventing them from mating with each other and producing offspring that are homozygous for resistance (*rr*). High doses (with refuges for susceptible insects to survive) are used in BT corn, and models of resistance development predict they can be successful. However, true high-dose management has no place in insect resistance management involving conventional insecticides in tree fruit crops. Unlike concentrations of BT toxins in transgenic corn, applying high doses of insecticides (specifically intended to kill *Sr* heterozygotes) to fruits and foliage (1) costs much more than standard doses; (2) causes more nontarget mortality of beneficial insects; and (3) leaves greater residues on fruit at harvest. In addition (and perhaps more importantly), even if specifically prescribed high doses that would kill heterozygotes were applied on a given day, residues decline rapidly to levels that likely kill all the homozygotes for susceptibility (*SS*) but not heterozygotes. This idea probably warrants far more explanation than I can present in this newsletter, but suffice it to say that high doses are not practical for insecticide resistance management in tree fruits. This does NOT mean that growers should use rates too low to provide adequate control for the desired treatment interval ... it just means that using rates greater than those listed on a product label is not an effective technique for delaying insecticide resistance.

Using mixtures to manage insecticide resistance involves applying a combination of insecticides (A + B) in each treatment. To be effective in delaying resistance, this approach assumes resistance to either component is very rare and that insects resistant to both components are so rare that they do not mate with each other and pass on that combined resistance. Where resistance to one ingredient already exists, these assumptions are not met. A key question centers on how much of each ingredient

Fruit Production and Pest Management: Continued from page 7

to put in a mixture. Using full rates of each ingredient means paying the full price for both products. Could you use a portion of the rates of each and expect additive results? Probably not. Let's start with the idea that a full rate of product A or product B would provide near total control of a target pest for a certain time period until we make our next cover spray (which is what we expect of effective products for codling moth control, for example). Then ...

•Assume (1) a half-rate of product A provides 70 percent control of the target pest over the planned time period before the next cover spray and (2) a half-rate of B also provides 70 percent control. How much control will the mixture provide?

- •If the action of the two ingredients is truly independent (two completely different modes of action and detoxification routes) ...
- •A controls 70 of 100 insects ... 30 remain alive.
- •B controls 70 percent of those 30 ... 21 dead and 9 remain alive. (B also would have killed some of the 70 that A killed, but hey, you cannot kill them more than once.)

•Oops ... a half-rate plus a half-rate did not provide equal results to a full rate of either component.
•If the target pest population already contained a portion that is resistant to A or B, control provided by that ingredient will be less than the 70 percent expected.

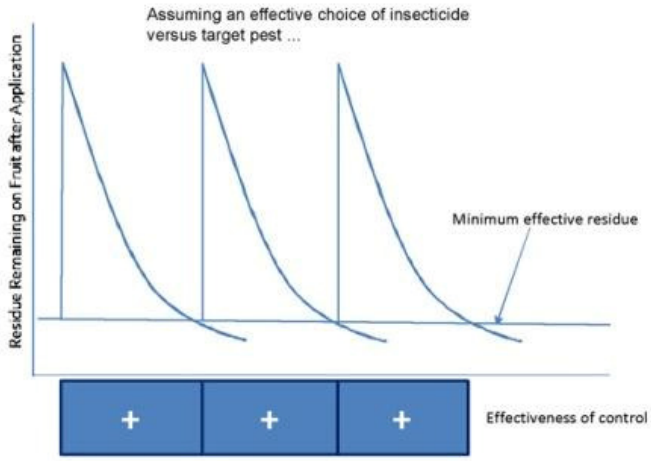
So ... in apples and peaches, where resistance is already an issue for several pests, mixtures may be valuable to control multiple pests (one ingredient against some, the second against others), but mixtures are not well suited for preventing resistance development. Rates of each ingredient have to be high enough to provide control for the necessary treatment interval. Appropriate mixtures in apples or peaches might include:

•Apples: Altacor or Delegate or Rimon to control OP-resistant codling moths plus Imidan for apple maggot control or plum curculio control
•Peaches: Altacor or Delegate or Assail (or mating disruption) to control pyrethroid-resistant oriental fruit moths plus Permethrin to control stink bugs and plant bugs

These mixtures are not really intended to delay resistance development but to manage a pest complex in which resistance is already an issue for one or more species.

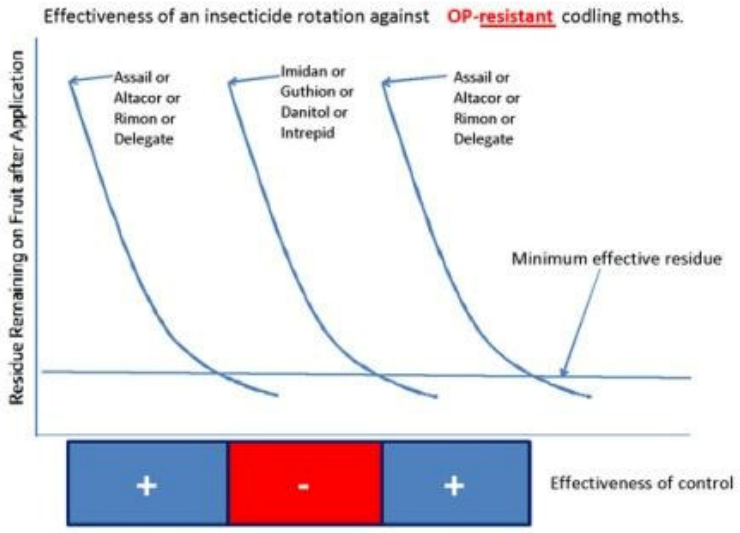
Rotations: The approach here is fairly straightforward ... use insecticide A for a period, then insecticide B, (then insecticide C ...), then eventually back to insecticide A. Usually the goal is to not use the same insecticide against successive generations of the same pest, with the hypothesis that any increase in resistance gene frequency (and prevalence of resistant insects) may decline again in the absence of treatment (selection). (This decline may or may not happen, but there is no negative cost to effective rotations.)

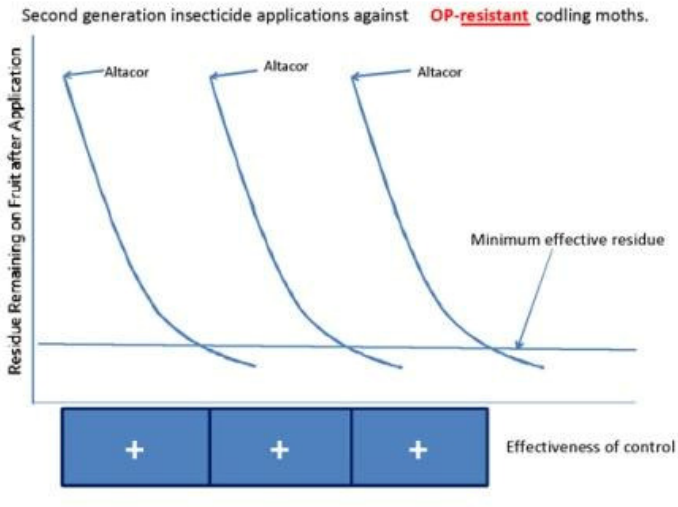
Let's look at what we expect of cover sprays for the control of internal pests of apples and peaches (focusing on codling moth and oriental fruit moth). In general, we apply an insecticide and expect that the residue will decline steadily over a period of time, and based on research and experience, we make another application when the residue is insufficient to control newly hatching larvae on fruit (IF traps and phenology models indicate control is still necessary). The idea looks something like this ...



Although rotations of different insecticides within a generation of codling moth or oriental fruit moth sprays is not usually recommended, some apple growers may use Imidan for apple maggot or Japanese beetle control and "rotate" it into the cover spray program. Where organophosphate-resistant populations already exist, as is true in many areas, this is a very BAD decision. The application of Imidan (or Guthion or even a pyrethroid or Intrepid if the population shows cross-resistance to these as well) leaves a "hole" in the spray program – a period in which fruit is not protected from the resistant population. Graphically, the problem looks like so ...

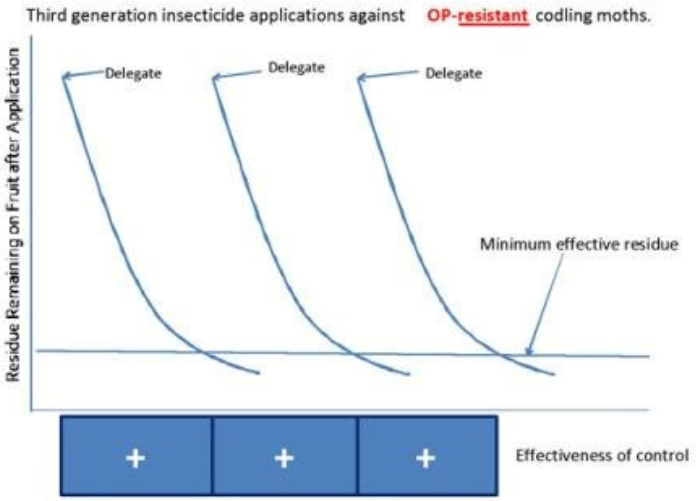
Fruit Production and Pest Management: Continued from page 8

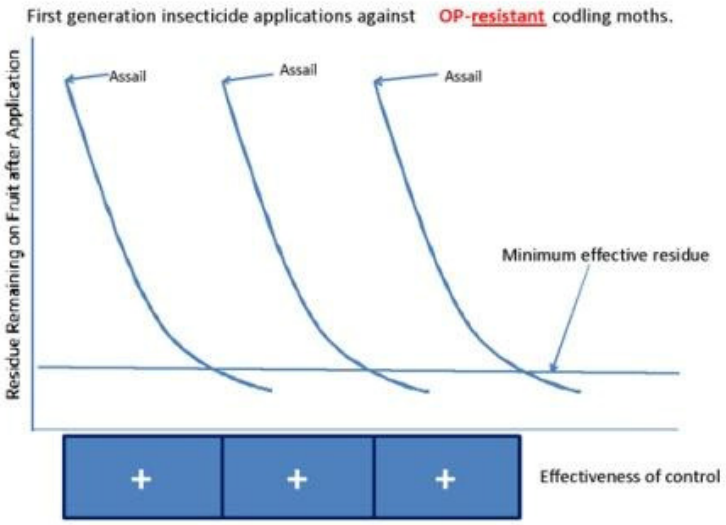




The point here is that if resistance to a given insecticide or group of insecticides already exists, it cannot be part of a rotation scheme against that pest (especially for internal pests, because they cannot be controlled after they enter fruit). The example above centers on codling moth in apples, but a similar "hole" in protection would occur in peaches if a grower chose to use permethrin (or another pyrethroid) to control stink bugs, plant bugs, or Japanese beetles at a time when pyrethroid-resistant oriental fruit moth larvae were hatching and entering fruit.

In general, the best approach to using rotations against key resistant pests in apples and peaches (codling moth and oriental fruit moth) is to rotate products from generation to generation. In apples this might look like so ...





The sequence illustrated above is not meant to be a specific recommendation, either in terms of the insecticides included or the sequence in which they are presented. Assail (and related neonicotinoids), Altacor, Delegate, and Rimon are all effective alternatives for codling moth control, but Altacor, Delegate, and Rimon do not prevent egg-laying scars from plum curculio and are not effective against apple maggot (or leafhoppers or plant bugs or stink bugs). In peaches, Assail, Altacor, and Delegate are effective against oriental fruit moth, but Altacor and Delegate do not control plum curculio; none are adequately effective against plant bugs and stink bugs. As a result, mixtures with additional insecticides may be necessary at certain times, whatever the rotation scheme is over generations.

Finally, all insecticide labels now bear an "IRAC" mode of action grouping number. IRAC is the abbreviation for the Insecticide Resistance Action committee, and the

Fruit Production and Pest Management: Continued from page 9

committee's classification system includes 29 mode of action groups. The groups and individual compounds are listed at: http://www.irac-online.org/documents/IRAC%20MoA%20Classification%20v5_3.pdf . Rotations intended to delay resistance development should always use ingredients from different mode of action groups.

Central Ohio Poison Control Number

(800) 222-1222
TTY # is (614) 228-2272
