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Update on Pest Management and Crop Development

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

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HORTICULTURE

## SPRING GREEN EYED


PREDICTING GREEN TIP IN 2013 (Terence Robinson and Mario Miranda, Horticulture, Geneva & Cornell Cooperative Extension, Newark; (tlr1@cornell.edu & mrm67@cornell.edu)


**A Review of Dormancy and Winter Bud Development**

❖❖ The physiology of trees during dormancy is highly complex. A simplified explanation of what we understand is as follows.

1. In late summer, growth inhibitors (natural chemicals) build up in fruit buds that 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°F 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

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IN THIS ISSUE…

end of rest is predicted when 1200 chill units have been accumulated. In New York, this usually occurs in late December or early January.

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, although non-visible development inside the closed bud is occuring with each hour of warm temperature. 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 late December or early January, 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 2012/2013**

The winter of 2012/2013 has been quite normal, with numerous days in the fall and early winter with optimum temperatures 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, chill units began to be accumulated in late September (18th) and reached an accumulation of 1200 chill units on Jan. 9, 2013 (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 2013, 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 Eastern NY since the completion of rest in early January show that trees have accumulated only 1138 growing degree hours by April 1 of the 2500 hours needed for green tip (Fig. 1), while in Western NY (Williamson), trees have accumulated only 1190 growing degree hours by April 1 of the 2500 hours needed for green tip (Figure 2). (Recall that last year we had reached the 2500 hour level by March 18 and 22 for ENY and WNY, respectively). This is only about 50% of the 2500 total hours needed to reach green tip. This indicates that we still need a significant number of additional heat units to reach green tip of apple.

**Forecasting Bud Break in the Spring of 2013**

Using forecasts for the next 3 weeks (until April 21), we estimate that green tip in ENY will be on April 13 for early bloom varieties (Idared) and on April 14 for mid-bloom varieties (Delicious), while at Williamson, NY, we forecast green tip on April 16 for early blooming varieties and on April 17 for mid-bloom varieties. The weather forecast indicates that we will slowly accumulate growing degree hours in the next few days and then rapidly accumulate growing degree hours after April 4. We caution that the estimated date of green tip is dependent on the accuracy of the weather forecast we used and the accuracy of the models (which in most cases is quite good). **Our prediction of April 13 in the Hudson Valley and 16 in WNY** should allow growers a little more time to get spraying equipment ready; but we suggest growers be ready to begin fungicide sprays to control scab by April 8. ❖❖

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scaffolds
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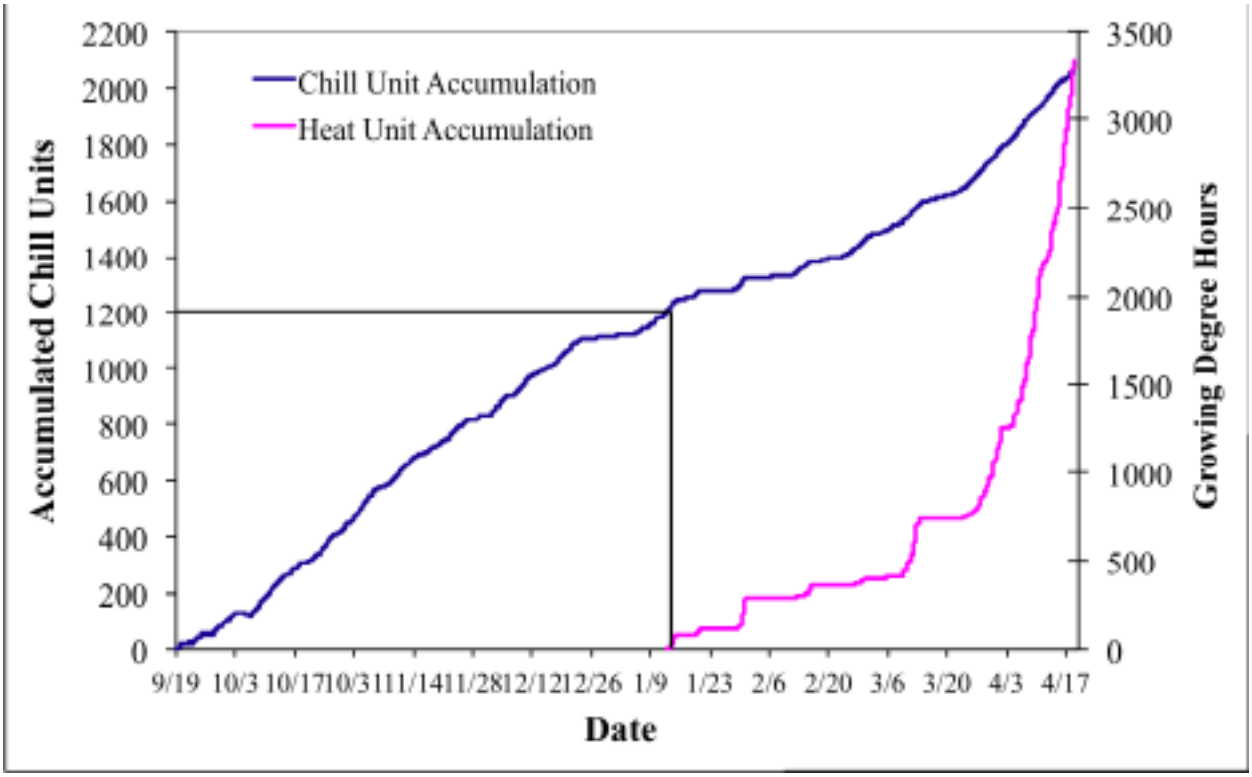


Fig. 1. Accumulated chill units after Sept.18, 2012 (blue line) and accumulated growing degree hours after 1200 chill units (pink line) at **Highland NY** during the fall and winter of 2012/2013 through April 1, 2013 with forecasted temperatures from April 1-April 18, 2013.

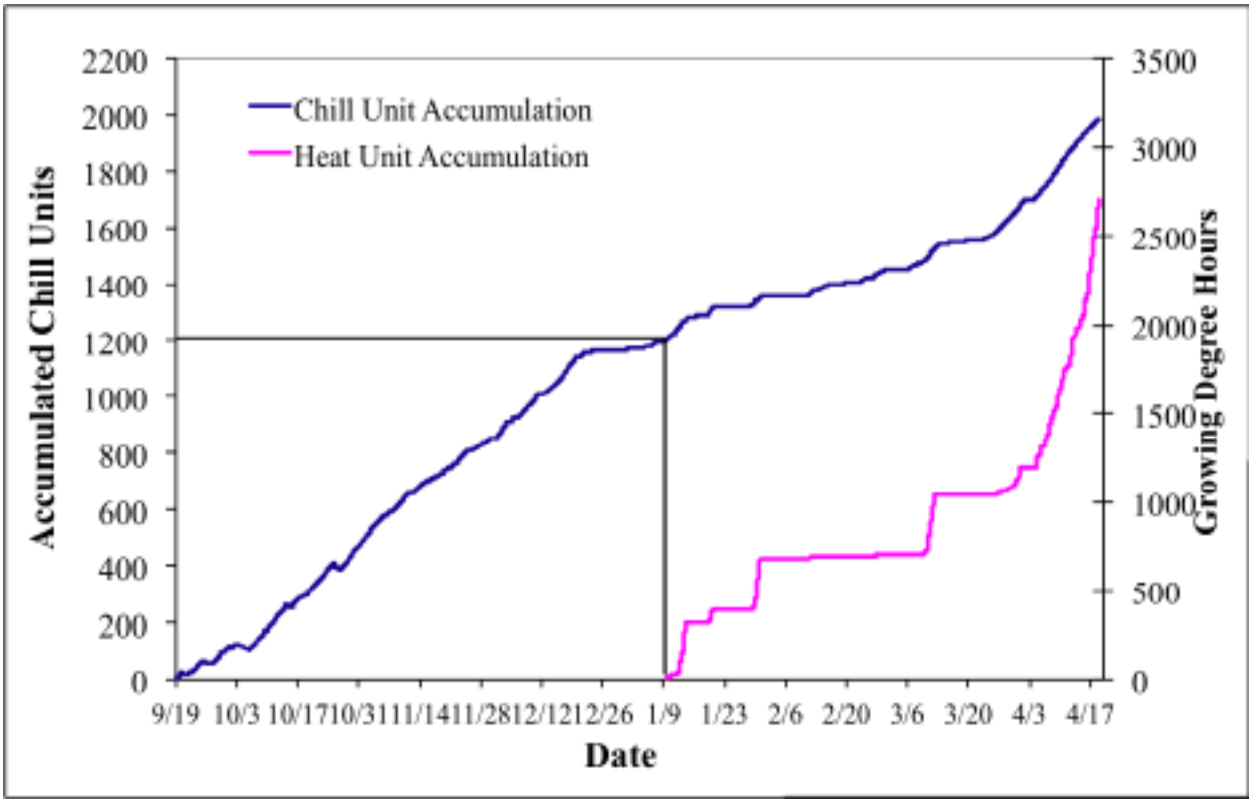


Fig. 2. Accumulated chill units after Sept.18, 2012 (blue line) and accumulated growing degree hours after 1200 chill units (pink line) at **Williamson NY** during the fall and winter of 2012/2013 through April 1, 2013 with forecasted temperatures from April 1-April 18, 2013.

GENERAL INFO

## EXACTLY

# PRECISION APPLE ORCHARD MANAGEMENT AND COMING EDUCATIONAL ACTIVITIES FOR 2013

(Mario Miranda Sazo & Alison DeMarree, Lake Ontario Fruit Team, Newark, mrm67@cornell.edu & amd15@cornell.edu; Terence Robinson & Lailiang Cheng, Horticulture, Geneva and Ithaca; tlr1@cornell.edu & lc89@cornell.edu)

❖❖ We recently conducted an in-depth school on "Precision Apple Orchard Management" with a conference room filled by more than 200 apple growers, researchers, and extension leaders who came from NY, Michigan, Ohio, Pennsylvania, Maine, Vermont, Virginia, Massachusetts, and Ontario, Canada. 110 growers attended from the three main NY production regions. Each of the speakers and participants shared their ideas on where we are and where we should go in apple orchard management in the next 5–10 years. We discussed 10 management areas where greater precision could be achieved with new technologies. For each management area we presented the state of the art in management and new precision orchard management technologies on the horizon.

**What is Precision Agriculture?**

It is a management philosophy that seeks to manage crop production in a precise manner to obtain the best possible economic outcome. Although precision agriculture tactics are more common in grain crops and less common in tree fruit crops, there are gains we can make in apple production by examining precision agriculture concepts within the context of apple orchard management.

**Precision Agriculture with Grain Crops**

Precision agriculture began with grain crops in the 1980s and focused on ways to reduce the variability in grain crop yield across fields with variable soils. The concept was to quantify within-field variation and then modify those areas of the field with low yield separately from the rest of the field to obtain equal crop performance across a field. It has focused primarily on fertilization and seeding practices within a field. The core of precision grain crop agriculture is to measure the variability in soil pH, nutrient levels, water stress, and yield across a field and then apply fertilizers, lime, water or tile to those parts of the field that need it to even out the yield. Key to this effort has been variable rate application of fertilizers. To assist in this effort, new technologies have been implemented to make the job easier. These include on-board computers to process data, GPS guidance of the tractor, mapping of the field for soil characteristics, and tying the map to GPS, GIS data management systems to develop field maps that are tied to GPS locations, and variable rate fertilizer applicators that are computer-controlled using the GIS maps to automatically apply different rates of fertilizer or lime to a field.

**Precision Agriculture with Orchards**

Precision apple orchard management is related to precision grain crop agriculture, but has a broader focus. It has as its central focus maximizing orchard profitability and it views each orchard management practice through the lens of the impact of this practice on orchard profitability. Fruit crops involve substantially more management of the crop than do grain crops. These additional crop management efforts include canopy management (pruning and training), crop load management (thinning), fruit quality management (light distribution within the canopy) and fruit maturity management (harvest maturity management). This requires a broader definition of precision orchard management than the traditional precision grain crop management of soil fertility, pest and weed control, water and yield.

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We have identified 10 orchard management practices that could lend themselves to more precise management, which could improve profitability. They include:

1) crop load management
2) nutrient management
3) water management
4) weed management
5) orchard design
6) labor management
7) risk management
8) disease management
9) insect management, and
10) harvest management

In every one of these 10 management areas, there has already been significant progress in the last 50 years with greater precision of management. This has made managing apple orchards quite complex. However, there are new methods being developed to improve the precision of management in each of the 10 areas that could impart significant financial benefits to apple growers.

With precision orchard management, some management strategies may be focused on the whole farm as the management unit, with other strategies for the individual field and others for one variety in a field, and even some management strategies that may focus on a small homogeneous land area within a field (traditional management unit).

**Economics and Precision Orchard Management**

The basic principle of precision agriculture is to measure something and acquire data and then make a management decision based on the data. Some things, which must be measured to increase precision, can be done with little effort by the grower, but other things will require significant effort by the grower. However, to implement precision orchard management practices on WNY farms, someone will have to do more than what we are currently doing. There will be a cost. Nothing is free. Some apple growers will prefer to avoid the complexity of more precise management and can continue to successfully produce a crop with low management precision; however, other growers will desire to manage their crop more precisely to reduce risk or capture greater profits.

To successfully choose where to place one's management efforts in precision orchard management, the question each grower must ask is: "Which precision orchard management strategy will add significantly to the profitability of the orchard?". There are some new technologies that are being developed that may not help improve profitability. If the new technology we want to adopt doesn't make us money, it must be considered a toy. Some technologies are fads or are just cool, but in the end don't improve the bottom line. Investment in toys is OK if a grower recognizes that they make the investment for fun, not for profit.

A related concept is the question of what income are we losing or not capturing by not managing our crop more precisely. Each grower should ask himself: "How much money are you leaving on the table, and can precision orchard management help you capture that money?

**Precision Orchard Management Extension Meetings for 2013**

As a follow up to the in-depth school, we would like to conduct a series of "Precision Orchard Management" field workshops this year. In addition to the traditional Petal Fall Thinning meetings conducted every year, we would like to invite you to attend 4 new educational meetings planned for the 2013 growing season:

• Precision Nutrient Management - Field meeting activity for all WNY fruit growers and consultants during April (location and time to be announced in an upcoming LOF newsletter)

• Precision Chemical Thinning Training class (offered in Geneva during late April) for all consultants and WNY growers interested in implementing the "Precision Thinning" approach. This is

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an improved method of conducting chemical thinning that utilizes both the carbohydrate model as a tool for predicting response prior to application of chemical thinners, and the fruit growth rate model for early assessment of thinning response immediately after application.

• Precision Hand Thinning and Irrigation Field meeting activity for all WNY fruit growers and consultants during mid-June (location and time to be announced in an up-coming LOF newsletter)

• Precision Harvest Management - Field meeting activity for all WNY fruit growers and consultants during late August (location and time to be announced in an upcoming LOF newsletter)

**On-Farm Visits in 2013**

Lastly, Mario is available to visit one-on-one with any WNY fruit grower who would like him to visit their farm to discuss these or other orchard management topics. Call for an appointment. Good luck this 2013 fruit growing season.

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## PHENOLOGIES

Geneva: All dormant.

Highland:
Apple: dormant
Pear (Bartlett/Bosc): swollen bud

## INSECT TRAP CATCHES (Number/Trap/Day)

**Geneva, NY**

| | 4/1 |
|---|---|
| Green fruitworm | 0 |
| Redbanded leafroller | 0 |
| Spotted tentiform leafminer | 0 |

**Highland, NY**

| | 4/1 |
|---|---|
| Green fruitworm | 1.6* |
| Redbanded leafroller | 0.5* |
| Spotted tentiform leafminer | 1.3* |

* first catch

## UPCOMING PEST EVENTS

| | 43°F | 50°F |
|---|---|---|
| Current DD accumulations (Geneva 1/1–4/1/13): | 39 | 8 |
| (Geneva 1/1–4/1/2012): | 259 | 138 |
| (Geneva "Normal"): | 84 | 33 |
| (Geneva 1/1–4/8 predicted): | 51 | 9 |
| (Highland 1/1–4/1/13): | 55 | 12 |

| Coming Events: | Ranges (Normal ±StDev): | |
|---|---|---|
| Green fruitworm 1st catch | 52–154 | 13–71 |
| 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 |

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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