scaffolds

Update on Pest Management and Crop Development

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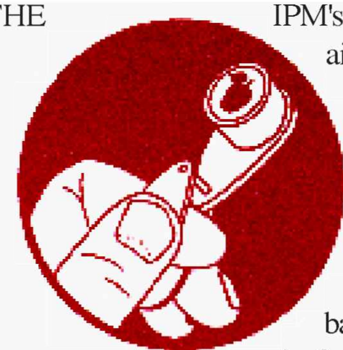
INSECTS

FUN AND PROPHET

AHEAD OF THE GAME

(Art Agnello, Entomology, Geneva; ama4@cornell.edu)



❖❖ Many orchards have now progressed to the stage where some insecticidal protection is typically needed, and this week's warmer-than-normal predictions could very well complete the transformation from a slow start to a healthy trot. Once again, we would point out the opportunity for testing out the predictive accuracy of our historical records combined with the best biological projections we can offer, by checking out the NEWA Apple Insect Models website.

During the last several years, we have been working to improve this web-based, "Real-Time" Apple IPM Decision Support System, which can deliver relevant, current information on weather data and pest populations to facilitate grower pest management decisions throughout the growing season. This system tracks seasonal development of fruit bud stage, key insect pests, and diseases using Degree Day and Infection Risk models. The models indicate pest status, pest management advice and sampling options, and are linked to an interactive system that helps growers choose appropriate materials when pesticide use is recommended. (So far, the apple phenology predictions have been pretty accurate.)

Insect pest developmental stages are calculated from Degree Day (DD) accumulations at IPM's NEWA and National Weather Service airport weather stations throughout the state, as well as a large number of sites in MA, VT, and NJ, plus several in CT, RI, PA, and DE. The insect pests addressed by this website are: apple maggot, oriental fruit moth, codling moth, plum curculio, obliquebanded leafroller, and spotted tentiform leafminer. Disease predictions are available for apple scab and fire blight, and summer diseases (sooty blotch and flyspeck).

Access to the Apple Insects (and Diseases) models is through the "Pest Forecasts" list or the "Apples" link on the NEWA homepage (http://newa.cornell.edu). From the Apples homepage, clicking on the link that says "Apple Insect Phenology Models and IPM Forecasts" brings up a state map showing the available weather stations, plus pull-down menus on one side. After the user selects a weather station, pest of interest,

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and the desired end date for weather data accumulation, pest DD models and historical records are used to calculate: Tree Phenological Stage, Pest Stage(s), Pest Status, and Pest Management Information, all of which appears on a "Results" page. The phenological stage can be adjusted according to field observations by selecting from a pull-down menu; this will generally change some of text provided in the advice boxes. Hyperlinks on this page can take the user to various other online resources, such as color photos of the bud development stages, NYS IPM Fact Sheets of the pests in question, and when appropriate, sampling charts for use in conducting field samples of specific pest life stages (e.g., eggs, larvae, mines). When a pesticide spray is recommended, a "Pesticide Information" link in the "Pest Mangement" box takes the user to the Pest Management Education Program's (PMEP) Tree Fruit IPM home page, where a pesticide decision filter helps users pick an appropriate material to use, based on anticipated pest severity and program type.

A pesticide search returns a series of profiles of all the NY-registered products fitting the specified pest species and efficacy rating. The profile gives the common and trade names, labeled use rate, re-entry and pre-harvest intervals, and EPA registration number of each product. Also included are some general remarks on the range of product efficacy, and any known effects on beneficial species. A "Details" link in each profile takes the user to a more extensive list of information, including notes on the active ingredient (including its mode of action classification), an overview of recommended use periods, and a link to a scanned copy of the NYS DEC-approved product label, which can be read or printed out.

All of the information presented is already available online at various other university sites, but this website brings these resources together in one place that is more convenient and efficient to access. Predictions provided by the website can be refined and adjusted to reflect current insect activity by user-entered events obtained through field monitoring (such as pest biofix; i.e., the first sustained flight of a pest species). The pesticide selection filter uses Cornell University product efficacy ratings and the type of management program selected by the user (i.e., conventional, reduced-risk, non-organophosphate, organic).

The website uses DD information based on either historical records or user-entered biofix data, and includes: the start, peak, or progress of the oviposition or egg hatch period (for CM, OBLR, OFM, and STLM); the start, peak or end of the pest's 1st, 2nd, etc., flight (for AM, CM, OBLR, OFM, and STLM); the first occurrence of adult or larval feeding, foliar or fruit damage, or mines (for OBLR and STLM).

We are continuing our efforts to refine and improve the accuracy of the website's pest predictions, and expand the range of sites from which weather data is able to be collected. During this process, we encourage everyone in the apple industry to check this website for themselves throughout the growing season, to see how well it forecasts pest events in specific areas of the state. We appreciate hearing of any anomalies or irregular predictions generated by using the local data to chart pest or disease development in your growing area, and hope to end up with a pest management tool that is useful and accurate for advising apple growers about what's

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BAD BOYS

DISRUPTIVE BEHAVIOR
(Greg Krawczyk and Larry Hull, Penn State Univ., Biglerville; Art Agnello, Entomology, Geneva)

[We are reprinting some excerpted advice on mating disruption of internal-feeding Lepidoptera contributed a couple of years ago by our Pennsylvania colleagues, with a few updates, to help in your preparations for managing these pests, which are already beginning to show up.]

❖❖ For growers planning to use mating disruption as part of their annual codling moth (CM) management program, you should have already purchased your products for this year. There are a number of products on the market that affect both codling moth and the oriental fruit moth (OFM) simultaneously, in addition to a number of products that just affect just a single species. Briefly, if your target is both CM and OFM, there are a number of products that affect both pests – CheckMate CM/OFM Duel, CheckMate CM/OFM Puffer, and Isomate CM/OFM TT. Please follow the label for each product for dispenser density and placement within the tree (i.e., for CM, place the dispensers in the top 20 percent of the tree canopy). Even though OFM has already started to fly, the above products should be in place before CM biofix.

For those growers who have used a mating disruption product for CM in previous years, it is likely that you will need some supplemental insecticides, especially for the first generation (see below for a listing of product choices). In addition, it is very important that you place pheromone traps in trees to monitor the success of your mating disruption program. We have conducted a number of studies with a newer lure from Trécé Inc. to monitor CM in mating disruption blocks, called a CM-DA Combo. It contains both the sex pheromone – that is released by the females to attract the males – and a kairomone (i.e., a plant-derived chemical volatile [i.e., pear ester]) that attracts both male and female moths. We recommend at least one trap per 5 acres with no less than one trap per 10 acres to determine the success of your mating disruption program. There are also powerful 10X lures available for monitoring CM male adults in mating disruption blocks. These products are available from either Suterra LLC, Trécé Inc, or other distributors.

If your plan is to use just conventional insecticides for CM control this year, your choice of products is quite varied, depending on the stage of CM you wish to target. Products that possess ovicidal activity (i.e., affecting the eggs) should be applied as follows: Intrepid (16 fl oz/acre) – apply within 150–175 DD after biofix and repeat 14 days later. Insecticides that target the hatching larvae (i.e., 230–250 DD after biofix) are as follows: diamides (e.g., Altacor, Belt), organophosphates, various neonicotinoids (e.g., Assail, Calypso), Avaunt, and Delegate. Please refer to the Tree Fruit Guidelines for rates on these products. It is important to implement good resistance management practices for all of the above products (i.e., use only one of the above active ingredients within the same generation of CM; do not use the same active ingredients across two consecutive generations).

Another option that growers can consider for CM control is a codling moth granulosis virus (CpGV) (i.e., Carpovirusine, Cyd-X, Virosoft). We have used these products very successfully over the past few years in combination with mating disruption to reduce the severity of this pest. CpGV products must be ingested by the hatching larvae. The larvae will continue to feed for a couple of days before the virus kills them. CpGV products are fairly short residual (i.e., 5–7 days); thus, they need to be reapplied more often than conventional insecticides. Growers will likely need 4–5 applications per generation depending the length of the egg hatch period, the severity of the populations, and weather conditions. [Note: Madex HP, the new Certis product containing a CpGV that is active on both CM and OFM, is not yet labeled in NYS.]

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Even if you are just using insecticides or CpGV for CM control this year, don't forget to use pheromone traps to monitor adult populations in your orchards. Monitoring traps in insecticide-only treated orchards require the use of a 1X lure. The traps are very important for setting biofix, determining the seasonality of adult flight, and they can estimate the relative adult population density in the immediate area. We don't yet have any reliable moth capture thresholds for determining whether to spray or not spray in insecticide-only treated orchards. [Note: However, we have recognized the utility in relying on the provisional "ballpark" values of 5 CM/trap and 10 OFM/trap - AMA.] ❖❖

DISEASES

ONE AND ONLY

BLOSSOM SPRAYS FOR FIRE BLIGHT

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❖❖ Streptomycin (strep) sprays have been used to protect apple and pear blossoms from *Erwinia amylovora*, the fire blight pathogen, for more than 50 years. Streptomycin (sold as Agri-Mycin 17 and Firewall) is still the most effective product available for protecting blossoms except in orchards where strep-resistant strains of the fire blight pathogen are present. By now, most apple and pear growers know that streptomycin sprays should be timed using either the MaryBlyt or Cougar Blight models.

Despite the effectiveness of strep sprays, numerous other products are labeled to control blossom blight. Many of these products gained registrations within the past few years, but NONE of the alternatives that have full EPA labels are as effective as strep. Some of these strep-alternatives are being heavily promoted in “resistance management strategies” for streptomycin wherein the alternative products are either mixed with strep or alternated with strep. However, I am not aware of any published evidence that validates either the logic or the effectiveness of these proposed resistance management strategies. At best they will prove to be harmless but expensive additions to blight control programs. At worst, they may actually increase selection pressure for strep resistance and/or contribute to fruit finish problems. Increased selection pressure for strep resistance may occur if ineffective products are alternated with strep, thereby allowing *E. amylovora* to build to high populations and/or initiate infections before strep is reapplied in the alternating program.

Historical evidence suggests that strep-resistant *E. amylovora* develops only where strep is used repeatedly during summer to prevent shoot blight. I am not aware of any evidence that strep resistance has ever emerged in orchards where strep was used exclusively to control fire blight during bloom, despite the fact that streptomycin has been widely used since the late 1950s. Thus, the ultimate resistance management strategy for streptomycin is to never apply it after petal fall except when a post-bloom spray is needed to protect trees that have suffered hail damage.

The strep-alternatives for blossom blight sprays can be subdivided into several categories: copper products, biocontrols, SAR-inducers, and other antibiotics. Many copper products have labels that allow application of low rates of copper during bloom to suppress fire blight. While copper applied during bloom will kill blight bacteria that it contacts, it does not move into flower tissue and young leaf tissue the way streptomycin does. As a result, it is less effective than strep. However, the bigger problem is that copper sprays that protect against fire blight frequently cause fruit russetting. The risk of russetting can be reduced by using very low rates of elemental copper and by applying the copper sprays with a low volume of water under fast-drying conditions. Newer products such as Cueva, Mastercop,

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Magnabon, and Phyton 27AG may be safer to apply during bloom than other copper products because, when applied according to their labels, the amounts of copper applied with those products is very low (less than 1.4 oz of actual copper/A). Nevertheless, even these low-rate copper products may cause fruit russet on copper sensitive varieties like Golden Delicious, Empire, and McIntosh if they are applied under slow-drying conditions or if applications are followed by misty rains that release copper ions without washing them from the tree.

Biocontrols that have been registered in recent years include Blossom Protect, Serenade Max, Bloomtime Biological, and BlightBan A506. Blossom Protect is a formulation of *Aureobasidium pullulans*, a yeast-like fungus sometimes known as a black yeast. The other three biocontrols listed involve three different species of bacteria. These biocontrols protect against fire blight either by occupying the biological niche required by the fire blight bacteria or by direct inhibition of *E. amylovora* by fermentation by-products captured in the formulations when organisms are harvested for packaging. If the biocontrols arrive on the blossom stigmas before *E. amylovora*, they can prevent multiplication of *E. amylovora* and the subsequent infections that lead to fire blight.

All of the biocontrols were developed and initially tested in the arid regions of California, Oregon and Washington under conditions that are quite different from the usual weather encountered in eastern United States. Rainfall in eastern regions may reduce effectiveness of the biocontrols both by washing away the biocontrol after it has been applied and/or by washing away the nutrients that are required for some biocontrols to multiply on blossoms and other plant tissues. Thus, evidence that biocontrols work well in the Pacific Northwest is not necessarily transferrable to fruit growing regions where rains occur more frequently during bloom. Serenade Max, along with earlier formulations of the same biocontrol bacterium, has been tested more extensively in eastern United States than any of the other biocontrols, and its performance has been lackluster at best (Sundin et al., 2009).

Aureobasidium pullulans, the active ingredient in Blossom Protect, is a documented contributor to fruit russet problems on apples (Heidenreich et al., 1997). It is not yet clear whether the specific strains of *A. pullulans* used in Blossom Protect will contribute to russetting when applied during the early part of the bloom period. Applications made during bloom might have no effect on russetting because russetting is usually initiated during the 30 days after petal fall. Blossom Protect has given especially promising results in the Pacific Northwest, and organic apple producers in that region may find that Blossom Protect will provide their best line of defense against fire blight after the OMRI-approval for streptomycin is cancelled at the end of 2014. However, more testing is needed under East coast conditions before we can be certain that Blossom Protect will not adversely affect finish when applied under rainy and humid conditions.

SAR-inducers are products that stimulate systemic acquired resistance in host tissue by turning on natural defense mechanisms within plants. While this resistance mechanism can sometimes reduce the severity of infections by various pathogens, it has not proven effective for controlling fire blight. Products in this category that have fire blight labels include some phosphite products (e.g., ProPhyt, Phostrol, Agri-Fos) and Regalia. Regalia is a plant extract from giant knotweed. Applying a phosphite during bloom should not have any adverse effect on blight control, but phosphites should not be used in place of strep sprays.

Oxytetracycline (Fireline, Mycoshield) is another antibiotic that is registered to control blossom blight. It can be combined with strep in orchards that contain a mixture of strep-sensitive and strep-resistant *E. amylovora*. However, oxytetracycline (OTC) is significantly less effective than strep because it does not move into plant tissue and because it only inhibits bacterial multiplication rather than actually killing the bacteria as strep and copper do. I am not aware of any published evidence that mixing OTC

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with strep serves any purpose except where strep-resistant fire blight is already present.

Kasumin is another antibiotic, and in some tests it has performed as well as strep. Although it is registered in Canada, Kasumin can be used in eastern United States only in those counties in Michigan where strep-resistant blight has been documented as the cause of significant losses. Even if it were registered nationally in the U.S., pricing alone would limit its usefulness to those locations where streptomycin is no longer effective.

In summary, we are fortunate that strep has remained effective against fire blight for so many years. Apple and pear growers should recognize that strep resistance develops primarily (perhaps exclusively) as a result of abusing strep during summer, and that once strep resistance is introduced, there are no equivalent alternatives. In the absence of resistance, growers can continue to use strep as their sole protection against blossom blight, but applications after petal fall should be avoided except as needed to protect orchards with active blight that receive hail during early summer.

Literature cited:

Heidenreich, M.C.M., CorralGarcia, M.R., Momol, E.A., and Burr, T.J. 1997. Russet of apple fruit caused by Aureobasidium pullulans and Rhodotorula glutinis. Plant Disease 81:337-342.

Sundin, G.W., Werner, N.A., Yoder, K.S., and Aldwinckle, H.S. 2009. Field evaluation of biological control of fire blight in the eastern United States. Plant Disease 93:386-394.

PHENOLOGIES

Geneva:

	5/13, predicted
Apple (McIntosh, Red Delicious): pink	bloom
Apple (Empire): late pink	bloom
Pear (Bartlett): bloom	bloom–petal fall
Sweet cherry: bloom	petal fall
Peach: bloom	petal fall

Highland:
Apple(McIntosh, Red Delicious, Empire): bloom
Apple (Ginger Gold): early petal fall
Pear (Bartlett, Bosc): bloom
Plum (Stanley): bloom
Apricot (early, late): petal fall, shucks on
Sweet cherry-early(Danube/ Balaton): bloom
Sweet cherry-late(Regina, Sweetheart): early petal fall
Peach-early: petal fall, shucks on

PEST FOCUS

Geneva: 1st **Oriental fruit moth** trap capture 5/1.

Wayne Co.1st **Oriental fruit moth** trap capture 4/30.

Highland: 1st **brown marmorated stink bug** trap capture today, 5/6.

INSECT TRAP CATCHES
(Number/Trap/Day)

Geneva, NY

	4/29	5/2	5/6
Green fruitworm	0.1	0.2	0.0
Redbanded leafroller	7.4	17.8	9.6
Spotted tentiform leafminer	0.5*	17.3	39.0
Oriental fruit moth	0.0	0.0	5.0*
Lesser appleworm	–	0.0	0.0
San Jose scale	–	0.0	0.0

Highland, NY

	4/29	5/6
Green fruitworm	0.9	0.0
Redbanded leafroller	29.4	18.6
Spotted tentiform leafminer	29.6	272
Oriental fruit moth	6.8	3.4
Lesser appleworm	0.4*	–

* first catch

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1–5/6/13):	267	135
(Geneva 1/1–5/6/2012):	479	254
(Geneva "Normal"):	335	167
(Geneva 1/1–5/13 predicted):	384	205
(Highland 1/1–5/6/13):	381	183

Coming Events:	Ranges (Normal ±StDev):	
Green fruitworm flight subsides	251–451	113–239
Redbanded leafroller 1st flight peak	234–368	106–188
Spotted tentiform leafminer 1st oviposition	143–273	58–130
Spotted tentiform leafminer 1st flight peak	268–404	124–208
Green apple aphid present	111–265	38–134
Obliquebanded leafroller larvae active	158–314	64–160
Comstock mealybug crawlers in pear buds	215–441	80–254
European red mite egg hatch	231–337	100–168
Oriental fruit moth 1st flight peak	347–547	175–291
Pear psylla 1st egg hatch	174–328	60–166
Lesser appleworm 1st catch	263–561	121–303
Mullein plant bug 1st hatch	331–443	163–229
Rose leafhopper nymphs on multiflora rose	239–397	96–198
San Jose scale 1st catch	430–614	215–337
McIntosh bloom	349–419	172–218

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