THE UNIVERSITY OF MAINE
Cooperative Extension
Pest Management Unit

Maine Tree Fruit Newsletter

Saturday, January 15, 2022 Vol 29:2

Maine Preseason Tree Fruit Webinars

Wednesdays at 7pm: March 2, March 16, March 30, 2022

Wed., March 2 Zoom link https://maine.zoom.us/j/86822754369
7:00pm **Legislative update.** Maine State Sen. Jim Dill and Sen. Jeff Timberlake.
7:30pm **Highmoor Farm research update.**
Dr. Renae Moran, UMaine - Predicting soft scald and bitter pit in Honeycrisp apples.
Dr. Peyton Ginakes, UMaine - Cold hardiness and fruit quality in new peach varieties.
8:15pm **Discussion, Q&A with audience**
8:30pm **Adjourn**

Wed., March 9 Zoom link https://maine.zoom.us/j/87463531466
7:00pm **Vertebrate orchard pests.** Adam Vashon, USDA APHIS Wildlife Service.
Assistance with deer, vole, turkey, squirrel, porcupine and other wildlife problems.
7:30pm **Successful Electric Fencing.** Allen LeBrun, North Chester Orchard.
7:50pm **Discussion, Q&A**
8:00pm **Adjourn**

Wed., March 16 Zoom link https://maine.zoom.us/j/88397126798
7:00pm **Status reports - Browntail moth, Winter moth, Brown marmorated stinkbug, Spotted lanternfly.**
Dr. Hillary Peterson, Maine Dept. Ag. Cons. & Forestry.
7:30pm **Maine Board of Pesticides Control Update.**
John Pietroski, Maine Dept. Ag. Cons. & Forestry.
8:00pm **Discussion, Q&A**
8:15pm **Adjourn**

Wed., March 23 Zoom link https://maine.zoom.us/j/89853154768
7:00pm **Old Rules, New Tools for Apple IPM.**
Glen Koehler, UMaine Cooperative Extension.
7:45pm **Discussion, Q&A with audience**
8:00pm **Adjourn**

The webinars do not qualify for pesticide applicator recertification credits, but there are numerous other opportunities for credits listed at the end of this newsletter.

Green Pug Moth & Insecticide Mode of Entry

Green Pug Moth (GPM) biology and life cycle are described at https://portal.ct.gov/CAES/Fact-Sheets/Entomology/Green-Pug. The species was introduced into North America around 1970 and has since spread throughout eastern and western apple growing regions. The young larvae are difficult to distinguish from winter moth and other early season caterpillars, but as they approach the pupal stage, GPM develop a red or brown stripe.

Green pug moth and Winter moth larvae. Photo by Heather Faubert.

This round up of insecticides with regard to contact vs. ingestion (i.e. "stomach poison") activity, arose from a grower inquiry about preventing larval GPM feeding damage in 2022.

A lot of attention is given to different pesticide modes of action. That is because resistance risk arises from repeated use of the same mode of action against multiple generations of a pest. But there are other aspect of insecticide-insect interaction that are worth attention. For example, one issue with use of Assail for apple maggot control is that the repellent action may temporarily prevent them for laying eggs, but not kill the egg bearing female AM outright. But it is also true that Assail can kill AM eggs after they are laid.

Map from Butterflies and Moths of North America. https://www.butterfliesandmoths.org/species/Pasiphila-rectangulata

Insecticide – insect interactions are complex. In the case of GPM control at Green Tip, whether the material works by contact or requires ingestion is a key factor. Even if GPM is not a concern, better understanding of the mode of entry aspect of the insect-insecticide interaction can be useful in choosing the best product for the objective.

GPM eggs hatch at Green Tip (GT) and the young larvae move into fruit cluster buds before feeding. Once inside a bud, a GPM larva is not be vulnerable to insecticidal control until they consume the first bud and move to another bud. Based on scouting recommendations that the best time to monitor GPM is at Tight Cluster, it seems that bud-to-bud migration may peak around that time.

Where there is a known risk of GPM infestation, tree bands can be used to concentrate GPM eggs and thus allow monitoring egg hatch starting shortly before McIntosh GT the following spring. Tree bands such as those used to prevent winter moth from climbing trees have been found effective at causing GPM to stop as they climb a tree and lay a clutch of eggs even though they might be able to fly to get around the barrier. https://www.harpswell.maine.gov/vertical/Sites/%7B3F690C92-5208-4D62-BAFB-2559293F6CAE%7D/uploads/WMBarrierHowTo_band.pdf.

Commercially available BugBarrier Tree Bands have been recommended for this application. See https://www.treebands.com/home. The timing to place bands to aggregate GPM eggs is different than for stopping Winter moth. GPM egglaying starts around 10 days after Petal Fall and continue for about 5 weeks until about 6-7 weeks after PF. Banding to create a set of GPM eggs to watch for hatch timing can allow a more precise timing of treatment the following spring. But there are no egg monitoring guidelines to judge how many GPM are present and whether an action threshold has been exceeded.

Treating for GPM at GT precludes being able to measure the density of the larval population density to see if control is needed. But where the population was high the previous season, expectation for an above threshold population the following season is not unreasonable. For the grower that inquired about GPM control for the coming season, total sales were reduced by about 40% in 2021 due to GPM, so a repeat performance this year is not acceptable.

GPM is reported to be able to completely defoliate trees, so this is not unprecedented in the literature, but it may be unprecedented in Maine. GPM is usually completely unnoticeable, or at worst a minor nuisance pest in Maine apple orchards.

As we are having colder temperatures this winter than in the previous few winters, one question was whether those low temperatures would kill the overwintering eggs. Specific information on winter temperature susceptibility of GPM eggs is not available, but one person who has worked with the species thought they were “pretty tough” and thus would not be controlled by temperatures as low as -16F.

Where damage has been substantial, beginning control at GT offers the advantage of attacking them when most of the generation is in a similar stage and at their most vulnerable as just-hatched larvae. It also allows preventing destruction of the initial bud in a cluster. After initial early control at egg hatch, there will be time to monitor the population at Tight Cluster when they become more visible to see if enough larvae have survived to require a second treatment. The treatment threshold developed in Nova Scotia is 6 GPM per 100 fruit clusters at Tight Cluster.

Based on GPM behavior, good insecticide options for GPM control at GT would require rapidly acting contact activity. While most current insecticides have both contact and ingestion (i.e. “Stomach poison”) activity, products and insecticide chemical groups vary in their degree of contact vs. ingestion activity. Here is a list of the major apple insecticide types used in apple with notes about their suitability for GPM control at GT.

Good options for GPM control at GT

Organophosphates, OPs. These have both contact and ingestion activity. Imidan and Chlorpyrifos would both likely be effective. Malathion is less effective against Lepidopteran larvae (caterpillars) than the first two.

Carbamates – Contact and ingestion. Lannate is likely to be effective. Carbaryl(Sevin) is moderately effective against caterpillars. Vydate is not likely to be effective.

Pyrethroids – Asana, Baythroid, Danitol, Lambda Cy, Pounce, Warrior – Contact and ingestion. The detrimental effects of pyrethroids on predators and pollinators would be reduced with early application at GT.

Questionable but may also be effective for GPM control at GT

Diamide – Altacor label lists both contact and ingestion activity, but having a similar mode of action as Exirel suggests that Altacor may also work primarily through ingestion.

Neonicotinoids – Assail, Actara, Admire Pro. These work by both contact and ingestion, but require ingestion for best effect. Part of their efficacy against apple maggot fly and perhaps other insect pests appears to be due to repellence vs. lethality. Due to locally systemic activity, these materials may move into bud tissue and be effective against caterpillars feeding inside the bud. But that is mere speculation. It seems more likely that the systemic activity is limited to the thin plane of a leaf surface and thus insufficient to permeate through the buds of a flower cluster.

Spinosyns – Delegate, Entrust. Contact and ingestion. These materials have good efficacy against caterpillars, but as with neonics their local systemic activity suggests that much of the active ingredient moves into plant tissue and it therefore less available for contact activity on non-feeding GPM larvae as they move into buds after egg hatch.

Not good choices for GPM control at GT

Avaunt – works primarily by ingestion.

Bt – Requires ingestion. Newly hatched GPM do not feed on their way into the buds.

Diamide: Exirel – While both a contact and stomach poison, Exirel works primarily by ingestion and is therefore not a good option for GPM at GT.

Proclaim – Most effective when ingested, limited contact activity does exist for a short period after application.

Surround – requires a layer of physical residue that will be difficult to achieve on such a small target at GT. Efficacy on Green pug moth unknown, but conceivably low as the larvae have no other option but to penetrate buds so repellence factor by clay residue may be ineffective.

Other materials

Abamectin (Agri-Mek) – Contact material but poor efficacy against Lepidopteran larvae (caterpillars).

Azidirachtin materials (Aza-Direct, Neemix) – Either not effective or not rated against caterpillars like GPM. Slow acting mode of action that presumably would not be effective during a short window of exposure for GPM larvae moving into buds at GT.

Grandevo – primarily active as a stomach poison, so requires ingestion. The active ingredient is fermentation solids derived from a bacterium.

Growth regulators (Esteem, Intrepid, Rimon) – Intrepid and Rimon require ingestion for effect. Esteem works on eggs before hatching and on immature insect life stages to prevent metamorphosis between instars. Given its efficacy on eggs, Esteem presumably would not require ingestion to effect larvae, but it is debatable if larvae would encounter enough exposure on their migration into buds to cause mortality.

Horticultural oil – Given that the GPM overwinters on eggs laid near the buds on twigs, a coating of oil prior to hatch might reduce egg survival. As the eggs are larger than mite eggs which are the usual target for dormant oil, a high application rate (e.g. no more than 2X concentration below dilute volume of tankmix,) and a high oil concentration (3%) might be required. This is mere speculation, as I have not seen data on oil efficacy against GPM eggs. Timing would be critical as the application would have to be made BEFORE GT when GPM egg at hatch begins.

Insecticidal soaps – Even though soaps act as contact materials, efficacy is limited on caterpillars and the residual efficacy is short-lived.

Movento – Acts through ingestion on immature stages of piercing-sucking insects so would not be effective against GPM at any time.

Venerate – Contact activity and ingestion. This product is derived from killed cells of a bacterium that kills insects by enzymatic degradation of exoskeletal structures and interference with the molting process. Therefore its prospects for GPM control at GT are probably similar to the growth regulators described above.

If GPM are discovered actively feeding at Tight Cluster at higher than tolerable numbers, then both contact and ingestion activity would be applicable, and a wider range of effective insecticide options is available. However, Bt may still not be a great option because by then the larvae are no longer early instar caterpillars, and thus may be less susceptible to control by Bt.

Sprayer Calibration & other videos for PAT credit

A list of videos with quizzes that qualify for a pesticide applicator recertification credit is at https://secure.touchnet.com/C22921_ustores/web/store_cat.jsp?STOREID=33&CATID=366&SINGLESTORE=true The cost for each test is $7.50. Many of the videos are about potatoes and other crops, but some that are relevant to tree fruit include:

What is IPM?
https://secure.touchnet.com/C22921_ustores/web/product_detail.jsp?PRODUCTID=2725&SINGLESTORE=true

Plant pathology basics
https://secure.touchnet.com/C22921_ustores/web/product_detail.jsp?PRODUCTID=2728&SINGLESTORE=true

Ticks in Maine
https://secure.touchnet.com/C22921_ustores/web/product_detail.jsp?PRODUCTID=2811&SINGLESTORE=true

Reading Pesticide Labels and Personal Protective Equipment
https://secure.touchnet.com/C22921_ustores/web/product_detail.jsp?PRODUCTID=2723&SINGLESTORE=true

Sprayer calibration Review
https://secure.touchnet.com/C22921_ustores/web/product_detail.jsp?PRODUCTID=2810&SINGLESTORE=true

Pesticides in Groundwater
https://secure.touchnet.com/C22921_ustores/web/product_detail.jsp?PRODUCTID=2721&SINGLESTORE=true

VT Ag Engineering Postharvest Planning

The university of Maine is advertising to fill an Ag Engineering position. In the meantime, here is a series of videos from Univ. VT on postharvest operations. While most of the focus is on vegetable production, many of the same principles are transferable to tree fruit production.

https://blog.uvm.edu/cwcallah/2020/08/18/project-planning-for-postharvest-efficiency-profitability-food-safety-free-8-part-packshed-webinar/

Remaining NE-NY Winter Tree Fruit Webinars

January 25 - **Apple, Cherry and Peach Cultivars Panel Discussion**
https://umass-amherst.zoom.us/meeting/register/tJMufuuvrz0uHdJXKmThtaSESXSAxqHzasmt

*** **February 1** - **Fungicide and Streptomycin Resistance in Apple Pathogens - Status and Management.** Pre-registration at https://umass-amherst.zoom.us/meeting/register/tJYsd-6grj8vG9G1ssCbYvKDfpsZnCOSL4Gp

*** **February 8** - **Spotted Wing Drosophila- Research Updates and Management.** Pre-registration at https://umass-amherst.zoom.us/meeting/register/tJMsce-srT4vG9bCC4Wa0Yn0pkI7BO9pLruN

February 22- Precision Crop Load Management in Honeycrisp. Pre-registration at https://umass-amherst.zoom.us/meeting/register/tJ0sceGorTMrG9KDBjI_tGZeQPmjJ_RuCulO

*** **March 8** - **Bacterial Spot and Phytotoxicity of Peach.** Pre-registration at https://umass-amherst.zoom.us/meeting/register/tJwpd-6vqTIvHtxim2TihMtOgov5c0AUorLL

*** **March 15** - **Herbicides: Materials, Timing and Rates.** Pre-registration at https://umass-amherst.zoom.us/meeting/register/tJMscOyspjwqG93on4Mrz4Yj0AJ7H3ndgWGb

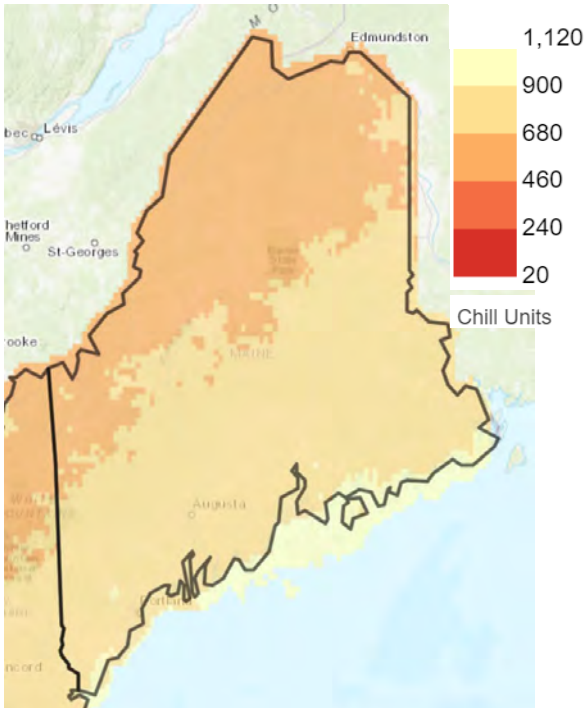
*** **March 22** - **Northeast Cider Apple Project.** *** Pre-registration at https://umass-amherst.zoom.us/meeting/register/tJIrfu2gqDojGN0ggQzv5NDTM99lMuAtgJSv

*** **March 29** - **Plum Curculio Research Update** Pre-registration at https://umass-amherst.zoom.us/meeting/register/tJMrce2vpj0rHNevn7FZpRRetls7cUUBB0Oq

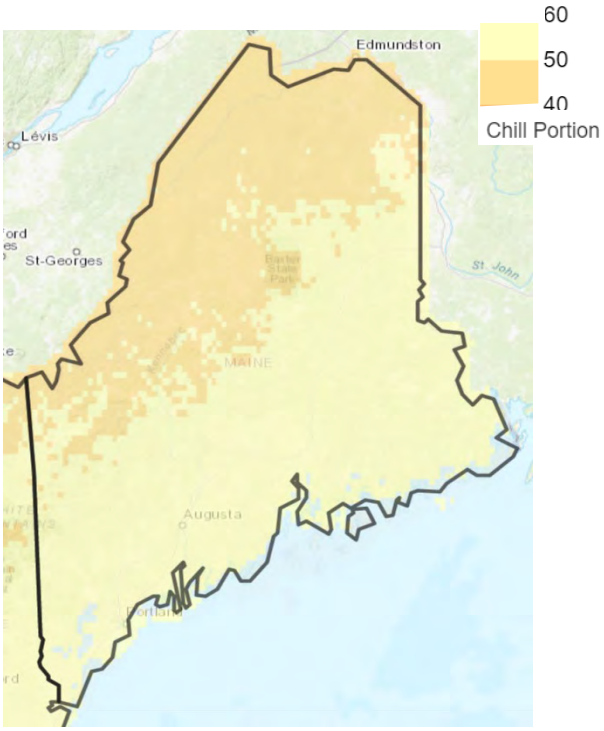
Chill Units

The topic of winter chill requirements gets more complicated the more you understand it. But complexities aside, statements can be made about the current situation. The previous standard measure for tree fruit chilling is the Utah Model defined by Richardson et al. in 1974, which assigns a chill unit for each hour according to its contribution to fulfilling a chilling requirement.

Confusion is created by common use of simple counting of hours between 32 – 45F or even more simply hours <45F. These simple counting of hours are not the same as Utah Model chill units and have been shown to inaccurately represent tree chilling accumulation in plants. Unfortunately research studies continue to use simple cumulative chill hours despite their known inadequacy. A good review of the need for standardized measures and methods is provided by Luedling 2012, Scientia Horticulturae 144:218–229.



Above: cumulative Utah Model Chill units.
Below: cumulative Dynamic Model Chill Portions.
Both as of January 13, 2022.
From Climatetools.org.
https://climatetoolbox.org/tool/climate-mapper



Utah Model Chill Unit Values
Richardson et al 1986.

Hourly temperature °F	Utah Model Chill Unit
32	0
34.2	0.5
38.7	1.0
51.8	0.5
58.1	0
64.6	-0.5
69.8	-1.0

Fluctuating fall and winter temperatures can cause a reduction in cumulative chill hours. Because temperatures below 32F contribute nothing to chill unit accumulation, colder weather does not result in more chill unit accumulation as one might expect. Counter-intuitively, as climatic temperatures warm, cooler areas like Maine are likely to increase their chilling units, while warmer areas such as California are expected to lose some of their limited (and for some fruit crops inadequate) number of chill units.

A more complex Dynamic Chill Portion model was defined by Fishman et al. 1987 and is becoming the de facto standard. In most comparisons the Dynamic Model was found to be more accurate for prediction of bloom dates than previous models, especially in warm locations. For a cool location like Maine, the Utah Model is probably about as accurate as the Dynamic Model. Unfortunately a simple translation of chill requirements based on the Utah Model or simple chill hours to equivalent Dynamic Model Chill Portions is not possible because the ratios vary by location.

Cultivar	Utah Model Chill Units	Dynamic model Chill portions
Apples		
Cripps Pink	1242	73.3
Delicious	1234	---
Elstar	1027, 1096	50, 65.6
Fuji	1307	77
Gala	---	50-55
Galaxy Gala	1300	76.7
Golden Delicious	---	50
Granny Smith	1049, 1239	59, 59.3, 72.8
Honeycrisp – similar to Cripps Pink based on chill hours.	(1242?)	(73?)
Kalei (from Gala)	1275	75.5
Red Delicious (Hi Early)	1307	77
Pome Fruit in general	---	High >70, Medium 30-70, Low <30
Bartlett Pear	1210	56
Peaches		
Elberta	800	43
O'Henry	---	63
Red Haven	870	75
Stone fruit in general	---	High >30, Medium 12-30, Low <12
Sweet cherry		
Bing	880	49, 54
Brooks	---	37
Lapins	---	35
Rainier	---	45
Sam	---	70
Montmorency sour cherry	954	---
'Italian' prune	788	---
Tilton apricot	720	---

Sources: Delgadoa et al. 2021; El Yaacoubi et al. 2016; Fernandez et al. 2020; Glozer & Grant 2006; Glozer & Ingels 2007; Hauagge & Cummins 1991; Noorazar et al. 2021; Parkes et al. 2020; Pope 2015; Richardson et al. 1986; Sapkota et al. 2021..

Apple trees have maximum winter hardiness during their endodormancy prior to their chill requirement being met. Once the number of chill units has been met, the tree completes its endodormancy, and can respond to warming temperatures to progress toward spring bud break. In warmer locations, temperatures to progress towards bud break start occurring before the end of endodormancy, which makes tracking chill and progress towards spring bud break more complicated because when the two periods overlap, interactions can occur. But in Maine that is not an issue as endodormancy is complete before spring warm up begins. (So even mud season has a silver lining!).

The number of chill units required to complete endodormancy varies between tree fruit species and between cultivars within a species. Even with global warming, Maine is at no risk of running short of chill unit accumulation. However in California and other warmer locations, lack of chill units is a serious concern for tree fruit growers. Not completing the chilling requirement can result in uneven and weak bloom, reduced productivity, and lower fruit quality.

The complexity around endo- and eco-dormancy is not limited to how to measure chilling. The effect of chilling are also complex and not well understood. Even the best predictions of bloom date based on chilling followed by heat unit accumulation only reduce the error about 50% below just using average dates. Some of that complexity is described in a Penn State fact sheet titled "Tree Fruit Cold Hardiness - Pruning Effects" by Rich Marini and Jim Schupp online at https://extension.psu.edu/tree-fruit-cold-hardiness-pruning-effects

There is a lot of misleading information about tree fruit chilling requirements on the internet, including spurious values posted by nurseries. Readers are advised to stick to peer reviewed publications. Any estimates based on simple Chill Hours <45F should be viewed with skepticism because that method has been repeatedly shown to be inaccurate.

Closing Words

"Be kind, for everyone you meet is fighting a hard battle,"

~ Ian Maclaren

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