Northern Michigan FruitNet 2016
Northwest Michigan Horticultural Research Center

Weekly Update

FruitNet Report – May 24, 2016

CALENDAR OF EVENTS

5/3 – 6/28	**Leelanau County IPM Updates, 12PM – 2PM** Jim and Jan Bardenhagen's Farm (details below)
5/3 – 6/28	**Grand Traverse County IPM Updates, 3PM – 5PM** Wunsch Farms (details below)
5/4 – 6/29	**Antrim County IPM Updates, 10AM – 12PM** Jack White Farms (details below)
5/4 – 6/29	**Benzie County IPM Updates, 2PM – 4PM** Blaine Christian Church (details below

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What's New?

- **Northwest Michigan Regional Report – May 24, 2016**
- **A Primer for Streptomycin, Kasumin, and Oxytetracycline use for Fire Blight Management (*repeated, just in case*)**
- **Apogee Application Time**
- **Understanding the Carbohydrate Model for Thinning**
- **Effectively controlling plum curculio in stone and pome fruits**
- **Food Security Program**

Northwest Michigan Fruit Regional Report – May 24, 2016

Apples are in bloom, and conditions favor fire blight this week; growers are also applying plant growth regulators at this time.

Nikki Rothwell and Emily Pochubay

Weather Report

Warmer temperatures are finally hitting the north region. The weather was beautiful over the weekend and perfect for pollination: sunny and warm. Warm weather is predicted to continue this week, and on Monday, we hit a high of 81 degrees F. At the NWMHRC, we have accumulated 457GDD base 42 and 204GDD base 50.

Rain is predicted for many days this week. Conditions have been extremely dry across the north. The last rainfall event was 13 May, and at that time, no station recorded above 0.5" of rain. These dry conditions have been good in terms of the lack of disease development, but the region could use the rain. There is variability among weather forecasts, but some percentage of rain is predicted for Wednesday, Thursday, Friday, Saturday, and Sunday at this time. Growers are planning to cover up prior to these rain events.

Crop Report

Most sweet cherries are finished with bloom, and tart cherry bloom is also starting to wane. Apple bloom varies throughout the region and by variety. We expect to move quickly through apple bloom with the predicted warm weather. Bee activity was good over the weekend, and we anticipate good pollination for trees that were in bloom.

With the predicted warm temperatures, apple bloom may be over quickly this year. Growers should be sure to use the plant growth regulator (PGR), Apogee, particularly on fire blight sensitive varieties. The EIP will be high this week with rain in the forecast, which are optimal for fire blight. Under these conditions, the use of Apogee is even more important as this PGR is a growth inhibitor that provides excellent control of shoot blight. The first timing for an Apogee spray is around king bloom petal fall when there is less than 3" of new shoot growth. This timing coincides with the beginning period of rapid shoot growth of the tree. However, in some years, shoot growth is accelerated around the king bloom petal fall timing. In this case, when Apogee is applied to trees that have shoot growth longer than 3", it does not work as well. Growers should pay particular attention to the timing of Apogee to ensure they obtain maximum effectiveness from the Apogee applications. Please refer to the Apogee Application Time article in Tuesday's (24 May) FruitNet.

Some growers are starting to think about thinning apples, particularly if they are using the nibble thinning approach. According to the carbohydrate model (Figure 1), we are entering a time of stress in the coming days with warm and cloudy days in the forecast; these are conditions where thinners will work better than under cold and sunny conditions when the trees have a surplus of energy. Growers should try to thin at this time, especially if they are at petal fall, which is a less sensitive time to thin and the deficit will benefit this thinning timing. Conditions during and after the thinner applications will influence the activity of the thinners. Growers will likely have good results from thinning early under these deficit conditions. We are recommending that growers consider mild to normal rates of thinners under these conditions. On an additional note, we have had droughty conditions across the region, and trees that are stressed from drought may thin easier than trees with adequate water. However, we are expecting significant rainfall this week, so trees will not likely be stressed from drought for much longer, if the weather forecasts are correct.

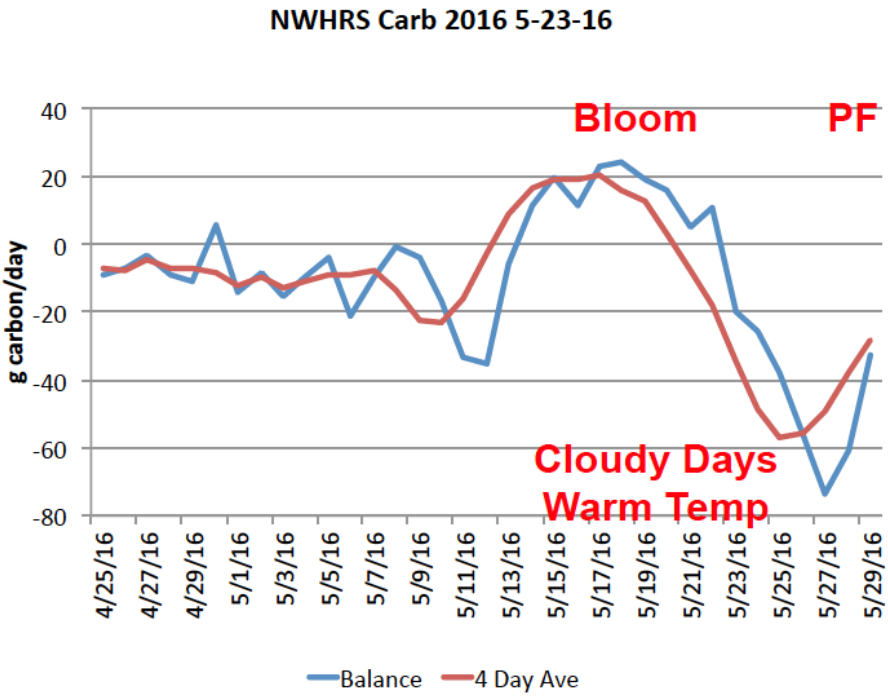


Figure 1. Carbohydrate model for the NW Station for May 20, 2016.

Pest Report

Thus far this season, the region has been fortunate to have conditions that are not conducive for cherry leaf spot and apple scab infections. Earlier spring conditions were cooler and not favorable for American brown rot during sweet cherry bloom. Although some areas had cool and wet conditions that favor for European brown rot infections in tart cherries, most growers were covered and protected for European brown rot.

Many cherry orchards are at petal fall, and early sweet cherries are starting to come out of the shuck. In anticipation of rain this week, growers are covering for cherry leaf spot. Prior to shuck split, chlorothalonil is an excellent early season material for leaf spot control. Good coverage will be critical as the leaf spot ascospores have had ample time to develop in recent dry and warm weather, and the region could have several warm days with rain this week—ideal conditions for leaf spot development. Some of the early season's rain events did not trigger leaf spot infections because conditions dried quickly and temperatures were cool; however, leaf spot infection periods will progress much quicker with the warm temperatures this week. Chlorothalonil has excellent leaf spot efficacy, but reapplication of a fungicide may be needed if there are several days of rain. Chlorothalonil is not a systemic fungicide, so if we have multiple days of rain or a single rainfall event over ~1", we recommend coming back in with another fungicide. Captan is also rated excellent for leaf spot and is recommended if a fungicide is needed before the 10-d retreatment interval of chlorothalonil is met.

The coming rain will also be a concern in apples for possible fire blight and apple scab infections. The Enviroweather fire blight of apple blossoms model is currently reporting high potential for fire blight infection for all weather stations in the region, and most growers have applied or will apply a bactericide prior to the predicted rain. Due to the warm and wet conditions that are predicted, apple growers need to be actively managing fire blight at this time. The output for Northport currently shows an EIP of 73 and although this EIP does not exceed 100, there is a high potential for infection if apples are in bloom. Therefore, growers in northerly Leelanau County should also apply a bactericide to susceptible and high value varieties, and in orchards with a history of fire blight. Applications made Mon-Tues this week will provide up to three days of control. Because conditions will continue to be warm, fire blight bacteria will grow rapidly; hence, if conditions later in the week are favorable for fire blight infection, growers may need to reapply a bactericide. Some orchards could also be approaching the timing (1-3" of new shoot growth) for application of the plant growth regulator Apogee, an effective tool for that inhibits shoot growth and also prevents shoot blight by thickening cell walls to stop the movement of fire blight bacteria through plant cells. The MSU Extension Michigan Fruit Management Guide 2016 also contains information on Apogee use on page 257.

Primary apple scab season is ongoing, and mature spores will readily discharge in the coming rain. The NWMHRC biofix for primary apple scab is April 17th, and at this time the station is at 91% spore maturity and 60% discharge. The model is currently predicting 100% maturity and 81% discharge by 29 May; hence, primary season will continue into June and possibly end by early to mid June. There has been substantial growth since the region's last rainfall, and this new tissue will need to be covered prior to rain. As mentioned previously for cherry leaf spot, many apple scab spores are mature and will be discharged, and good coverage will be critical especially if conditions are wet for several consecutive days. The SDHI fungicides have very good to excellent efficacy against apple scab, and they are the best available fungicides for scab control.

Aprovia is a newly registered SDHI and like Fontelis, it is a single chemistry fungicide; Luna Tranquility and Merivon are premix fungicides. These SDHI fungicides also provide powdery mildew control. We remind growers to use the maximum label rate for SDHI fungicides and to tank mix with a protectant for all fungicides that are at risk of resistance development. A maximum of two applications of an SDHI per season is recommended to preserve the longevity of these materials for scab control. The SI fungicides Indar and Inspire Super have good efficacy against scab, and tank mixing these materials with a protectant is also recommended.

This is the third week of American plum borer moth activity, and we found an average of 12 moths per trap in cherries. Lesser peachtree borer activity has not been detected at this time; lesser peachtree borers could begin flying later this week. Larval activity of leafrollers and green fruit worm is ongoing. We remind growers that the diamide insecticides Belt, Altacor, and Exirel are rated excellent against the larvae of obliquebanded leafroller (OBLR), codling moth, and oriental fruit moth; Delegate also has excellent efficacy for OBLR. In the case of insects that have multiple generations per year, OBLR and codling moth, it is recommend that different modes of action are use for the first and second generations to minimize the potential of resistance development. Anecdotal evidence suggests that Belt works better early for targeting the overwintering OBLR larvae at the petal fall timing rather than for second-generation larvae that come out at or near harvest time.

In apples, a total of two oriental fruit moth were found in traps at the station this week; this was the NWMHRC's first detection of oriental fruit moth this season. We have not detected codling moth at the station; but the first codling moth in the region was detected late last week and we are continuing to receive reports of activity in known hot spots. Spotted tentiform leafminer moth activity is ongoing, and trap numbers remain low (~20 moths per trap); control of spotted tentiform leafminer larvae is often achieved with materials that are commonly used for other key apple insect pests around petal fall timing.

We have not observed plum curculio activity at this time, and we expect that these beetles will show up in orchards soon as small cherry fruit are beginning to come out of the shuck and nighttime temperatures are above 60 degrees F. Some growers are planning to apply an insecticide for plum curculio within the next 5-7 and/or following rain this week. Growers with fruit at susceptible/exposed growth stages should protect fruit from plum curculio oviposition.

Wine Grapes
Duke Elsner, MSU Extension

All of the varieties in the research center vineyard are now at bud burst through 3 inch shoot stage, and the warm weather ahead will push some rapid growth. The rains

predicted for later this week will likely result in the first significant infection period for powdery mildew on *vinifera* cultivars and a few hybrids that are somewhat susceptible. Getting on a protectant spray for powdery mildew, especially in vineyards that had a significant infection in 2015, is advised. For growers with some of the table grape varieties that are prone to phomopsis, these rains could also start the season for that disease and a protectant spray is in order. No significant pest insect activity was noted this week.

Saskatoons
Duke Elsner, MSU Extension

Most sites are in petal fall. Insect activity has really picked up due to recent warm weather. Sweep net samples at the research center planting caught saskatoon sawflies (lower numbers than last week), apple curculio (first detection this year), tarnished plant bug, leaf-feeding weevils and several types of small moth caterpillars. There were also many beneficials in the sampling—spiders and parasitoid wasps. Unfortunately the threat of fruit losses from sawflies and curculios outweigh the current value of the beneficials, so it is advisable to protect the fruit with an insecticide at this time. It is also time to start protecting fruits from rust and entomosporium spot disease, especially with the threat of rain later this week.

A primer for Streptomycin, Kasumin, and Oxytetracycline use for fire blight management

George Sundin, MSU Extension, Dept. Plant, Soil, and Microbial Sciences

The apple or pear flower is a critical site for multiplication of the fire blight pathogen *Erwinia amylovora*. When temperatures are conducive for growth (70s to low 80s optimal), *E. amylovora* populations can grow to one million cells per flower within one to two days. As these populations grow, remember they will also be very quickly disseminated among flowers by pollinators. Thus, warm and sunny days during bloom can very quickly lead to high percentages of flowers colonized with incredibly large fire blight populations.

The fire blight pathogen only grows well on flower stigmas, not on other flower parts. These bacteria do not need rain to grow on the stigma. They do, however, require free moisture, as little as 0.01 inch rain, to move from the stigma tip down the outside of the style to the base of the flower where infection occurs through the nectaries. Blossom blight infection can really kick start a fire blight epidemic because these infected flower clusters will ooze more inoculum out and bacteria will be spreading internally through the tree.

With the full registration of Kasumin by the Environmental Protection Agency (EPA) last fall, we now have three antibiotics available for fire blight management during bloom. Below is information about these antibiotics and suggestions for best use. These suggestions will differ based on the occurrence of streptomycin resistance in the fire blight pathogen in your orchard or region.

Streptomycin

Streptomycin is an **excellent** fire blight material and provides forward control for two to four days prior to rain events and will be effective for blossom blight control if applied within 12-24 hours after a rain event. Streptomycin is used at a rate of 24 ounces per acre and should be applied with a non-ionic surfactant such as Regulaid (1 pint per 100 gallons). The use of the surfactant enhances deposition of the antibiotic on flowers and increases the chances that the critical stigma targets will be hit.

Note: If streptomycin is reapplied within three to four days after a previous application, Regulaid can be omitted to avoid phytotoxicity – usually viewed as yellowing of leaf margins. Streptomycin is partially systemic and can reach fire blight bacteria that have entered flower nectaries.

Kasumin

Kasugamycin is an antibiotic related to streptomycin. There is no cross-resistance between Kasumin and streptomycin as Kasumin controls streptomycin-resistant strains of *E. amylovora*.

Kasumin is an **excellent** fire blight material and provides forward control for two to four days prior to rain events and will be effective for blossom blight control if applied within 12 hours after a rain event. Kasumin is used at a rate of 2 quarts (64 fluid ounces) per acre in 100 gallons of water per acre and should be applied with a non-ionic surfactant such as Regulaid (1 pint per 100 gallons). Read the Kasumin label carefully as there are some specifications, including:

- Do not apply Kasumin in orchards in which the soil has been fertilized with animal manure.
- Do not apply after petal fall.
- Do not use alternate row applications.

The main difference between Kasumin and streptomycin is that Kasumin is not partially systemic like streptomycin is. Thus, Kasumin will not penetrate into the nectaries and will not be able to control an infection once the fire blight pathogen reaches the nectaries.

Oxytetracycline

Oxytetracycline is a **good** fire blight material and should be applied within one day prior to a rain event for best results. Oxytetracycline is bacteriostatic and does not kill fire

blight bacteria, it only inhibits their growth. Thus, it has to be applied prior to rains where it can prevent growth on stigmas, but it can't eliminate existing populations. Oxytetracycline is also highly sensitive to degradation by sunlight and much of the activity is lost within one to two days after application. Oxytracycline is best used as a 200 ppm solution (1 pound per 100 gallons) and should be applied with a non-ionic surfactant such as Regulaid (1 pint per 100 gallons). Per the label, a maximum of 1.5 pounds per acre can be applied, using 150 gallons water in this case.

Two slightly different formulations of oxytetracycline are sold: Mycoshield (OxyTc-calcium complex) and FireLine (OxyTc-hydrochloride). The FireLine formulation is a bit more soluble than Mycoshield and has performed slightly better for blossom blight control in head-to-head comparisons.

Antibiotic use for blossom blight management

Fire blight predictive models such as MaryBlyt or Cougar Blight should be used as guides for timing management decisions. The output of the MaryBlyt model, for example, is the epiphytic infection potential (EIP) number, which is an estimator of the risk of blossom blight infection. The higher the number, the larger the infection risk. I would place forecasted EIP numbers into four categories of risk:

1. Low to moderate ($50 < EIP < 75$)
2. Moderate to high ($75 < EIP < 100$)
3. High ($EIP > 100$)
4. Epidemic potential ($EIP > 200$)

When the infection risk is moderate to high, high or of epidemic potential, only streptomycin or Kasumin can be expected to provide adequate blossom blight control. These two antibiotics provide the best blossom blight control and also reduce or eliminate most of the fire blight inoculum from flowers. During these types of high-risk conditions, the spray interval for streptomycin or Kasumin is usually predicated by the occurrence of rainfall. Very high EIPs (greater 200) also necessitate additional antibiotic applications at shorter intervals. Finally, remember the overall risk increases as bloom progresses as the fire blight pathogen is building up populations on flowers over time. In addition, the more open flowers there are increases fire blight risk, provides more sites for pathogen growth and increases the number of unprotected flowers (flowers opening since the last spray).

Firstly, when the EIP is high (greater than 100) but conditions are dry for several days, remember inoculum is building up rapidly on flower stigmas. Growers should apply streptomycin or Kasumin strategically in the middle of a period such as this to reduce inoculum potential. The outcome of enabling several days of population buildup by doing nothing will make blossom blight much more difficult to control if rain events follow. Controlling diseases under high inoculum situations is always more difficult than controlling diseases in a lower inoculum situation.

When the EIP is high and rain events are forecasted, the application of streptomycin or Kasumin would be best about 24 hours before the rain event and then followed up about one to two days after the rain event. Subsequent spray applications will be based on current and future conditions. For example, if temperatures cool significantly and EIPs are reduced to low to moderate risk values, sprays can be held off. If EIPs remain high, a third application should be made within two to four days based on the occurrence of wet or dry conditions.

Oxytetracycline is best used when the infection risk is low to moderate (EIP less than 75). Under warmer conditions when *E. amylovora* is capable of very rapid growth on flower stigmas, oxytetracycline can be overwhelmed by the pathogen and fail to provide adequate control. In addition, the incidence of shoot blight infection is typically higher in oxytetracycline-treated trees compared to streptomycin- or Kasumin-treated trees because the innate activity of this antibiotic is the lowest of the three and its effect on inoculum reduction is the lowest.

In the absence of streptomycin resistance, streptomycin is the best choice for fire blight management. While the effectiveness of streptomycin and Kasumin are essentially equivalent in the inoculated blossom blight control tests that I have conducted over a seven-year period, the partial systemic nature of streptomycin gives it an advantage in that it can reach internal populations of *E. amylovora* that Kasumin cannot. Streptomycin is also significantly cheaper than Kasumin. Long-term evidence from around the Midwest and eastern United States suggests that if streptomycin use is limited to a maximum of three to four applications per season, and only used during the bloom period, then the chances of streptomycin resistance development are very low.

The main risk factor for streptomycin resistance development is an increased number of applications per season above four and regular use during the summer for shoot blight control. This use pattern increases the chances of mutation of the fire blight pathogen to streptomycin resistance or acquisition of a streptomycin-resistance gene from the indigenous microflora in orchards.
A resistance management strategy for streptomycin can be used; the best strategy would be to alternate applications of streptomycin and Kasumin. Michigan State University Extension advises that a tank-mix strategy of using streptomycin and oxytetracycline is not a resistance management strategy. Since the oxytetracycline is not killing bacterial cells, it would not kill any streptomycin-resistant cells that might arise; it would only temporarily prevent their growth.

In streptomycin-resistance situations, Kasumin is the antibiotic of choice and is best used in advance of moderate to high risk conditions. This is because where we have detected streptomycin resistance in orchards in Michigan, the incidence of resistant bacterial pathogen strains is usually very high to 100 percent. Thus, streptomycin should not be used in these situations because it will have no effect on the pathogen. If the

disease risk is low to moderate, oxytetracycline is also an effective substitute for streptomycin in orchards where streptomycin resistance occurs.

Summary of antibiotic use for fire blight management
The target of antibiotic sprays for fire blight control is the stigma surface, style and base of the flower. Adding a non-ionic surfactant such as Regulaid to antibiotic sprays increases the chances of deposition on target surfaces. The best timing for all antibiotics is to arrive prior to the arrival of fire blight bacteria because these arriving populations are typically small and can be readily controlled if the antibiotic is already present. However, streptomycin and Kasumin can be used effectively after *E. amylovora* cells have arrived and started growing on stigmas. When EIPs predict potential high risk to epidemic conditions, only streptomycin or Kasumin will be effective for blossom blight control. Under these conditions, the two most important considerations are very tight spray intervals and excellent spray coverage.

Apogee Application Time

Nikki Rothwell, NWMHRC
Phil Schwallier, MSUE

Apogee® is a plant growth regulator composed of prohexadione-calcium that can be used in apples with significant advantages to the grower. Prohexidione-calcium reduces terminal growth by inhibiting important enzymes that help form growth-specific gibberellins. In laymen's terms, Apogee helps control tree vigor. Controlling vigor can reduce the amount/intensity of pruning, decrease internal shading--a major proponent to properly color apples, and reduce canopy density for thorough pesticide coverage. This product has also been a reliable tool for minimizing impacts of shoot blight caused by the fire blight pathogen, *Erwinia amylovora*. Shoots that have less growth are not as susceptible to fire blight, and Dr. George Sundin's work has shown that Apogee greatly reduces the potential for shoot blight. When applying Apogee to apples, growers should consider the following: timing, rate per acre, and compatibility with other chemistries in the tank.

Timing
Apogee should be applied when vegetative shoot growth is less than three inches. To best time the application, there is a 7 to 10-day window beginning at king bloom petal fall. In recent years, we are recommending that growers apply slightly earlier than petal fall as most growers miss that king bloom petal fall timing and if there is more than three inches of growth, Apogee will not work as well. Growers should try and time these applications for less than 3" of shoot growth, which in many years coincides with king bloom petal fall. This timing applies to most varieties in most years. Two more applications should be made at two-week intervals following the bloom application.

Sometimes a fourth application is needed when excessive rainfall or light crops increase vegetative growth.

Rate

The rate per acre is usually calculated on a tree row volume basis and can be adjusted to two-thirds of the full-rate. This suggested two-thirds rate per acre is a season-long rate. For example, if trees are at 75% tree row volume, then 24 ounces per acre is the seasonal rate (48 * 0.75 * 2/3). Best results are achieved when the seasonal rate is split into three or four sprays. For example, Apogee applications should be applied at 8 + 8 + 8oz per acre for a total of 24oz per acre per season. When the fire blight risk is high, the first application of Apogee at or prior to king bloom petal fall timing should be increased to as much as 150 percent of the split rate. For example, the rate should be increased from 8oz per acre to 12oz per acre. If the first spray rate is increased, subsequent sprays (second and third sprays) should be reduced. The seasonal application would be 12 + 6 + 6 = 24 ounces per season instead of 8+8+8=24oz. If temperatures continue to remain high with the potential for rainfall for many days this coming week, a higher rate of Apogee is recommended as the EIP for fire blight is high at all sites across NW Michigan.

Compatibility

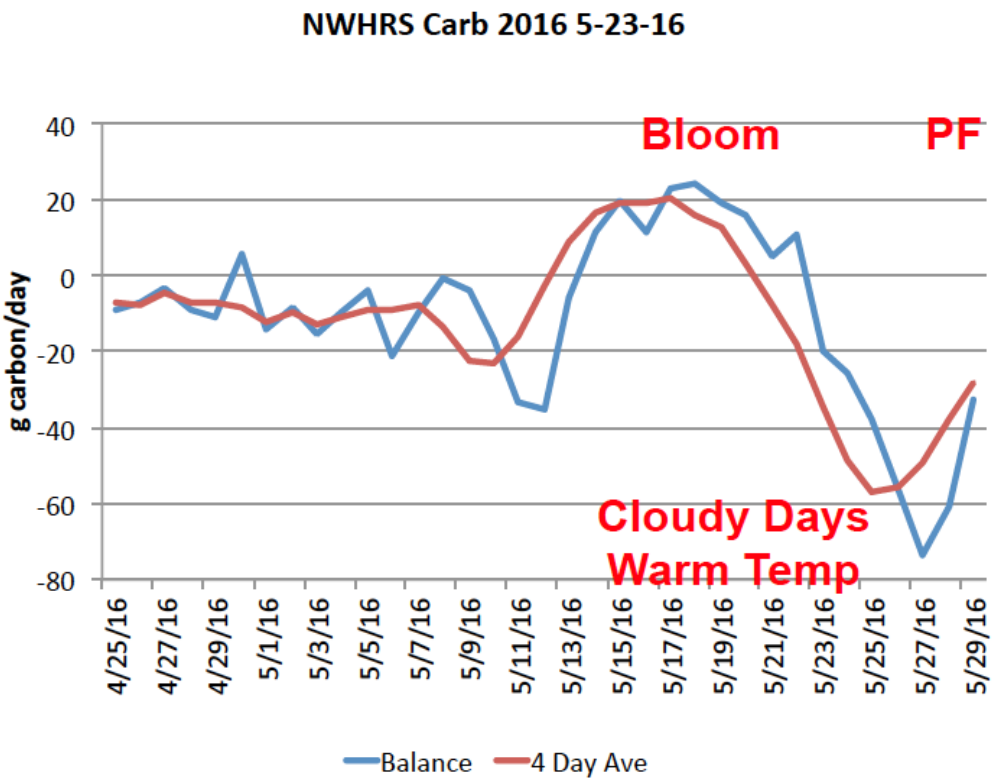
Apogee is not compatible with calcium or boron in the tank. We also recommend that Apogee be applied after the thinner application. If the two-week timing interval is also the ideal time to thin, make the thinning application first and follow with Apogee a few days later. Growers should read the Apogee label carefully. Apogee must be used with an organosilicone surfactant, and an equal weight of spray grade ammonium sulfate should be applied. Do not use Apogee on 'Empire,' 'Stayman,' or 'Winesap' because of the potential for fruit cracking.

To conclude, Apogee is an excellent tool to help control vegetative growth, which decreases the need for summer pruning and can suppress the spread of fire blight among shoots and within shoots. The above recommendations are the best way to maximize the use of Apogee.

Understanding the Carbohydrate Model for Thinning

Fruitlets need energy to grow, survive, and set. The carbohydrate model predicts the grams of carbon/tree unit that are available to the tree for fruitlets and vegetative growth. A deficit of energy (carbohydrates) causes stress in the tree. When apple trees are under stress they are more sensitive to naturally drop fruitlets. In the same sense, stressed trees also respond more to chemical thinning applications. We have been using the carbohydrate model as a thinning guide for many years in Michigan with good success. The model is not a silver bullet, but it is intended to provide forecasted weather data that will help growers make decisions on timing and rates of thinners.

At the time of thinning, which with precision thinning can begin as soon as bloom, we like to see 2-3 days in a row that have stress to optimize thinner applications. A single day of deficit is not important as the trees can probably buffer that deficit. We need 2 or 3 days of deficits of carbohydrates to obtain the stress effects, and thinners will work when we have a deficit of carbohydrates, which is -10 to -40g carbon/day. The more of a deficit in carbohydrates, the more thinning activity growers will obtain from their thinning applications. A surplus of energy (carbohydrates) will strengthen fruitlets, and they will resist thinning. Traditionally, our region likely has hard-to-thin situations in most years because we have cold, sunny conditions, which creates a surplus of energy, and the trees resist thinning.



We are at full bloom at the NWMHRC on 23 May. If we thin at petal fall (~May 25), we have a -30 to -40 level of stress, and we will have moderate thinning at that time. If we were at a more sensitive thinning window, 8-10mm fruit, thinners should work well during this time but because the trees are in a deficit, the thinners will probably work too well. In this case, we would recommend reducing the rates of the thinners.

This model can help us understand what will happen if we have 2-3 day deficit and the different timings when thinners are applied. We need to be careful at 10 to 15mm when a deficit of -60 or lower occurs. Our choices are to back off rates or delay thinning. However, if a -80 g carbon/day occurs at petal fall and you thin, you may get the job done perfectly.

Here is a rule of thumb guide based on Phil Schwallier's work with the carbohydrate model:

If we have 3 days of stress, then the following natural drop may happen at the 10-15 mm stage:

Stress Level	Amt. of Thinning
-20	2%
-40	15%
-60	25%
-80	40%
-100	80%

Guide for time of thinning application of aggressive combinations (i.e. Sevin+NAA or Sevin+MaxCel): Thinning Percent at Different Time During Season and Stress Levels:

	0	-20	-40	-60	-80	-100
Petal Fall	0%	10%	15%	25%	35%	50%
6 mm	5%	20%	30%	40%	50%	60%
10mm	15%	30%	40%	50%	60%	80%
15 mm	15%	30%	40%	50%	60%	80%
20 mm	10%	20%	30%	40%	45%	50%
25 mm	3%	10%	15%	20%	30%	35%
30 mm	0%	0%	2%	5%	10%	15%

MaluSim Carb Model Thinning Decision Guide.

Stress Level	4 Day Ave Carb Balance	Thinning Rate Recommendation	Example for Gala
No	> 0	Increase Rate by 30%	S+M 150 ppm
Slight	-20 to 0	Use Standard Rate	S+M 100 ppm
Mild	-40 to -20	Reduce Rate by 15%	S+M 100 ppm
Moderate	-60 to -40	Reduce Rate by 30%	S+M 50 ppm
Severe	-80 to -60	Reduce Rate by 50%	S or M 150 ppm
Extreme	<-80	Do not thin, many fruits will fall off	

To conclude, this model is a tool that can help guide thinning strategies and thinner applications. We are in the process of trying to put the carbohydrate model onto Enviroweather.

Effectively controlling plum curculio in stone and pome fruits

Emily Pochubay, Nikki Rothwell, John Wise, and Mark Whalon

This modified article was originally published by J. Wise, N. Rothwell, and M. Whalon on MSUE News May 26, 2015.

Plum curculio (PC) is a key early season pest on pome and stone fruits. There are many insecticides available for plum curculio control, but their performance characteristics vary greatly compared to our traditional broad-spectrum chemistries. Although we have not yet detected plum curculio (PC) this season, most of the region has accumulated >150 growing degree-days base 50ºF, and PC are likely active at this time. Small apricot fruit are exposed in some orchards, and growers have covered these fruit to protect them from PC oviposition. The PC female makes a crescent-shaped wound on the flesh of developing fruit and oviposits an egg into the scar. White larvae with a dark head capsule hatch from eggs, bore into the developing fruit, and feed inside the fruit. PC management should target adults to prevent oviposition and feeding damage in developing fruit. Sweet cherries are beginning to come out of the shuck, and tarts will soon follow, so growers are planning their PC management strategy. In apples, active PC can be managed at petal fall timing, after pollinator activity subsides. Here are some tips and reminders when considering materials for PC management this season:

- Organophosphates (OP) and pyrethroids work primarily as lethal contact poisons on PC adults in the tree canopy. Avaunt also works primarily by lethal activity, but this insecticide must be ingested by the adult weevils. The optimal timing for these chemistries is petal fall. Actara is an anti-feedant, and Avaunt needs to be ingested, so growers should be sure to use Avaunt first followed by an Actara in their rotation if they plan to use Avaunt.
- Some growers use Imidan for PC control in cherries, and we remind these growers that this material is also excellent for spotted wing drosophila control. Therefore, growers planning to use Imidan for PC should be mindful to not apply more than 7.5 lb of Imidan 70-W (5.25 lb of active ingredient) per acre per year in tart cherries.
- Neonicotinoids are highly lethal to plum curculio via contact for the first several days after application. These systemic compounds also move into plant tissue and protect fruit from plum curculio injury by deterring egg laying and preventing feeding. The optimal timing for neonicotinoid use is after fruit set in pome fruits and shuck-split in stone fruits.

- If growers miss the optimal timing for PC, neonicotinoids and OP's can be used as rescue treatments because they have curative action that can kill eggs and larvae that are already present in fruit.
- The recommended rate of Actara for PC is 4.5 to 5.5 oz per acre.
- Voliam Flexi can be used for PC control, but only the neonicotinoid (Actara) component will be effective against PC. The recommended rate of Voliam flexi for PC control is 6 to 7 ounces in cherry and 4 to 7 in apple, and growers should be sure to apply an adequate amount of Voliam Flexi to meet the recommended rate to control PC.
- Leverage (imidacloprid + cyfluthrin) and Voliam Xpress (Chlorantraniliprole + Lamda-cyhalothrin) are other pre-mix materials labeled for PC control.
- For organic growers, Surround WP can reduce plum curculio injury to fruit if applied to attain a heavy coating on the tree canopy; this kaolin clay product works as a PC repellent. Building up and maintaining several coats of the clay on fruit as the fruit continues to grow is key to successful use of this product.

Several other compounds, like Rimon, Esteem and Delegate, are commonly used in tree fruit pest management programs and have limited activity on plum curculio. Rimon, when targeted to control obliquebanded leafrollers or codling moth at petal fall, will sterilize PC eggs when adults are exposed to residues in the tree canopy. These sub-lethal effects will *not* prevent injury to fruit from adults but will result in nonviable PC eggs, thus no live larvae. Delegate, when ingested by PC adults, will cause moderate levels of mortality. Esteem, when used approximately two weeks post-harvest in cherries (San Jose scale crawler timing), will reduce female PC overwintering viability. However, Rimon, Esteem and Delegate are not labeled for stand-alone PC control, but when used in pest management programs may contribute to overall PC population management.

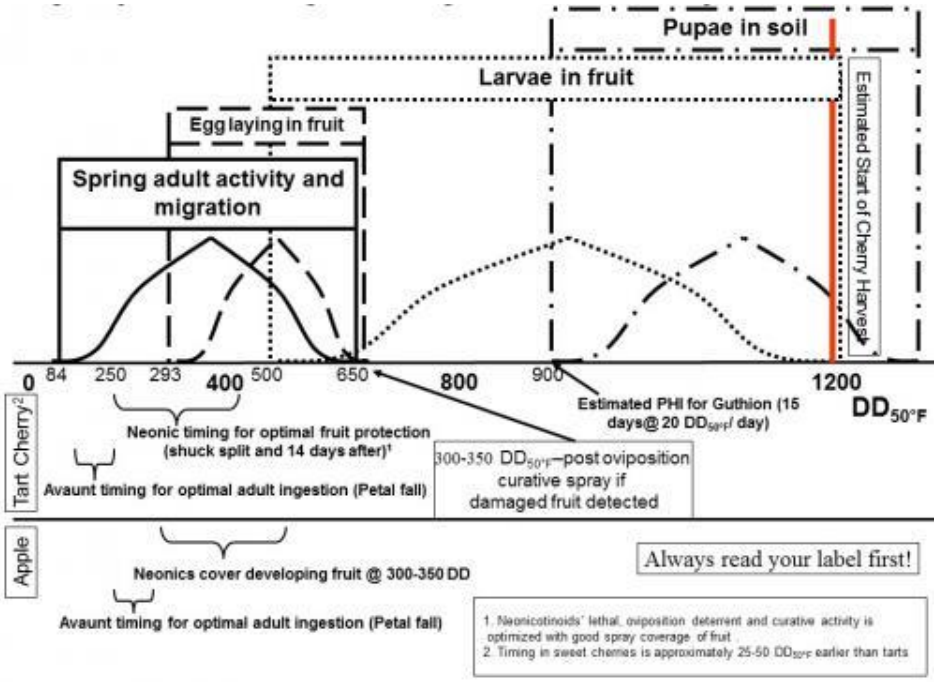
Summary of control materials for plum curculio

Compounds[2]	Chemical class / activity	Crop	Rate	Crop stage and initial control timing (DD_{50})
Imidan 70W**	Organophosphate	Pome fruit	3 lb	Petal fall (approx. 250 DD)
	Lethal via contact	Stone fruit	2 1/8 lb	Petal fall (approx. 175 DD)
Actara 25WG**	Neonicotinoid	Pome fruit	4½ oz	Petal fall + 3-5 days (approx. 300 DD)
	Lethal, Antifeedant and Curative	Stone fruit	4½ oz	Shuck-off (approx. 250 DD)
Calypso 480SC** (Label was voluntarily cancelled; can be used	Neonicotinoid	Pome fruit	4 oz	Petal fall + 3-5 days (approx. 300 DD)
	Lethal, Antifeedant and Curative	Stone fruit	4 oz	Shuck-off (approx. 250 DD)

through 2016)				
Assail 30SG**	Neonicotinoid	Pome fruit	6 oz	Petal fall + 3-5 days (approx. 300 DD)
	Lethal, Antifeedant and Curative	Stone fruit		Shuck-off (approx. 250 DD)
Belay 2.13SC**	Neonicotinoid	Pome fruit	6 oz	Petal fall + 3-5 days (approx. 300 DD)
	Lethal, Antifeedant and Curative	Peach		Shuck-off (approx. 250 DD)
Delegate 25WG*	Spinosyn	Pome fruit [1]	6 oz	Petal fall (approx. 250 DD)
	Lethal via ingestion	Stone fruit [1]		Petal fall (approx. 175 DD)
Avaunt 30WG	Oxadiazine	Pome fruit [1]	5 oz	Petal fall (approx. 250 DD)
	Lethal via ingestion	Stone fruit [1]		Petal fall (approx. 175 DD)
Surround WP	Particle film Repellent	Pome & Stone Fruits	Usually 16 lb by First Cover	Multiple applications starting before bloom to achieve complete coverage
Pyrethroids	Asana, Warrior, Baythroid	Pome fruit	Variable	Petal fall (approx. 250 DD)
	Lethal, repellent	Stone fruit		Petal fall (approx. 175 DD)
Rimon* (targeting codling moth, OBLR)	IGR	Pome fruit	20-40 oz	Petal fall (approx. 250 DD)
	Egg sterilization	Stone fruit		
Esteem* (targeting scale)	IGR	Pome fruit	5 oz	Post-harvest
	Adult sterilization	Stone fruit		
Leverage 2.7F	Pyrethroid + Neonicitinoid	Pome fruit	4.4-5.1 oz	Petal fall (approx. 250 DD)
	Lethal, Repellent, Curative	Stone fruit	4.5-5.1 oz	Shuck-off (approx. 250 DD)
Voliam Xpress	Pyrethroid + Diamide	Pome fruit	6-12 oz	Petal fall (approx. 250 DD)
	Lethal, Repellent	Stone fruit	6-12 oz	Petal fall (approx. 175 DD)
Voliam Flexi	Neonicotinoid + Diamide	Pome fruit	6-7 oz	Petal fall (approx. 250 DD)
	Lethal, Antifeedant, Curative	Stone fruit	6-7 oz	Shuck-off (approx. 250 DD)

*Not labeled for plum curculio (or just for PC suppression)
**Have curative properties that can kill eggs and larvae that are already present in the fruit.

Optimal timing and order selection of insecticides for plum curculio management is based on matching the performance characteristics of each compound with plum curculio life cycle development (see figure) and tree phenology (see table). Because organophosphates and pyrethroid insecticides are contact poisons, they can be used as early as petal fall to knock beetles out of the tree canopy. However, MSU Extension cautions the use of pyrethroids as they are toxic to mite predators, which can potentially lead to outbreaks of pest mites. Plum curculio adults feed on tree parts



during bloom and petal fall, so Avaunt can be used at this petal fall timing.

The performance of neonicotinoids is optimized when sprays are made after fruit set (pome fruits) or shuck-split (stone fruits), so that fruit and foliage are both covered. Surround will not work unless the tree and fruit are completely covered, so multiple sprays are needed on the tree prior to plum curculio oviposition activity. If PC infestation occurs and a rescue treatment is needed, organophosphates and neonicotinoids can provide curative action up to two weeks after plum curculio infestation, although in some cases dead cadavers can still be found in fruit.

Food Security Program

The League of Women Voters Leelanau County will host a forum entitled "**Food Security"** on Wednesday, June 1, 2016 at noon in the lower level of the Government

Center in Suttons Bay. The forum will explore the impacts of a changing climate on sustainable food security and mitigations and adaptive strategies to address these changes. The panelists include Dave Barrons, former TV weather reporter and climate change activist; Richard Allen, Leland yard farmer and gardener; Kelly Lively, Policy and Outreach Partner at Cherry Capital Foods; Jim Nugent, former head of MSU Horticultural Center and local fruit farmer; and Jim Schwantes of Sweeter Song CSA and contributor to local farmers' markets. Before the forum at 11:15 AM there will be a meet and greet with local and regional food-related organizations and businesses who will provide opportunities to learn new skills and information on what an average person can do.

Many people bring a sack lunch. LWVLC business meeting to follow presentation.
For more information: Call 231-271-5600, visit LWVLeelanau.org or follow LWVLC on Facebook at League of Women Voters Leelanau County

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2016 IPM Update Schedule

Emily Pochubay and Nikki Rothwell
Michigan State University Extension

Tree Fruit IPM Updates beginning the first week of May through mid-July (as needed) will highlight management of the seasons current potential pest challenges dictated by weather and pest biology. Attendees are encouraged to bring examples of pests and damage found on the farm to these workshops for identification and discussion. Workshops will be held weekly in Leelanau and Grand Traverse counties and bi-weekly in Antrim and Benzie counties in May. Beginning in mid-June, we will hold weekly meetings in all four locations. Tree fruit growers are welcome to attend meetings at any of the locations and times that are most convenient (see below). These workshops are free and do not require registration. For more information, please contact Emily Pochubay (pochubay@msu.edu), 231-946-1510.

Leelanau County

Location: Jim and Jan Bardenhagen, 7881 Pertner Road, Suttons Bay
Dates: May 3, 10, 17, 24, 31; June 7, 14, 21, 28
Time: 12PM – 2PM

Grand Traverse County

Location: Wunsch Farms, Phelps Road Packing Shed, Old Mission
Dates: May 3, 10, 17, 24, 31; June 7, 14, 21, 28

Time: 3PM – 5PM

Antrim County

Location: Jack White Farms, 10877 US-31, Williamsburg (south of Elk Rapids on the southeast side of US-31)
Dates: May 4, 18; June 1, 15, 22, 29
Time: 10AM – 12PM

Benzie County

Location: Blaine Christian Church, 7018 Putney Rd, Arcadia, MI 49613
Dates: May 4, 18; June 1, 15, 22, 29
Time: 2PM – 4PM

WEB SITES OF INTEREST:

Insect and disease predictive information is available at:
http://enviroweather.msu.edu/homeMap.php

This issue and past issues of the weekly FruitNet report are posted on our website:
http://agbioresearch.msu.edu/nwmihort/faxnet.htm

60-Hour Forecast:
http://www.agweather.geo.msu.edu/agwx/forecasts/fcst.asp?fileid=fous46ktvc

Information on cherries:
http://www.cherries.msu.edu/

Information on apples:
http://apples.msu.edu/

Information on grapes:
http://grapes.msu.edu

Fruit CAT Alert Reports:
http://news.msue.msu.edu