scaffolds

Update on Pest Management and Crop Development

F R U I T J O U R N A L

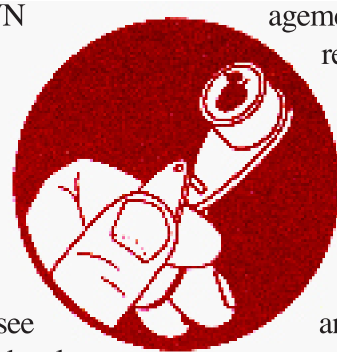
March 19, 2012 VOLUME 21, No. 2 Geneva, NY

I N S E C T S

READY, AIM, ...

LOOKING DOWN THE BARREL

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



❖❖ It will be interesting to see just how faithfully arthropod pest development responds to ambient temperatures during this year's unnaturally early spring warm-up, and whether our traditional correlations with tree phenology will break down in deference to raw heat accumulation and its effects on insect growth processes. For instance, European red mite egg hatch has always been associated with tight cluster bud stage, but will it jump the gun this year, or else maybe lag behind tree growth? We don't have any good basis for predicting either way, so for the time being, I imagine we'll just proceed with our recommendations as if the calendar actually said April instead of March.

To that end, we historically take the approach of pointing out 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

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IN THIS ISSUE…

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.

Chappie's Chapter

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.

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scaffolds
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Dept. of Entomology
NYSAES, Barton Laboratory
Geneva, NY 14456-1371
Phone: 315-787-2341 FAX: 315-787-2326
E-mail: ama4@cornell.edu

Editors: A. Agnello, D. Kain

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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.

Finger on the 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 a more recent 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. ❖❖

COUNTING THE DAYS

A MATTER OF DEGREE DAYS

(Julie Carroll, NYS IPM Program, Geneva; jec3@cornell.edu)

GENERAL INFO

❖❖ Several inquiries regarding degree days have surfaced in the past as NEWA (Network for Environment and Weather Applications, newa.cornell.edu) use has increased. Degree days (DD) are, essentially, a mathematical way to calculate the accumulation of heating units over time. (Cooling units, i.e., chilling hours, can also be calculated, though this is not currently programmed into NEWA.) A brief description of DDs is available from the University of Illinois at http://ipm.illinois.edu/degreedays/calculation.html.

Keep in mind:

- NEWA serves many agricultural and horticultural commodities.
- There are several formulas that can be used to calculate degree days.
- Max and Min temperatures are collected during a "defined" 24-hour period.

Because DDs are a way of expressing heating units, entomologists, plant pathologists, horticulturists, and agronomists have utilized DD calculations to model the development (phenology) of arthropod pests, plant diseases, plants, crops, and weeds. For instance, we know that the best fit for explaining the devel-

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opment of ascospores of the apple scab fungus is by using degree days calculated with a low cutoff temperature of 32°F. We also know that codling moth development does not progress below 50°F. This is also the case for most plants, thus DDs calculated with a base temperature (or low cutoff) of 50°F are commonly referred to as growing degree days, or GDDs.

NEWA serves many agricultural and horticultural commodities

Several crop, pest, and disease phenology models are programmed into NEWA. Some rely solely on DD tables, some display results directly (so the DD accumulations are not apparent to the user), and some provide DD ranges when IPM decisions and interventions are needed (hanging traps, timing sprays, etc.).

Degree Days (DD) calculated in NEWA at http://newa.cornell.edu/index.php?page=degree-days and the insect phenology and disease models for which they were developed.

Base Temp	Insect Phenology Model or Disease Development Model
4°C	cabbage maggot
0°C	apple scab
40°F	onion maggot
43°F	obliquebanded leafroller, spotted tentiform leafminer
45°F	oriental fruit moth
47.14°F	grape berry moth
48°F	alfalfa weevil
50°F	growing degree days (GDD), codling moth, plum curculio, apple maggot
55°F	fire blight shoot blight symptom development

Implementation of these models is guided by research and extension faculty at Cornell University, as well as extension educators in Cornell Cooperative Extension. NEWA also provides a platform for stakeholder input to improve model performance and webpage results. For example, if you are looking at the "Results" pages generated by the Apple Insect Models on NEWA, those screens are generated by accumulating temperature data for the location of interest, generating a DD value (using Baskerville-Emin calculations, see below), and then comparing that total against a lookup table of DD ranges and corresponding text messages that are used to populate the Pest Status, Pest Development, and Pest Management boxes on the screen.

There are several formulas that can be used to calculate degree days

In NEWA, historically, the simple Max-Min formula has been used for DD calculations. This formula can readily be calculated by hand and was also included in many of the Cornell Pest Management Guidelines. The Baskerville-Emin (BE) formula uses a sine wave algorithm and results in more precise DD calculations. This formula was implemented in NEWA in ~2006.

We chose to place the simple DD formula choices at the top of the drop-down selection list on the NEWA Degree Day Data webpage http://newa.cornell.edu/index.php?page=degree-days to reduce confusion among our long-time NEWA users. Those choices that use the BE DD formula are noted as "BE" in the name. Currently, in all the NEWA apple disease and apple insect phenology models that utilize DD accumulations, the BE formula is being used. Kerik Cox and Art Agnello have chosen to use BE DDs because of their higher precision. Furthermore, BE DDs have been used in the entomology field observations in Geneva, NY, for the past 25 years or more.

If you are comparing the Scaffolds "Upcoming Pest Events" tabulated DDs with what is tabulated for Geneva in NEWA, make sure you compare these with the BE DDs to get the best match. "Best match" because, having used two calculators to crunch an involved equation and come up with two

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answers that don't exactly match, it is true that software programs can differ slightly in the way they handle rounding of decimal places, etc., which can create some differences in the mathematical answer.

Max and Min temperatures are collected during a "defined" 24-hour period

Another area that introduces variability in DD accumulations is how the 24-hour period is defined. For some, the 24-hour day begins at midnight, and for some it ends at midnight. That is, in some systems midnight is 0:00, in some it is 24:00. In NEWA, midnight marks the beginning of the day and is tabulated as 0:00 in the Hourly Data pages. NEWA's 24-hour period runs from 12:00 AM (= 0:00) until 11:59 PM. Data is collected for NEWA's database at the top of the hour. Therefore, some NEWA weather stations may miss the true Max and true Min temperature for a given day, because it might have occurred at 2:16 PM. Hence, this adds another source of variability! Consequently, NEWA's new weather stations with the IP100 ethernet interface, described at http://newa.cornell.edu/index.php?page=get-weather-station, will be programmed to collect the true daily Max and Min values.

Daylight savings time can be problematic. Essentially, an hour is lost and then gained in the annual time continuum. NEWA will soon begin utilizing the same methodology as the National Weather Service (NWS) for dealing with this 23-hour-long day and 25-hour-long day during the year. The NWS has Weather Observer sites reporting daily Max and Min temperatures. These sites collect data, once per day, at specified times, which can affect DD value calculations.c Consider the time when you look at the values from your Max-Min thermometer and then clear them. If you look at these first thing in the morning and invariably at 5:00 AM, then you are collecting a true 24-hour Max and Min temperature for the period 6:00 AM until 5:00 AM the following day. If you collect this data in the afternoon, the 24-hour period range would be different. Over time, climatologists have found that "afternoon" observations typically accumulate more DD's than "morning" ones.

The bottom line

When comparing DD data, keep in mind the sources of variability in DD accumulations. And don't sweat the discrepancies you find too much; like they say, "you can measure it with a micrometer, but what's the sense if you have to cut it out with a hatchet?" Nothing is more accurate than looking outside and seeing if you have green tip or counting the insects in your traps. We certainly don't expect an adult codling moth to pop out on the dot at 489 DD (base 43°F) from Jan 1, or plum curculio to stop immigrating into the orchard at 308 DD (base 50°F) from petal fall; there are simply too many sources of variability (e.g., in whose data one is using, how it was collected, at how representative a site, and at what point in time, etc.) to make this level of tracking practical.

NEWA provides theoretical predictions and forecasts. The theoretical models predicting pest development or disease risk use the weather data collected (or forecasted) from the weather station location. These results should not be substituted for actual observations of plant growth stage, pest presence, and disease occurrence determined through scouting or insect pheromone traps.❖❖

PEST FOCUS

Highland:
Pear psylla egg laying has begun. **Green fruitworm** 1st catch 3/14. **Redbanded leafroller** 1st catch today (3/19).

HORTICULTURE

HEY, BUD!

THE EFFECT OF THE MILD WINTER OF 2011/12 ON FRUIT TREES

(Terence Robinson; tlr1@cornell.edu and Mario Miranda Sazo; mrm67@cornell.edu, Horticulture, Geneva, and Lake Ontario Fruit Team, Newark)

Note: This article was initially written on March 12, 2012

❖❖ The mild winter weather of 2011/12 has led to questions about what effect will this have on tree bud development this spring. The physiology of trees during dormancy is a highly complex phenomenon. A simplified explanation of what we understand is as follows.

1. In late summer, growth inhibitors (natural chemicals) build up in fruit buds which prevent them from growing even though temperatures are favorable. This is to prepare the tree for winter and is called summer dormancy. This type of dormancy is the reason we can summer prune in the month of August and not cause regrowth of the shoots, whereas such summer pruning in June will cause shoot regrowth.

2. As trees experience cold but non-freezing temperatures in the fall and winter, the level of inhibitors in the buds gradually declines. When inhibitor levels are high, buds will not begin to grow even if warm temperatures are experienced. This is termed “rest”. At some point in the winter, when enough cold temperatures have been experienced, the level of inhibitors is lowered enough in the buds that they will begin to grow if warm temperatures are experienced. This point is called “rest completion”.

3. The internal physiological events associated with rest completion are still unclear, but the progression from summer dormancy to rest completion has been modeled using accumulated cold temperatures. A temperature accumulation unit termed a “chill unit” was developed, which is defined as 1 hour at the optimum temperature for chilling (45°F). Experimental data has shown that temperatures in a 15-degree band above and below 45 have a positive effect on chilling and contribute a partial chill unit for each hour of such temperatures. In contrast, temperatures above 65°F have a negative effect on chilling and subtract a partial or whole chill unit from the total. Experimental data has also shown that many apple varieties require 1000 to 1200 chill units to reach rest completion. To predict when enough chill units have been accumulated for rest completion, chill units are summed beginning at the onset of summer dormancy in late July. Hourly temperatures are assigned either a positive, negative or fraction of a chill unit. Usually the warm temperatures in August and early September result in a negative chill unit accumulation, which does not help end rest. However, with the arrival of cool temperatures in late September and early October, positive chill units are usually accumulated. Once positive chill units begin to accumulate a running total is calculated from that point forward and the end of rest is predicted when 1200 chill units have been accumulated. In New York this usually occurs in December.

4. Once rest is completed, buds can respond to temperatures greater than 40°F. However, a significant accumulation of warm temperatures (above 40°F) is required before visible bud development can be seen. This process is termed heat unit accumulation and the units used to measure it are growing degree hours. Experimental data has shown that about 2500 growing degree hours (base 40°F) are required from the end of rest completion until green tip. In most winters in NY, the cold temperatures of Jan., Feb. and early March limit heat unit accumulation so that, even though rest has been completed in early to late December, buds do not begin to develop until warmer temperatures arrive in late March and April.

Chill Unit and Heat Unit Accumulation During the Winter of 2011/2012

The winter of 2011/12 has been milder than normal. Although it has been mild, there have been many hours of temperatures in the optimum

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range for chill unit accumulation (32–60°F) (Figure 1). Using the chill unit model developed in North Carolina, which is an improved version of the original chill unit model from Utah, we estimate that in western NY, it appears that chill units began to be accumulated in late September (28th–29th) and reached an accumulation of 1200 chill units on Dec. 31, 2011 at Somerset, NY, on Jan. 5, 2012 at Williamson, and Lyndonville, NY, and on Jan. 10, 2012 at Lafayette (Figure 2). It should be noted that low chill varieties of stone fruits, which require less than 1200 chill units, completed rest even earlier than most varieties of apple.

Following the completion of rest in early January 2012, fruit trees in western NY have been responding to warm temperatures (accumulating heat units) with non-visible bud development leading toward bud break. Our calculations of growing degree hours in Western NY since the completion of rest in early January show that trees have accumulated 950 (Williamson) to 1055 (Lafayette) growing degree hours by March 12 (Figure 2). This is about 40% of the 2500 total hours needed to reach green tip. This indicates that, although we still need some heat before seeing green tip in apples, we have had a significant amount of heat to move us along the path toward green tip.

The forecast temperatures this week and early next week are expected to be much higher than normal, which will rapidly accumulate growing degree hours and bring on bud break. Using the growing degree model and forecast temperatures until March 26 gives estimated green tip date for apples of March 19 for Somerset, March 20 for Williamson and Lyndonville and March 21 for Lafayette. Growers should be ready to begin fungicide sprays to control scab by the third week of March. Low chill plums and flowering cherries, which have accumulated more heat units than apples (since they completed rest earlier), will start to show signs of bud development sooner. Growers should be ready to begin fungicide sprays to control scab by the third week of March.

Full bloom will be about 3–4 weeks after that, depending on how warm the early part of April is. Such an early budbreak and bloom will bring a huge risk of spring frost-induced crop loss. It would appear that western NY orchards are at a significant risk of an early bloom and preparations for frost protection should be made. ❖❖

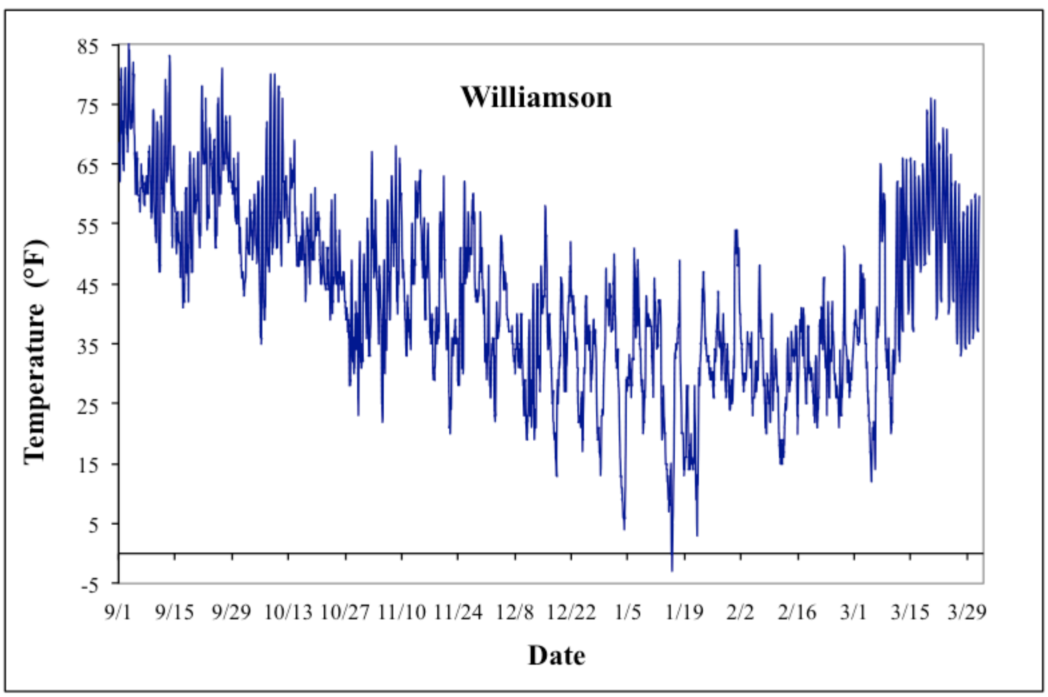

Figure 1. Hourly temperatures at Williamson NY over the fall and winter of 2011/2012 through March 12, 2012 with forecasted temperatures from March 12–March 31, 2012

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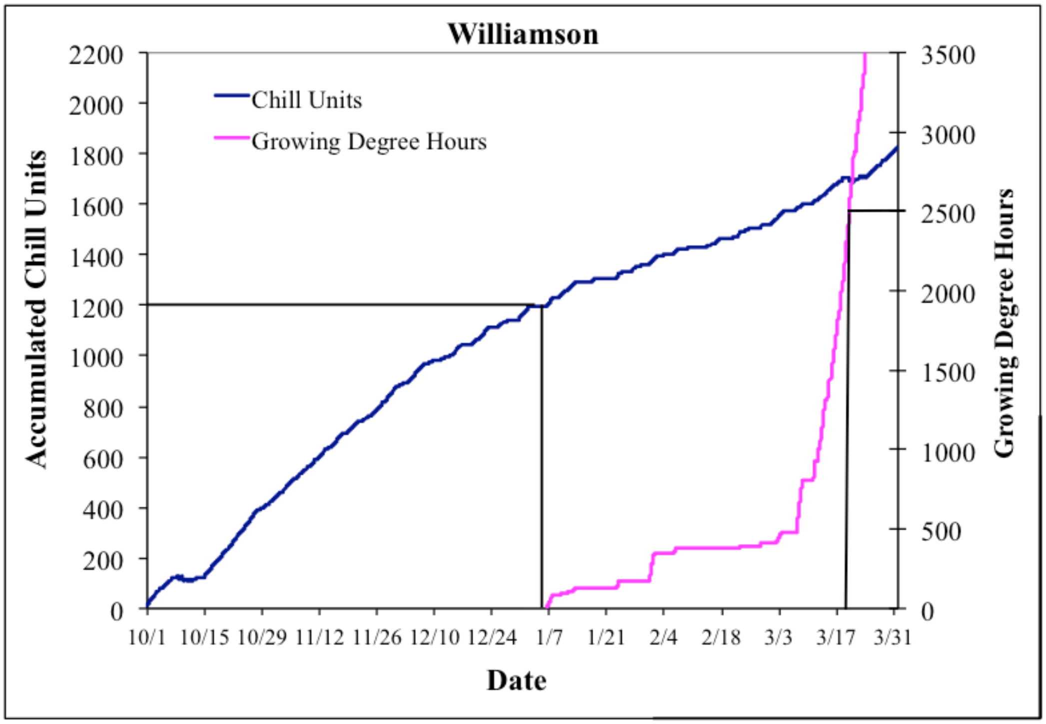
Williamson
Chill Units
Growing Degree Hours
Accumulated Chill Units
Growing Degree Hours
Date
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0
500
1000
1500
2000
2500
3000
3500
10/1
10/15
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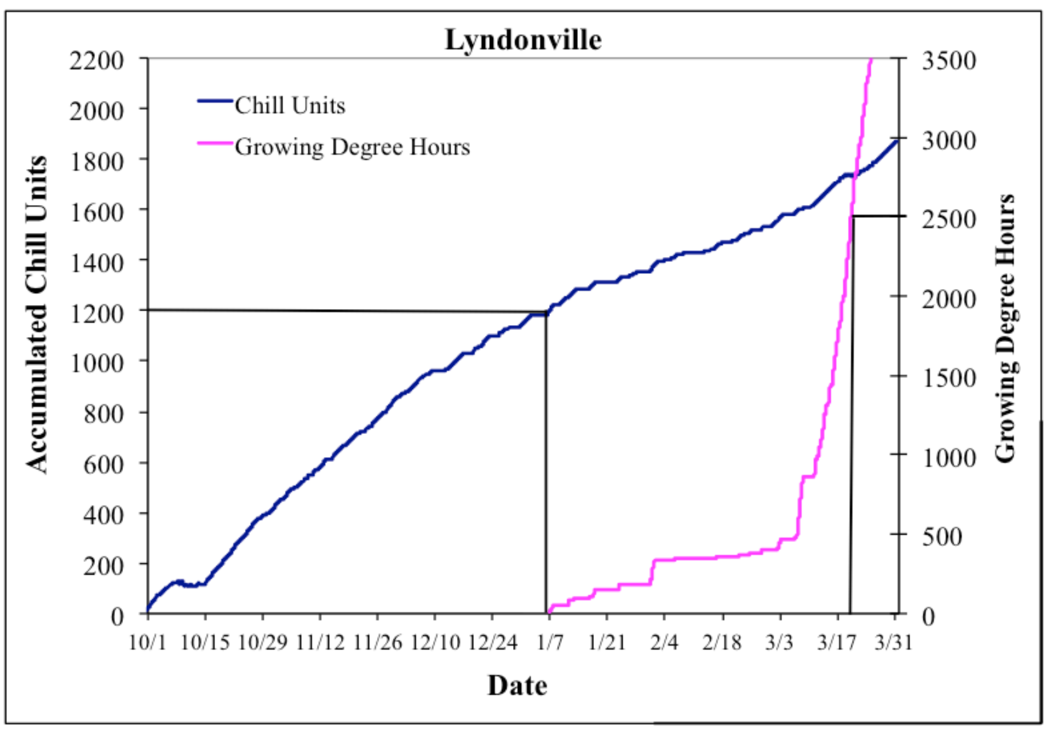
3/3
3/17
3/31


Lyndonville
Chill Units
Growing Degree Hours
Accumulated Chill Units
Growing Degree Hours
Date
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0
500
1000
1500
2000
2500
3000
3500
10/1
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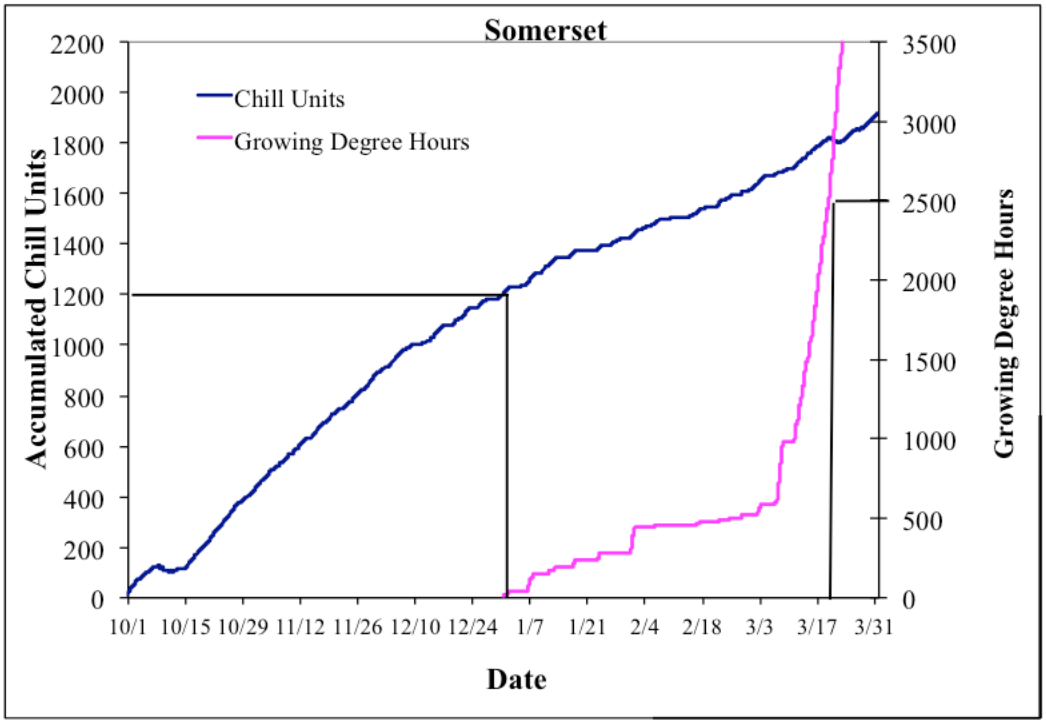

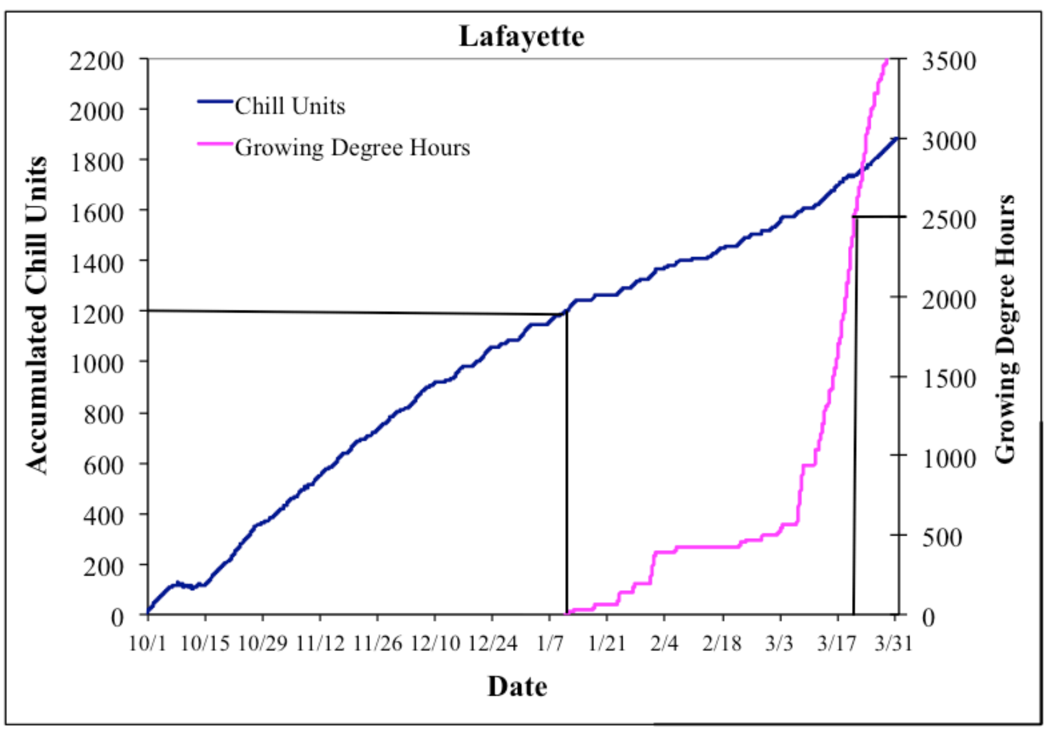

Figure 2. Accumulated chill units after Sept.29, 2011 and accumulated growing degree hours after 1200 chill units at Williamson, Lyndonville, Somerset and Lafayette, NY during the fall and winter of 2011/2012 through March 12, 2012 with forecasted temperatures from March 12–March 31, 2012

PHENOLOGIES

Geneva:
Apple (McIntosh, Red Delicious, Empire): green tip
Pear (Bartlett): swollen bud
Peach: bud burst
Sweet cherry: swollen bud
Plum(early): bud burst
Plum(late): swollen bud

Highland:
Apple (McIntosh): dormant
Apple (Empire, Ginger Gold): green tip
Pear (Bartlett): swollen bud
Apricot (early): white bud
Sweet cherry (Danube, Hudson): green tip

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1–3/19/12):	139	67
(Geneva 1/1–3/19/2011):	38	9
(Geneva "Normal"):	45	14
(Highland 1/1–3/19/12):	156	44
(Highland 1/1–3/19/11):	55	19

Coming Events:	Ranges (Normal ±StDev):	
Green fruitworm 1st catch	60–132	17–59
Green fruitworm peak catch	102–216	39–101
Pear psylla adults active	31–99	8–34
Pear psylla 1st oviposition	40–126	11–53
Redbanded leafroller 1st catch	109–175	39–79
Spotted tentiform leafminer 1st catch	112–206	42–96
Green apple aphid present	111–265	38–134
Rosy apple aphid present	134–244	56–116
European red mite egg hatch	231–337	100–168
Obliquebanded leafroller larvae active	158–314	64–160
Oriental fruit moth 1st catch	224–328	95–165
McIntosh half-inch green	153–199	64–92
McIntosh tight cluster	213–257	93–125

NOTE: Every effort has been made to provide correct, complete and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly, and human errors are possible. These recommendations are not a substitute for pesticide labelling. Please read the label before applying any pesticide.

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