SCAFFOLDS Fruit Journal, Geneva, NY
Volume 22, No. 3
Update on Pest Management and Crop Development
April 8, 2013

COMING EVENTS

	43°F	50°F
Current DD accumulations		
(Geneva 1/1-4/8):	57	17
(Geneva 1/1-4/8/2012):	274	141
(Geneva "Normal"):	105	41
(Geneva 1/1-4/15 predicted):	109	40
(Highland 1/1-4/8):	78	19

Upcoming Pest Events – Ranges (Normal +/- Std Dev):

Green fruitworm flight peak	102-216	39-101
Pear psylla adults active	31-99	8-34
Pear psylla 1st oviposition	40-126	11-53
Redbanded leafroller 1st catch...	110-178	40-82
Spotted tentiform leafminer		
1st catch	113-213	41-101
McIntosh silver tip	60-110	18-42
McIntosh green tip	95-147	36-62

Phenologies
(Geneva): All dormant

(Highland): Apple (McIntosh, Red Delicious): silver tip
Apple (Empire, Ginger Gold): green tip
Pear (Bartlett): swollen bud
Pear (Bosc): dormant
Plum (Stanley): dormant
Apricot (early): swollen bud
Sweet cherry-early (Danube): swollen bud
Sweet cherry-late (Regina): dormant
Peach-early: swollen bud
Peach-late: dormant

TRAP CATCHES (Number/trap/day)
Geneva

	4/1	4/4	4/8
Green fruitworm	0	0.2*	0.3
Redbanded Leafroller	0	0	0
Spotted Tentiform Leafminer	0	0	0

Highland (Peter Jentsch)

	4/1	4/8
Green fruitworm	1.6*	2.1
Redbanded Leafroller	0.5*	0.1
Spotted Tentiform Leafminer	1.3*	0.0

* = 1st catch

[Section: DISEASES]

FUNGICIDE RESISTANCE COMPLICATES MILDEW CONTROL PROGRAMS FOR APPLES

(Dave Rosenberger, Plant Pathology, Highland; dar22@cornell.edu)

[Box text: D@M# I& ALL!]

Controlling apple powdery mildew is becoming more complicated because DMI fungicides are losing effectiveness against mildew in many orchards, and in some cases the strobilurin fungicides may also be losing effectiveness. Most mildew control failures result from (i) using fungicides that have lost effectiveness due to fungicide resistance; (ii) starting mildew control programs too late in the season; (iii) stretching spray intervals during dry periods when no scab sprays are needed; or (iv) poor spray coverage. As fungicide resistance in powdery mildew becomes more common, it will be critical to start mildew control programs before bloom and to rotate fungicides with different modes of action within seasonal spray programs.

The mildew fungus, *Podosphaera leucotricha,* overwinters in infected buds and grows out of the buds in spring. Signs of powdery mildew growing from infected fruit buds first become evident about the time

that buds reach the tight cluster stage, but these early symptoms are easily overlooked. Overwintering mildew that has colonized terminal shoot buds becomes evident slightly later, often during late bloom, when terminal shoots begin to grow rapidly. The shoots that develop from buds that carried mildew through winter appear as completely colonized "flag shoots". Inoculum from primary infections subsequently spreads to other leaves and causes secondary infections. Secondary spread of mildew continues so long as new leaf tissue is being produced. Mildew does not invade mature leaf tissue, so the spread of mildew ceases when trees stop producing new terminal leaves in early to midsummer.

Most fungal spores require water for germination, but powdery mildew spores can germinate and infect tissue anytime that relative humidity is between 70 and 100 percent with temperatures between 50 and 80°F. Optimum infection conditions are 96 to 100 percent relative humidity and 68 to 72°F. Rain actually deters mildew by washing spores off of primary infections and by slowing spore germination. Because mildew thrives in dry weather, mildew problems are often more severe in years that have extended periods with little or no rain between tight cluster and second cover. Thus,

mildew sprays may still be required during dry periods when there is little risk from apple scab.

Powdery mildew can sometimes cause fruit russetting on mildew-susceptible cultivars, but russetting from mildew is not very common. Published reports suggest that fruit are most susceptible to mildew when trees are at the petal fall stage, and there is no evidence that mildew can cause fruit russetting after first cover even though leaves must be protected until terminal growth ceases.

The main objective in controlling mildew is to prevent secondary infections on new leaves, thereby breaking the disease cycle so that there will not be any mildew available to infect the buds for the next year. Thus, orchards with poor mildew control last year may produce many white flag shoots that will persist through the season as a reminder of last year's failure, but presence of flag shoots does not indicate that fungicides currently being applied are failing. The current season program is designed to prevent secondary spread and infections that would lead to primary infections for the next year.

The DMI fungicides (Rally, Procure, Indar, Inspire Super, and Topguard) were exceptionally effective for controlling powdery mildew when this chemistry was introduced more than 25 years ago. However, many populations of mildew have gradually become less sensitive to these fungicides. Problems developed in some New York orchards in 2010 when growers switched from Rally or Vintage to Inspire Super, which is slightly less effective against mildew than other DMI chemistries. That difference allows mildew to explode when Inspire Super is applied in orchards where the mildew population has already shifted toward DMI resistance.

In the absence of resistance, the older DMI fungicides controlled mildew not only by protecting new foliage, but also by eradicating incubating infections before they appeared on leaves and by suppressing sporulation of older infections. Therefore, when DMI fungicides were introduced, they provided effective control of powdery mildew even when the first mildewcide spray was delayed until petal fall. None of the other mildew fungicides (including the new SDHI group) provide an equivalent level of post-infection activity against mildew. Therefore, all mildew programs must now be initiated earlier in the season, beginning

no later than tight cluster, so as to protect new leaves against secondary infections and thereby limit the amount of inoculum that can develop if sprays are delayed until petal fall.

To manage DMI resistance in mildew, a non-DMI mildewcide should now be included in sprays starting at either half-inch green if sulfur will be the primary mildewcide or at tight cluster if a strobilurin (Flint, Sovran, Cabrio) will be used for mildew control. Where labeled (i.e., except in NY), one of the new SDHI fungicides could be used instead of sulfur or a strobilurin in prebloom sprays. Mildew programs should be initiated before bloom even where DMI fungicides are still working so as to reduce selection pressure for DMI-resistant mildew.

Except for orchards where oil is being applied at tight cluster or pink, the least expensive approach for controlling mildew before bloom will be to include 3 to 5 lb of sulfur per acre in all prebloom scab sprays. This low rate of sulfur will suppress mildew and provide some assistance with scab control, but higher rates of sulfur (e.g., 15 to 20 lb/A) are required if sulfur alone is being used to control scab. Sulfur can be especially useful in programs where captan or captan-mancozeb

mixtures are being used for scab control. Neither captan nor mancozeb will control mildew. (Dodine, Vangard, and Scala also lack mildew activity).

Sulfur fungicides that are formulated with bentonite clay generally provide better residual activity than other sulfur products. One advantage of sulfur is that mildew will not develop resistance to it. A second advantage of using sulfur in prebloom sprays is that, at this application timing, temperatures are usually low enough to eliminate concerns about sulfur phytotoxicity. Sulfur will sometimes burn leaves and even fruit if temperatures exceed 80 or 85°F during the three to five days after sulfur has been applied. Sulfur can also be used for mildew control in petal fall and cover sprays, but the high temperatures that contribute to sulfur burn are more likely to occur after bloom.

The strobilurins (Flint, Sovran, Cabrio) provide effective protection against mildew so long as the mildewcide programs are initiated before bloom. The strobilurin fungicides provide sub-optimal mildew control if they are applied at petal fall in orchards where no mildewcides were applied before petal fall. Unlike DMI fungicides, the strobilurins do not appear to eradicate pre-existing infections, so they must be used

in programs that include prebloom applications of mildewcides.

Where Rally, Procure, Topguard, or Indar are still working against mildew, they are especially useful during the period immediately after bloom because they will provide both post-infection and protectant activity, not only against mildew, but also against rust diseases. However, if Inspire Super will be used for scab control, then it should probably be supplemented with sulfur at 3 to 5 lb/A to ensure that mildew will be controlled during this critical period.

Protection against powdery mildew is especially important from petal fall through second cover because the rapid growth of terminal leaves during this period provides a constant supply of new mildew-susceptible tissue. Failure to control mildew during this critical period can result in devastating levels of mildew by late June and an abundance of inoculum for infecting the buds that will carry mildew through winter into the next growing season. By the time mildew appears on terminal leaves in mid to late June, it will be too late to implement effective control measures. Thus, mildew control must be integrated into scab sprays during the entire period from tight cluster through at least second

cover. Mildew protection may be required all the way through midsummer on non-bearing trees where terminal growth continues long after bearing trees have set terminal buds.

[Section: INSECTS]

OIL BOOM
(Art Agnello, Entomology, Geneva; ama4@cornell.edu)
[Box text: SLIP SLIDIN']

With this year's leisurely progress into the growing season so far, growers have an uncharacteristically adequate amount of time to consider the potential value of using horticultural mineral oil as an early season pest management tactic, which used to be a pretty much universal practice years ago, when mites and scales were more problematic and the options for dealing with them were less abundant. Those of us familiar with fruit insect and mite trends still believe it is worthwhile to consider the use of oil applications for early season mite and insect control in both apple and pear plantings, because of its effectiveness, relative affordability, and safety from a biological and pesticide resistance perspective. Taking advantage of the most favorable spraying conditions to maximize tree and

block coverage can be a challenge in our area, but few pest management efforts have such potentially high returns when all factors are taken into account, and this year may offer more opportunities than are normally available.

Mite and scale population trends are typically not the same each year, and weather conditions are certainly among the most variable of factors in the pest scenario from one year to the next. Before you decide that it's too much trouble or cost to invest in a prebloom spray of oil, be sure you're aware of how much it could cost you (biologically as well as financially) if a rescue treatment for mites or scales ends up being necessary later in the season.

Probably first, chronologically, early oil applications are useful against **pear psylla** all throughout the swollen bud stage. Although it's capable of killing adults and nymphs that are directly contacted, oil is recommended mainly because the residue repels adult females looking to deposit their eggs, something that is already taking place across the state. The objective of using oil is to delay the timing of any needed insecticide spray until as late as possible before (or after) bloom. Oil rates depend on when you start: If your buds are at

the dormant stage (most orchards are probably past this point), one spray of 3% oil, or two of 2% through green cluster are recommended; if you start at swollen bud, one spray at 2% or two at 1% up to white bud should be adequate for this purpose, especially if applied as soon as the psylla become active (which they have). This will also give some European red mite control at the same time.

The Book of Paul

The following advice developed from Paul Chapman's original research is essentially unchanged from what I print every spring, which shows the durability of not only the information, but also of a crop protectant that's still as good as it used to be:

A delayed-dormant spray of petroleum oil in apples from green tip through tight cluster can be a favored approach for early season mite control, both to conserve the efficacy of and to help slow the development of resistance to our contact miticides. Our standard advice has been to try for control of overwintered eggs using 2 gal/100 at the green tip through half-inch green stage, or 1 gal/100 at tight cluster; this assumes ideal spraying conditions and thorough coverage. Naturally, this is not always

achieved in real life, mainly because of weather and coverage challenges, coupled with the difficulty of getting to a number of blocks during a fairly brief window. It is possible for mites to start hatching when the trees are at solid tight cluster, so the suffocating mode of action tends to be compromised if the nymphs are able to pick their way through the droplets, or else dodge them entirely. Let practicality determine how best to use the following guidelines.

First, to be sure that mites are in the egg stage, start on your blocks as soon as the weather and ground conditions permit, even if this means using a higher rate. Depending on how wet the winter months have been, local conditions will be the prime determinant of how easily you can get through the rows early on. Also, tend toward the high end of the dosage range, especially if there's been no frost during the 48-hour period before your intended spray, and no danger of one for 24–48 hours afterwards. For example, use 1.5 gal/100 if the buds linger somewhere between half-inch green and full tight cluster during your chosen spray period. Naturally, when warm temperatures start as early in the year as they have this season, cold snaps and overnight frosts are a wild card, so be aware of any

imminent changes in weather patterns that could result in tissue damage in oil-treated trees.

Obviously, good coverage of the trees is critical if you're to take advantage of oil's potential efficacy; this in turn requires adequate spray volume delivered at an appropriate speed. Experience and research have shown that a 1X concentration (300 gal/A) in large trees is clearly preferable; however, if all other conditions are optimal (weather, speed, calibration), then 3X, or 100 gal/A, is the highest concentration that should be expected to give acceptable control at any given time. Growers like to concentrate more than this to save time and the hauling of extra water, but reducing coverage too much can compromise your efforts if you end up covering only a small fraction of the egg population with the residue.

Don't limit this mite control tactic just to apples and pears. Talks with stone fruit growers have reminded us that many cherry, peach and plum plantings can suffer equally serious European red mite infestations that weren't given the early season attention they might have needed. We don't have hard and fast threshold guidelines for these crops, but stone fruit plantings with a history of past ERM problems should be examined for

presence of the red overwintered eggs, and if they're numerous enough to see without a hand lens, then a prebloom application of 2% oil would be a prudent tactic to help ward off this damage, particularly if your fungicide program at this time doesn't present any compatibility problems.

A Matter of Scale

San Jose scale is one of the historically important pests that has taken advantage of our changing insecticide programs during the last few years. The disappearance of products like Penncap-M and Lorsban from our list of summer spray materials has been at least partly responsible for the fact that SJS persists or has returned to pest status in a number of orchards. It's therefore worth pointing out that a 2% oil treatment at half-inch green will control the immature forms overwintering on the trees, and this is a preferred treatment if no other problem insects need to be controlled. Combining the oil with an insecticide generally has not been shown to be more effective than using the oil (or insecticide) alone, except possibly in the case of one alternative, Esteem, which has shown good efficacy when mixed with 2% oil at the pre-pink timing.

Finally, regarding the frequently voiced concern that oil may have a negative impact on the health of the trees, I would note that petroleum oil has been used for well over a century as a delayed-dormant treatment to control mites, scales, and even some aphids, with no ill effects on the health of the tree or the current season's crop. The primary cautions we advise when using oils at that time of year stem from their use a) in association with or too close in time to applications of sulfur-containing fungicides, or b) just before or too soon after sub-freezing temperatures; both of these practices risk the occurrence of phytotoxicity, as oil's penetrant activity is capable of damaging the bark, wood, or bud tissues in these situations. Application of oil under any circumstances that do not allow for normal drying to occur can also result in some tissue damage. Also, oil sprays during pink bud can cause burning of the sepals or petals, which may or may not affect normal pollination and fruit set.

ALL IN THE MIX

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

[Box text: HEAD SCRATCHER]

With the increasing number of insecticide products available to growers comes increasing complexity in

selecting the most effective and economical product to use for a given management decision. This has always involved weighing the traditional factors such as efficacy, chemical class, pest spectrum, impact on non-target species, and of course, cost. Added to this in recent years have been the more challenging considerations involving pesticide resistance, mode of action, seasonal maximums and, as companies have begun marketing pre-mixes that are combinations of two (for the time being) different active ingredients, the need to compare benefits vs. drawbacks of going with a pre-mix as opposed to a single-a.i. product for a given spray.

Like most university extension entomologists, I have expressed concern in the past over the proliferation of these pre-mixes in the marketplace, as I feel that growers are better off deciding for themselves what products should be mixed in their tanks, and when. Furthermore, I think that pre-mixed product combinations make it too easy to abuse the active ingredients by overusing them when both may not be strictly necessary. This not only promotes a higher risk of resistance development in the pest population, but adds to the complexity of juggling rates to achieve equivalent levels of pest control, since a spray of a pre-

mix product containing A + B may not be the same as the amount of either A or B contained in their respective single-a.i. products. Moreover, the added challenge of having to observe different seasonal maximum uses for each product is enough to cause a grower to start seeing double and inadvertently making mistakes.

Naturally, agrichemical companies love pre-mixes because they seem to make sense from a sales point of view, and I have yet to see sound biological arguments ever win out against the forces of marketing, so it's a sure bet that there will continue to be more of these products introduced into the market as time goes on. Some university specialists have chosen to ignore the pre-mixes altogether in their crop guidelines, but this doesn't seem very realistic, as the products do exist and there are admittedly some management decisions when they may be the optimal choice, so growers do use them. For the time being, I have chosen to keep them in the NY "Recommends", although I've taken pains to segregate them from the single-a.i. products, and have preceded each of their listings with the following advisory: "For best effectiveness and insecticide resistance management, the use of pre-mixes should be reserved for situations when multiple

pest species are present and are appropriately matched to the combination of active ingredients and modes of action contained in the product." This is advice that I hope growers take seriously, because the long-term utility and effectiveness of these active ingredients depends on our responsible stewardship in using them, and the short-term convenience and economy of having them available will not compensate for burning them out prematurely if they are applied needlessly or overused. (Thus endeth today's sermon.)

All this being said, I am often as confused as anyone else when confronted with the choice between a pre-mix and the single-a.i. alternative. I'm waiting for someone who is a lot more clever than I to develop some sort of expert-system app that will take into account all of the factors one should keep in mind when making such a deliberation. For the moment, however, I've made up the following table of "A.I. Equivalences", which might be of use in comparing the levels of actual insect control you might expect to achieve from different formulations of a given a.i. More details might have been included, but I hesitated to make this any more complicated, because the main intent is to provide a basis of comparison for some of the more likely decisions that could be made in choosing a

pesticide product. Just to give an idea of how this table might be used, note that the amount of chlorantraniliprole a.i. in a high-rate application of Voliam Xpress (0.078 lb) is lower than a comparable application of Altacor (0.099 lb); also, you can see the difference in thiamethoxam a.i. between the use rates of Endigo (0.046-0.055 lb) and Actara (0.070-0.086 lb). Additionally, note that thiamethoxam is limited to a maximum seasonal total of 0.172 lb/A, regardless of the formulation, which can complicate mixing & matching of products during the season. Many comparisons are possible, of course, and the information in this table is only a start, but it may help make things a bit simpler than trying to reference a bunch of individual labels. We'll see what we can do to improve on how this information is presented over time.

Active ingredient equivalents between pre-mix and single-a.i. insecticide products

Product	Labeled amt/Acre	a.i. #1	lb a.i./ applic	a.i. #2	lb a.i./ applic	Max seasonal use/A
Pre-mixes						
Voliam Xpress	6-12 fl oz	CTPL	0.039-0.078	LAMB	0.0195-0.039	31 fl oz (0.2 lb CTPL)
Voliam Flexi	4-7 oz	CTPL	0.063-0.109	TMX	0.063-0.109	11 oz (0.172 lb of each)
Leverage	2.4-2.8 fl oz	IMID	0.038-0.044	BETA	0.019-0.022	2.8 fl oz (0.044 lb IMID)
Endigo	5-6 fl oz	TMX	0.046-0.055	LAMB	0.034-0.041	19 fl oz (0.172 lb TMX)
Agriflex	5.5-8.5 fl oz	TMX	0.055-0.084	ABA	0.012-0.018	17 fl oz (0.169 lb TMX)
Single-a.i. products						

Altacor	2.5-4.5 oz	CTPL	0.055-0.099	9 oz (0.2 lb CTPL)
Actara	4.5-5.5 oz	TMX	0.070-0.086	11 oz (0.172 lb TMX)
Admire Pro	1.4-7.0 fl oz	IMID	0.05-0.25	14 fl oz (0.5 lb IMID)
Agri-Mek SC	2.25-4.25 fl oz	ABA	0.012-0.023	8.5 fl oz (0.047 lb ABA)

CTPL = chlorantraniliprole; IMID = imidacloprid; TMX = thiamethoxam; ABA = abamectin; LAMB = lambda-cyhalothrin; BETA = beta-cyfluthrin

---

This material is based upon work supported by Smith Lever funds from the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

Scaffolds is published weekly from March to September by Cornell University -- NYS Agricultural Experiment Station (Geneva), and Ithaca -- with the assistance of Cornell Cooperative Extension. New York field reports welcomed. Send submissions by 2 p.m. Monday to:

Scaffolds Fruit Journal
Editors: A. Agnello, D. Kain
Dept. of Entomology, NYSAES
630 W. North St.
Geneva, NY 14456-1371
Phone: 315-787-2341 FAX: 315-787-2326
E-mail: ama4@cornell.edu

Online at <http://www.scaffolds.entomology.cornell.edu/index.html>