



## Healthy Fruit, Vol. 29, No. 5, May the 4<sup>th</sup>, 2021

Prepared by the University of Massachusetts Amherst Fruit Team

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### Current degree day accumulations

UMass Cold Spring Orchard, Belchertown, MA (Since March 1)	03-May
Base 43 BE (NEWA, since March 1)	385
Base 50 BE (NEWA, since March 1)	189

According to the NEWA Degree Days prediction, by May 10 (next Monday) we will have reached 454 DD's Base 43 BE. McIntosh petal fall should be occurring 439 to 523 Degree Days Base 43 BE.

### Current bud stages

Current bud stages. 03-May, 2021, UMass Cold Spring Orchard, Belchertown, MA

				
McIntosh apple Bloom	Honeycrisp apple King bloom	Gala apple King bloom+	Crispie pear Bloom+	Redhaven peach Petal fall

More 2021 bud stages [here...](#)

### Upcoming pest events

Coming events	Degree days (Base 43 BE)
European red mite egg hatch complete	368-470
Green fruitworm flight subsides	267-499
Lesser appleworm 1st catch	276-564
Lesser appleworm 1st flight peak	364-775
Oriental fruit moth 1st flight peak	331-533
Codling moth first catch	395-562

Spotted tentiform leafminer 1st flight peak	267-405
Spotted tentiform LM sapfeeding larvae present	343-601
Spotted tentiform leafminer mines forming	367-641
White apple leafhopper nymphs on apple	302-560
McIntosh petal fall	439-523

## Upcoming meetings

You are invited to a Zoom meeting: Bloom Fruit Team “Virtual Twilight “Meeting  
 When: **May 6, 2021 05:30 PM** Eastern Time (US and Canada)

Register in advance for this meeting:

<https://umass-amherst.zoom.us/meeting/register/tJcqc-2orTMtGdJO8BzzPTNd8hXpHrIZBqeH>

After registering, you will receive a confirmation email containing information about joining the meeting. One pesticide recertification credit.

### Pending final UMass approval and continued improvements in COVID test results...

The UMass Extension Fruit Team will be holding its first-in-a-while **IN PERSON Twilight Meeting**, May 19, 2021 at the UMass Cold Spring Research orchard. Details will be forthcoming. Since this is our first in person meeting in a while, please bear in mind there will be some new protocols in place. For example, there will be no food available, the University will require masks and social distancing, pre-registration will be required and we will be requiring symptom screening. We will be doing our best to make this as smooth a process as possible and are looking forward to seeing you all!

**The way I see it...**

Jon Clements

Another wet, cool bloom. McIntosh full bloom at the UMass Orchard is, well, right about now. About. Honeycrisp king bloom. The weather forecast does not look like it is going to make things move too fast, I expect apple bloom will last a week if not longer. We've had one or two days of good bee activity on open flowers, likely enough to set a crop. But I am not rushing out to bloom thin with a caustic thinner this year, so won't bore you with the details of the [pollen tube growth model](#), etc., etc. The big talk about chemical thinning now seems to be an NAA or NAD application at bloom, 4 oz. and 4-8 oz. per 100 gallons dilute tree row volume respectively, mostly to initiate the return bloom process, particularly important to do on biennial varieties such as Honeycrisp and Fuji.

I am missing in-person twilight meetings! Next best thing I guess -- but that is arguable -- is our bloom Zoom (Bloom Zoom!) twilight meeting Thursday (May 6) at 5:30 PM. Expect some wisdom from Duane Greene about bloom and post-bloom chemical thinning, and pest management updates from Jaime Pinero and Dan Cooley, a little bit of grape info from Elsa Petit, and maybe "Apple Fruit Thinning Myths -- TRUE or FALSE" from me. Maybe, unless it is 7 PM when everyone else gets done! :-)



Who says cider apples are late bloomers? Redfield on 3-May, 2021 at UMass Orchard at petal fall!

## **Insects**

Jaime Piñero

**Weekly report of insect pest captures in monitoring traps at Cold Spring Orchard (Belchertown, MA)**

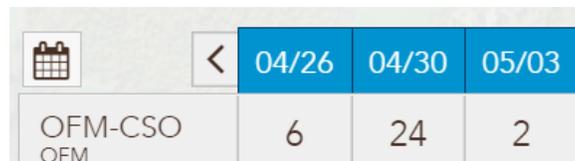
[Period: 4.27 - 5.3.2021](#)

Insect	Average captures/trap	Notes
Tarnished plant bug	0.08	Unbaited white sticky cards
European apple sawfly	0	Unbaited white sticky cards
Plum curculio	0.33	Odor-baited traps (deployed on 4.15.21)
Oriental fruit moth	26	Pheromone delta trap

**Tarnished plant bug (TPB).** Only one TPB was captured at the Cold Spring Orchard for the past seven days. Only 1 TPB was captured in a trap in 1 out of 9 monitored orchard blocks throughout MA.

**Plum curculio (PC).** After a long wait, the first PC (we have three traps set up) was captured (on April 28) by an odor-baited pyramid trap at CSO. DD43 (not BE) accumulated up to that date was 277. Based on daily weather forecasts for the next 10 days, very low levels of PC activity are expected.

**Oriental fruit moth.** BIOFIX was set on April 26 at CSO. For the past seven days, a significant increase in captures of OFM males was recorded, as shown below:



	04/26	04/30	05/03
OFM-CSO OFM	6	24	2

### **Efficacy of non-pyrethroid insecticides applied against plum curculio and Oriental fruit moth in apple (petal fall) and peach (shuck split), with notes on environmental impacts.**

The performance of insecticides that are available to control PC depends on the product characteristics. Conventional insecticides, such as organophosphates and pyrethroids, work primarily as lethal contact poisons on PC adults. Avaunt (active ingredient: indoxacarb), an oxadiazine pesticide that has been adopted by a good number of growers for PC control, also works primarily by lethal activity, but its efficacy increases if ingested. Neonicotinoids are highly

lethal to PC via contact for the first several days after application, but as these systemic compounds move into plant tissue, they can also protect fruit from PC injury via egg-laying and feeding deterrence. According to Dr. John Wise (Michigan State University), if a rescue treatment is needed, organophosphates and neonicotinoids can provide curative action up to two weeks after PC infestation.

The following two tables summarize the relative efficacy of non-pyrethroid insecticides (10 for PC, 12 for OFM) for petal fall (apple) and shuck split (peach) applications against these pests. Information presented on the four columns on the right pertains to the potential environmental effects of the pesticides listed using the Environmental Impact Quotient (EIQ) developed by Dr. Joseph Kovach and collaborators (1992).

*The EIQ was created to provide growers with data regarding the environmental and health impacts of their pesticide options so they can make better informed decisions regarding their pesticide selection. **The higher the EIQ value, the greater the negative impact of a pesticide. Conversely, lower field use EIQ values represent the least toxic choices.***

### Plum curculio

Product	Fruit crop	Efficacy <sup>1</sup>	Field Use EIQ value
Imidan 70W (phosmet)	Apple	Excellent	48.8
	Peach	Excellent	48.8
Sevin XLR Plus (carbaryl)	Apple	Good	30.1
	Peach	Good	40.1
Assail 30SG (acetamiprid)	Apple	Excellent*	4.3
	Peach	Excellent	2.9
Avaunt 30WDG (indoxacarb)	Apple	Excellent	2.9
	Peach	Good/excellent	2.9
Delegate 25WG (spinetoram)	Apple	<i>Suppression only</i>	2.6
	Peach	<i>Suppression only</i>	2.6
Actara (Thiamethoxam)	Apple	Good	2.3

	Peach	Good	2.3
Voliam Flexi WDG (thiamethoxam + chlorantraniliprole)	Apple	Excellent	1.9
	Peach	Excellent	1.9
Altacor 35WDG (chlorantraniliprole)	Apple	Fair	1.0
	Peach	<i>Not labeled for PC control in peach</i>	-----
Exirel (cyantraniliprole)	Apple	Good/excellent	1.0
	Peach	Good/excellent	1.0
Verdepryn (Cyclaniliprole)	Apple	Good	Not available
	Peach	Good	Not available

### Oriental Fruit Moth

Product	Fruit crop	Efficacy <sup>1</sup>	Field Use EIQ value
Imidan 70W (phosmet)	Apple	Excellent	48.8
	Peach	Excellent	48.8
Sevin XLR Plus (carbaryl)	Apple	<i>Not labeled for OFM control in apple</i>	-----
	Peach	Fair/good	40.1
Intrepid 2F (methoxyfenozide)	Apple	Good	5.4
	Peach	Good	4.5
Dipel DF ( <i>Bacillus thuringiensis</i> , subsp. <i>Kurstaki</i> ) OMRI-listed	Apple	Good	3.6
	Peach	Good	3.6

Avaunt 30WDG (indoxacarb)	Apple	Good	2.9
	Peach	Fair	3.5
Assail 30SG (acetamiprid)	Apple	Excellent	2.2
	Peach	Excellent	2.9
Delegate 25WG (spinetoram)	Apple	Excellent	2.0
	Peach	Excellent	2.6
Rimon 0.8EC (novaluron) =IGR)	Apple	Excellent	1.7
	Peach	Excellent	1.7
Voliam Flexi WDG (thiamethoxam + chlorantraniliprole)	Apple	Excellent	1.3
	Peach	Excellent	1.3
Entrust SC (spinosad) <i>OMRI-listed</i>	Apple	Good	1.2
	Peach	Good/excellent	1.2
Altacor 35WDG (chlorantraniliprole)	Apple	Excellent	1.0
	Peach	Excellent	1.2
Exirel (cyantraniliprole)	Apple	Excellent	0.7
	Peach	Excellent	0.7
Verdepryn (Cyclaniliprole)	Apple	<i>Expected to be good</i>	Not available
	Peach	<i>Expected to be good</i>	Not available

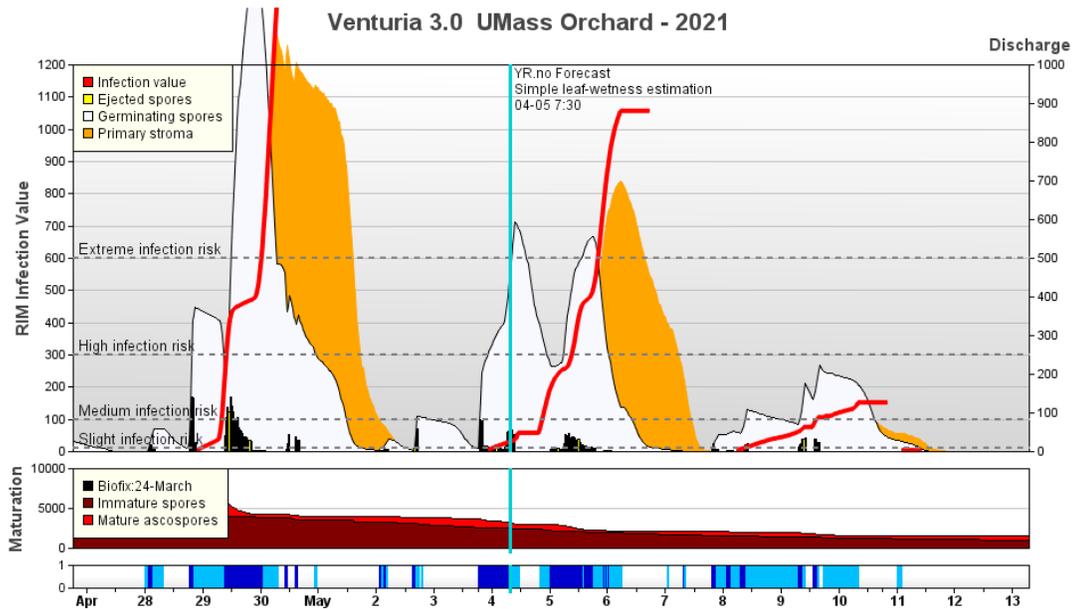
## Diseases

[Liz Garofalo](#) and Dan Cooley

### Apple scab

After a slow start, scab has become a real threat. The RIMpro output below lets us see it clearly. All you really need to know is that because the red infection lines go well above extreme risk, the infection period last week and the one going on now (May 4) are serious.

This is the time to use the more effective systemic fungicides, mixed with the low label rates of either mancozeb or captan. Look at the [April 13 Healthy Fruit](#) for details on fungicides.



[RIMpro](#)'s current (as of 5-4-21, 8:30am) apple scab risk forecast. The DSS is currently estimating another significant scab infection event. This event began on May 3, yesterday, and is forecast to reach critical level May 5 and should last through May 6.

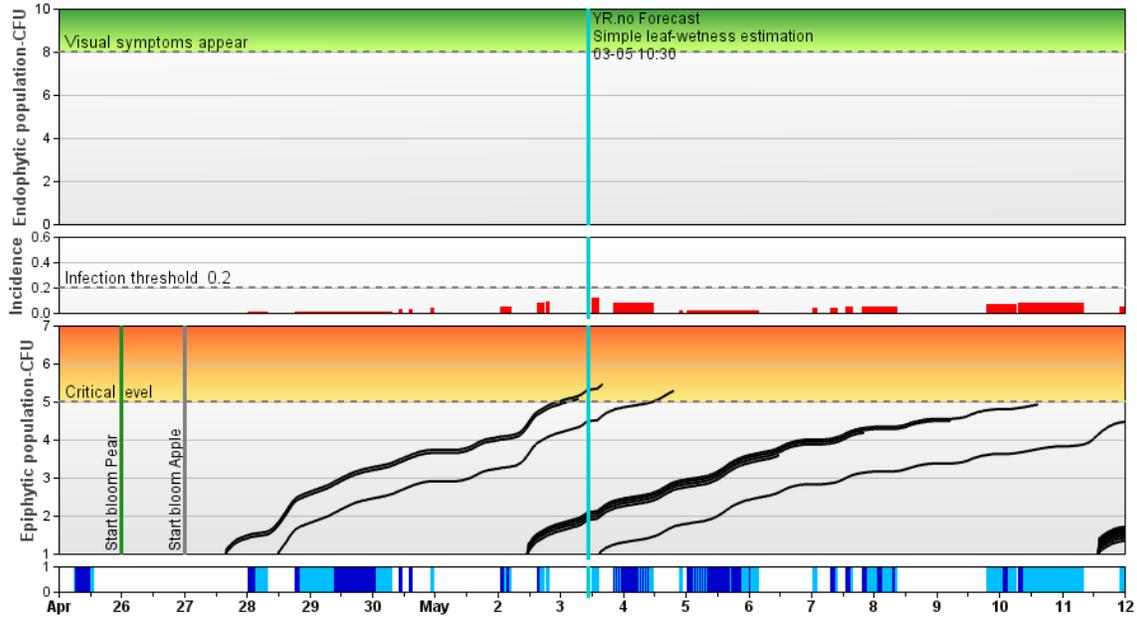
Ascospore counts from yesterday showed a total (petri plate assay and funnel trap counts) of 2,428 spore. Spores observed on the Petri plate assay germinated overnight. RIMpro, NEWA and we agree - we are in the thick of primary apple scab season.

## Fireblight

Right now fireblight is not in the forecast. Recent NEWA and RIMpro charts for Belchertown, shown below, look good. If forecast temperatures (for Belchertown) stay steady, this will hold true at least through this coming Sunday (May 9, hey, that's Mother's Day!). This is not to say we are out of the woods. As long as there are open flowers, then there is a risk of bloom infections. If temperatures warm up, then the risk of fire blight can change quickly. Keep an eye on NEWA, or RIMpro. Late bloomers (favorite cider varieties) and cultivars prone to straggling bloom will be at risk even if almost everything else has moved past petal fall.

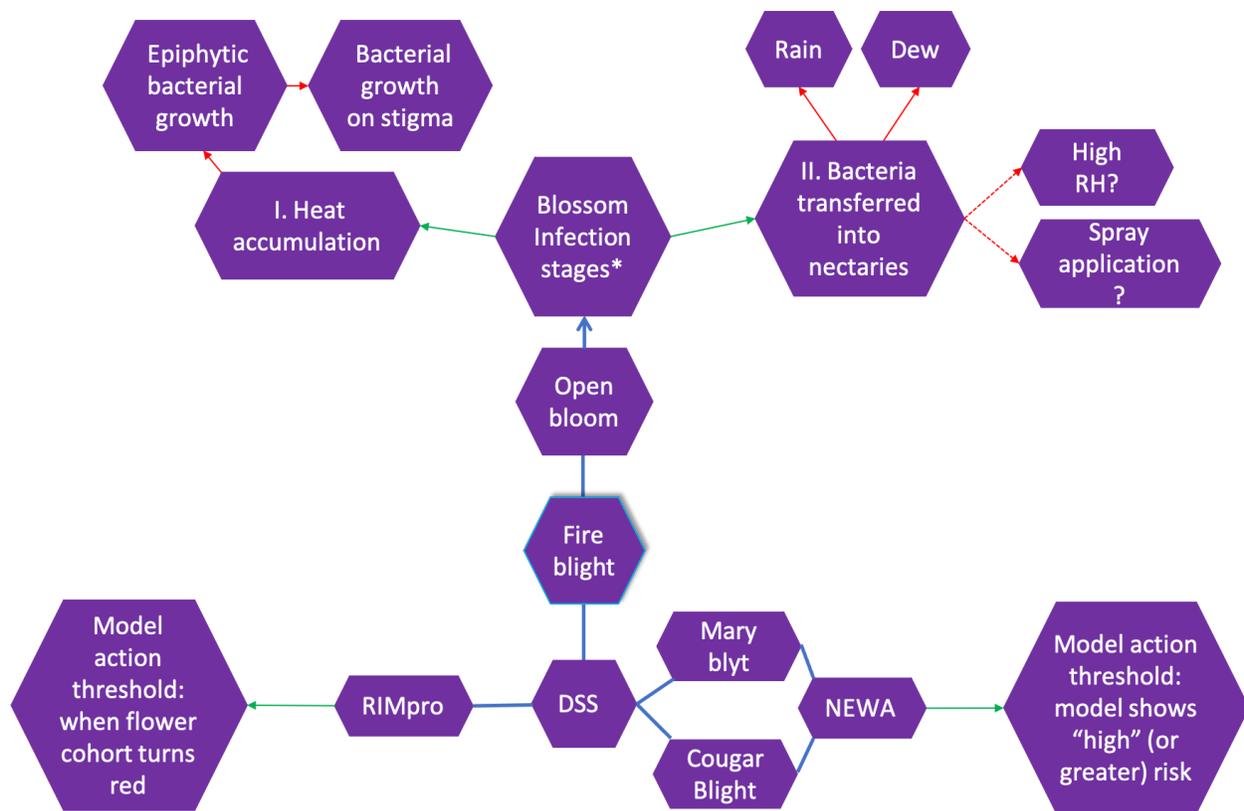
### RIMpro-Erwinia location UMass Orchard - 2021

Indicated potential infection events only relevant for trees in bloom.



RIMpro's current fireblight forecast for Belchertown, MA shows no infection right now. The black lines represent cohorts of opening flowers. When one of those floral cohort lines becomes red, that is an indication that infection is forecast and treatment should be made.

Ever wonder why it seems so complicated to make a decision about fireblight? Well, that is because it *is* a complicated situation.



An incomplete (does not include degree of susceptibility, orchard history, climatic nuances, shoot blight, etc.) graphical representation of the various complexities contributing to the overall fireblight conversation and treatment decision making process. \*The two phase blossom infection stage concept was discussed in a meeting of pathologists and was contributed by Dr. Quan Zeng.

In the chart above you see fireblight at the center of an overall picture of the many factors we consider when deciding whether to spray, strep more often than not, for this disease during bloom. Making this decision requires more than just knowing that fire blight is out there, of course. There's always some around. What's more important is how much fire blight bacteria is around, especially at bloom. *Erwinia amylovora* has a broad temperature range in which it can operate. In vitro (lab studies), the minimum temperature for growth ranges from 38°F - 54°F, the maximum temperatures have been reported to range from 95°F - 99°F with optimum growth occurring between 70°F and 82.5°F. **65°F has long been considered the baseline temperature for infection to occur.**

As you move up the chart from center(ish), you see, fireblight requires open blooms, and often, even before we see open blooms, temperatures may have occurred that are sufficient to drive the development of epiphytic (these are bacterial populations that exist outside of the host) bacterial populations. Given open blossoms are present and *Erwinia* has been moved to receptive stigmas, population growth will continue there, the first stage of blossom infection has begun.

Next we enter into the second stage of blossom infection where the bacterium are washed down into the flower's nectaries. Nectaries are glands occurring on many plant tissues (at the inside base of the flower in this case) which hitch into the host's vascular system. This washing down can occur as a result of a rain event or a heavy dew. More recent information also suggests that a spray application or even high relative humidity are able to cause this as well. Now, infection has gotten underway.

**Interpreting NEWA.** Many, but not all, of these moving pieces are incorporated into the Decision Support Systems (DSSs) we have at our disposal these days. While they give us useful information, to some extent the DSSs are a work in progress. [NEWA](#), the most commonly used DSS in our area, shows two different risk values, one from the Washington State Cougar Blight model (NEWA spells it Cougarblight, but it's Cougar Blight), and one called Infection Potential, based on the Epiphytic Infection Potential (EIP) from the Univ. of Maryland Maryblyt model. Both models have an involved set of calculations that go into estimating risk. NEWA boils these down to report four risk levels: Low, Moderate/Caution, High, and Extreme/Infection.

In addition, for each model NEWA gives numbers that represent risk. These are based on degree hours over the previous four days, so they're labelled 4-Day DH. In Cougar Blight, whether those numbers mean risk is Low or Extreme or something in between depends on what the fire blight situation was or is like in, as Mr. Rogers would say, the neighborhood. There are three options: no fire blight, fire blight occurred, and fire blight is active now. For the middle value, fire blight was in the neighborhood last year, the 4-Day DH number has to hit 150 to reach moderate risk, 300 for high risk, and 500 for extreme risk.

In Infection Potential, or EIP (a.k.a. MaryBlyt), the risk and numbers are more difficult to explain, and aren't worth discussing in detail here. Unlike Cougar Blight, the EIP numbers don't directly translate to risk. Risk basically depends on whether flowers are open, a calculation of different degree hours and degree days using different base temperatures, and whether there's any wetting. Ultimately, risk can be moderate or even high whenever flowers are open, there's some wetting and it's above 60 F. It doesn't take the bacterial population, the EIP, into account. So, EIP can be very low, but the Infection Potential, the risk, will still show as high. However, as a general rule, unless EIP reaches 100 or higher, risk is actually low or at worst moderate. This can make it hard to interpret what you should do, spray or not?

Sometimes, like yesterday, we get a situation where Cougar Blight and the EIP in NEWA disagree. (See the NEWA output below.) In this case, Cougar Blight shows low to moderate (caution) risk, while EIP shows moderate to high risk. Notice the EIP is very low. Should you spray strep or not?

	Past	Past	Current	5-Day Forecast					<a href="#">Forecast Details</a>
Date	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	
<b>Cougarblight 4-Day DH</b>	Low 23	Low 101	Caution 150	Low 148	Low 147	Low 56	Low 7	Low 12	
<b>Infection Potential EIP value</b>	Moderate 0	Moderate 23	High 34	Moderate 23	Moderate 11	Low 0	Low 0	Low 0	

	Past	Past	Current	5-Day Forecast					<a href="#">Forecast Details</a>
Date	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	
<b>Cougarblight 4-Day DH</b>	Low 44	Low 88	Low 88	Low 89	Low 47	Low 6	Low 6	Low 11	
<b>Infection Potential EIP value</b>	Moderate 11	Moderate 18	Moderate 12	Moderate 6	Moderate 0	Low 0	Low 0	Low 0	

NEWA's dual output fireblight forecast. The top is for May 3 at Belchertown, and the bottom is for May 4. Cougar Blight and the Infection Potential (MaryBlyt) disagreed about risk. In the top, the numbers that they use to estimate bacterial populations, 4-Day DH and EIP value, were both very low. But because the average temperature was estimated to be over 60 F, the Infection Potential said risk was High. It probably wasn't, and by the next day, when the average temperature was actually shown to be lower than 60, Inf. Potential is moderate.

In this case, growers might have made a decision to spray strep when none was probably(?) needed. That wastes some time and money, but doesn't put trees at risk. The more dangerous situation is on the other side, where Cougar Blight and/or the EIP say that risk is only moderate, but the 4-Day DH and the EIP are extremely high. In a situation like that, a little moisture or even high relative humidity can lead to infection. A situation like that happened last year, and some folks didn't spray strep when they should have. It's important to know something about those numbers in the two fire blight risk estimates, and not just read the words and see the colors in NEWA's risk evaluation.

### Notes from the field

Psylla nymphs are on the scene. These are early instars and are accompanied on the leaves by eggs. If you have had issues with psylla in the past, it is a good time to get out and scout (with a hand lens or other magnification tool) and see where things are at in your orchard. Summer oil (1% rate) applications are an effective way to manage psylla and keep resistance development at bay. The overlapping generations of this pest make them *highly prone* to resistance development.



## Horticulture

Jon Clements

This just in from Duane Greene...

### Bloom and Petal Fall Thinning

Duane Greene

Flower development has been erratic and proceeding in fits and spurts. However, it does appear that development in many orchards is approaching or will be at full bloom this week. The bloom and petal fall stages are excellent times to start your chemical thinning.

### Bloom and Petal Fall

Bloom is a time when orchardists frequently do not choose to thin. The bloom period has not yet occurred so there is uncertainty about how favorable it will be for bees to fly. Also, the potential for frost still exists. However, it should be noted that the sooner you can start the thinning process, the better chance you have of influencing and encouraging return bloom. There are several options available to use at bloom.

Petal fall is a thinner time of application that most orchardists choose. The pollination period is known and there is a reduced chance of frost. If a bloom thinning spray was not applied a petal fall application of a thinner becomes very important.

With one exception (Carbaryl) the same hormone thinners can be used at either bloom or petal fall. When selecting a thinner(s) it should be emphasized that thinners are not as potent when used at bloom as when they are applied at the traditional 7-14 mm stage. A rough rule-of-thumb is that thinners applied at bloom and petal fall are about 50% less effective at thinning as they are if they were applied at the 7-14 mm stage.

### Naphthaleneacetic Acid (NAA)

NAA has been used by growers for over 75 years. There is some comfort in using a compound that has passed the test of time. I routinely suggest application of NAA at 10 to 12 ppm. I have never over-thinned a tree using these rates. Lower rates will be less effective. NAA at 10 to 12 ppm could be applied to a broad spectrum of cultivars.

### Naphthaleneacetamide (Amid-Thin)

This is a thinner that has garnered increased interest from growers recently. Amid-Thin is a weaker thinner than NAA and it rarely, if ever, over-thins. It has a reputation for being a reasonably consistent thinner. The label allows application of up to 8 oz/100 gal. I do not recommend using a rate any lower than 8 oz/100 gal. (Ed. note: Amid-Thin W is not currently registered in Rhode Island.)

### Ethephon

Ethephon may be used as an early thinner. The recommended rate is 300 ppm or 1 pt/100 gal. Some have applied it at a rate as high as 400 ppm with good results. It may not be as consistent as other thinners but it remains a viable option. Since it produces ethylene it may also be useful to enhance return bloom.

### Carbaryl

Historically, this has been the most popular thinner in New England. Unfortunately, it is very toxic to bees so it can not be used until the bees are removed from the orchard at petal fall.\* Carbaryl is unusual as a thinner in that its effectiveness is concentration independent. It is routinely used at 1 pt to 1 qt/100 gal. Carbaryl is an excellent choice to combine with either NAA or Amid-Thin at petal fall to enhance thinning activity. I like the addition of carbaryl with Amid-Thin to enhance the thinning activity of Amid-Thin.

Petal fall is a somewhat nebulous term. I consider it to be a period of time between the time petals fall from the flowers and when the receptacle starts to grow. Early in this period the receptacle is not growing, or growing very slowly, so there is little carbohydrate demand exerted by the fruit. Consequently, I generally do not pay much attention to the carbohydrate model during this period of time. However, when fruit grow to 5-6 mm then the carbohydrate model plays an important role in making thinning decisions.

Bloom and petal fall thinner applications are an important component in a comprehensive thinning program. This opportunity to help regulate crop load should not be missed. *The real danger in bloom and petal fall thinning is not over-thinning but not thinning enough!*

Ed. Note: Bee very careful when using carbaryl at petal fall. Note this BEE CAUTION on the Carbaryl 4L label. BEE CAUTION: MAY KILL HONEYBEES AND OTHER BEES IN SUBSTANTIAL NUMBERS. This product is highly toxic to bees exposed to direct treatment or residues on crops or weeds in bloom. Notifying beekeepers within 1 mile of treatment area at least 48 hours before product is applied will allow them to take additional steps to protect their bees. Limiting application to times when bees are least active, e.g., within 2 hours of sunrise or sunset, will minimize risk to bees. For crops in bloom (except soybean and corn): Do not apply this product to target crops or weeds in bloom. OBSERVE BEE CAUTION. On apples, avoid use during the period from full bloom until 30 days after full bloom unless fruit thinning is desired.

## Guest article

### Honey Bee Management in Tree Fruit Orchards

Tim Lawrence, WSU Extension, Island County; and Tory Schmidt, WA Tree Fruit Research Commission. March 23, 2018. Updated April 14, 2019. Re-printed from <http://treefruit.wsu.edu/article/honey-bee-management-in-tree-fruit-orchards/>

Most people in agriculture understand the crucial role cultivated honey bees play in the production of specialty crops across the country, particularly in the tree nut and tree fruit industries of the West Coast. Without a large influx of these key pollinators every spring, Washington growers would set only a small fraction of the apples, pears, cherries, and other stone fruit necessary for commercial viability. Historic advice on managing honey bees from experts like Free, Mayer, and Delaplane is still largely relevant, but with today's modern production systems, a new generation of growers, and continually advancing research, we offer these updated guidelines for current best management practices for orchardists renting commercial bees.

Before considering specific issues about using hives in orchards, some understanding of basic honey bee biology can be instructive. A healthy colony in the spring and summer typically consists of a queen bee, several hundred drones (males), and many thousands of workers (females). The queen lays the eggs, the drones' principle role is to mate with virgin queens, and the workers perform a complex, but well-organized myriad of tasks including: foraging for pollen, nectar, and water; caring for the larvae and queen; producing honey; maintaining the hive environment; cleaning the hive; and protecting the hive. All members of the colony are crucial, but it is the activity of the worker bees that is of greatest interest to growers who want their crops

to be pollinated. Maintaining a healthy pollinator agro-eco environment is one of the most important things growers can do to ensure optimal pollination.

If the hive is healthy and presented with an opportunity for good foraging (i.e. an abundant nearby pollen, nectar, and water), the colony will respond with more efficient foraging activity, which ultimately benefits both the colony and the orchardist. As more pollen and nectar is brought in to the hive, the queen is stimulated to lay more eggs; in response to the nutritional demands of more larvae, the worker bees are stimulated to collect even more pollen and nectar. Colonies under stress, however, will not forage as effectively, resulting in reduced fruit set. In addition to things like pest and diseases, stress can include exposure to pesticides, nutritional deficiencies and lack of clean water. It is very much in the grower's interests, therefore, to minimize stress on the hives regarding factors they can control such as:

- providing a diversity of floral sources,
- ensuring adequate supplies of clean water,
- and limiting pesticide exposure.
- These simple steps will increase the likelihood that as many as a third of the population of a healthy and productive hive will be focused on foraging activities.

Bear in mind that foraging bees don't really care if you produce a lot of fruit, they're only interested in gathering the resources to support the nutritional needs of the colony. Bees need a diversity of pollen and nectar to meet these nutritional requirements and will change their foraging behavior to satisfy deficiencies. Not all pollen or nectar contain all of the essential nutrients, and protein content of pollen can vary widely. Bees prefer to work within a half mile of the hive but will fly up to 6 miles to forage in search of what they need. The more time and energy bees expend in lengthy flights to meet nutritional demands, the fewer the number of available bees to visit your fruit trees. Growers can do themselves a favor by making sure their bees don't have to work too hard to find fresh water and a variety of flowers to provide diverse sources of carbohydrates (nectar) and protein (pollen) and other essential nutrients to fuel the hive.

The cultivation of a range of flowering plants such as borage, sunflower, poppy, clover, alfalfa, and even dandelions in and around your orchard will also encourage the development of native pollinator populations including wild bees. These alternative species often provide important supplementation to pollination services from honey bees because they often forage in cooler, windier conditions and work orchard rows in different patterns than your rented bees. Even better, research has shown that the presence of competing foragers alters honey bee foraging behavior, increasing activity between rows and within tree canopies.

### Highlights of Current Bee Research

Most experts point to the Varroa destructor mite as the primary cause of dwindling honey bee populations. Ongoing research projects suggest that overwintering of hives in controlled

atmosphere cold storage (namely with high CO<sub>2</sub> concentrations) can kill off the mites without harming the bees (“Bees in the dark”, Good Fruit Grower, March 15, 2018, pp. 14-16). WSU scientists have been rearing bees bred in part from semen collected from wild bees in the Tien Shan mountains of Kazakhstan, the home of vast forests of wild apple tree species. This project promotes the genetic diversity of germplasm available to bee breeders, potentially producing new populations of pollinators that may offer some advantages to tree fruit growers (<http://www.goodfruit.com/a-new-old-bee/>).

Work led by USDA-ARS scientists in Utah indicates that *Osmia lignaria* (Blue Orchard Bee or Orchard Mason Bee) can be established in commercial orchards, creating a native population of pollinators that work in cold, windy conditions and help supplement pollination services provided by rented Italian honey bees (“The search for a better bee”, Good Fruit Grower, March 15, 2018, pp. 8-11).

Work conducted at Michigan State University and the University of California has demonstrated that providing a diversity of floral sources can increase the diversity of pollinators within an orchard. This diversity of pollinators changes the foraging behavior of honey bees to the benefit of the grower.

Research from the United Kingdom, Israel, and elsewhere has demonstrated the need for a diversity of floral sources to meet the nutritional demands for bees. This type of research is critical to ensure the optimization of pollination activities of bees.

Recent modeling work by USDA-ARS scientists in Arizona suggests that as much as 80-90% of fruit set in apple and almond orchards occurs not because a single bee picks up pollen from a pollinizer (i.e. crabapple) and directly deposits it on the flower of the main crop (i.e. apple), but due to pollen transfer that occurs within the hive itself when bees which have been working flowers of diverse plant species rub against each other.

An ongoing project involving scientists from WSU, USDA-ARS, and the WA Tree Fruit Research Commission seeks to develop a predictive model of honey bee foraging activity under various weather conditions (sunlight, temperature, wind, precipitation) as an indicator of potential fruit set; this model is currently being evaluated by industry beta-testers on WSU’s Decision Aids System (<https://decisionaid.systems/>).

## Recommendations

With this background, here are some specific recommendations and information regarding the use of rented honey bee hives to pollinate tree fruit orchards in WA:

**Timing:** For most crops, deploy your hives as bloom is starting to open, sometime between “popcorn” stage and 10% open bloom; for crops that are not as attractive to bees (i.e. pear), delaying until 25% open bloom may be helpful in preventing bees from finding other crops to

work. Hives should be removed when the orchard no longer has viable pollen, and/or all flowers have dried up; move hives only between dusk and dawn when foraging activity is minimal.

**Hive clustering and placement:** Place hives in an open, warm, sunny area with good air flow for optimal foraging. Hives may be clustered in drops of 12-20 hives (3-5 pallets). Depending on the crop, using one to two hives per acre is adequate for most orchards. Distribute hives throughout the orchard bearing in mind that bees prefer to work within a ½ mile of their hive.

**Water:** Bees need a lot of water to help regulate the temperature and humidity within the hive. Pans of water with burlap draped over the edge to prevent drowning can be very effective if the water is refreshed every few days. Dribbling sprinklers or drip emitters can also be effective provided they are not carrying any chemicals or fertilizers. Bees may also use standing water, so growers should be careful not to leave puddles when mixing chemicals for sprays or fertilizing.

**Dandelions:** As mentioned above, dandelions provide an important source of nectar and pollen to support hive health, so growers should consider leaving them in the field. In fact, cultivation of a flowering cover crop in or near the orchard may actually promote fruit set. Be careful with application of pesticides in these areas; only when pesticides known to be harmful to bees will be sprayed to the cover crop should these areas be mowed prior to placing bee hives.

**Assessing hive health:** Counting bees coming in and out of the hive may be instructive but doesn't give a full picture. The surest method is to crack open a hive and examine individual frames – a healthy hive should have bees covering of 5 or 6 frames in both the top and bottom boxes. You should also see evidence of developing brood (medium brown cell coverings) in the frames. If you are not comfortable opening hives, ask your beekeeper to do so; a random sampling of 5-10% of your hives should provide a good indicator of the quality of your bees.

**Pesticide concerns:** Always follow label directions; if there is any warning about bee toxicity, do not use that material when bees are present. Broad spectrum insecticides such as organophosphates, carbamates, neonicotinoids, and many pyrethroids are known to be very hard on bee colonies. If possible, it is best not to spray or chemigate with any materials at all while hives are in your orchard, but if you must, try to do so at night or early in the morning before bees become active.

**Pollen supplements/foraging stimulants:** Foraging stimulants have mixed reviews with some support for the use of brood pheromone to increase seed set in carrots, but in blueberry and tree fruits, use of nasonov pheromone has shown little or no benefit. Orchards designed with adequately distributed compatible pollinizers in a pollinator-friendly agro-ecosystem design should not need any pollen supplement, either in the form of pollen inserts or floral bouquets.

**Human safety around hives:** Generally speaking, honey bees have jobs to do and aren't too concerned about what humans are doing around them until those people present a threat to the

colony. Move calmly and slowly around the hives and try to approach from the sides if necessary. Avoid wearing dark colors such as red or black and refrain from using noisy equipment like chainsaws and weed eaters around the hive. The purchase of a bee veil might be a good investment if you need to work near the hive, or even better, a smoker – a few puffs of white smoke can help calm bees considerably. Finally, remember that angry bees can fly faster than you can run in a straight line, so try ducking around trees and bushes to escape the worker bees defending their colony.

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**Jon Clements**

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**Jon Clements**

Wow, seems to be a disparity of opinions here. Interesting, I thought it was pretty clear cut, but now warrants further reading/research. West coast seems to want to keep the dandelions, east coast says 2,4-D (in fall). 😞

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**Peter Mitchell**

**Jon Clements** time the mowing. Dandelions start to bloom two weeks before apple. use them to bring in bees. Mow the dandelions when apples bloom. Drive the bees into the trees. Make sure there are no apple or dandelion blooms prior to any insecticide. ... **See More**

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## Useful links

UMass Fruit Advisor: <http://umassfruit.com>

[UMass Extension Fruit Team YouTube Channel](#)

[UMass Fruit Loop IPM Podcast](#)

[Scaffolds Fruit Journal \(1995-2020\)](#). With the retirement of Dr. Art Agnello from Cornell University, this publication has come to an end. See Peter Jentsch's blog below.

Network for Environment and Weather Applications (NEWA): <http://newa.cornell.edu>

Follow me on Twitter (<http://twitter.com/jmcextman>) and Facebook (<http://www.facebook.com/jmcextman>)

[Acimovic Lab at Hudson Valley](#)

[Peter Jentsch's Blog](#)

The next Healthy Fruit will be published on or about May 11, 2021. In the meantime, feel free to contact any of the UMass Fruit Team if you have any fruit-related production questions.

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