# Northern Michigan FruitNet 2014
# Northwest Michigan Horticultural Research Center

## Special Update
**June 6, 2014**

### Northwest Regional Update
Emily Pochubay and Nikki Rothwell
MSU Extension Educators

Covering for possible disease infections has been inconvenient in the last few weeks due to rains that have been predicted over the weekend and early in the week. Growers were out spraying last weekend in anticipation of rain that came on Monday 2 June, which resulted in infections of **fire blight, apple scab, and cherry leaf spot.** Unfortunately, possible rain showers are predicted again for Saturday 7 June evening and Sunday 8 June morning. Temperatures are predicted to be in the mid to upper 70s ºF on Friday and Saturday, and cooler in the mid 60s ºF Sunday.

In the last week, fire blight bacteria have been growing and multiplying on open flowers when temperatures have exceeded 65ºF. If the forecast is correct and rain comes on Sunday, susceptible apple varieties with open blossoms will need to be covered to protect from a fire blight infection. Currently, the fire blight model on Enviro-weather is predicting a possible infection period for the NWMHRC on Saturday with an EIP value of 113; current EIP values for Sunday are predicted to be over or under 100 depending the biofix date for a particular block. Growers that are able to use Kasumin under the Section 18 need to remember that a maximum of three sprays can be used per season and an alternative mode of action needs to be used between Kasumin applications..

**Traverse City (NWMHRS) Fire Blight Assist Chart(Report issued 6/6/2014 7:51 )**

**Directions for assist chart:**

**Locate the Biofix Date (the date bloom opened or the date a spray was applied to control Fireblight) on the top row. Follow that column down to determine Epiphytic Infection Potential for that block on each date in the left column. If this number is greater than 100, and the average temperature is greater than or equal to 60°F, this area will be highlighted, and rain, or trauma (high winds or hail) is all that is needed for infection. Repeat for additional blocks that bloomed or were sprayed on a different date.**

| 2014 | | Temperature(F) | | | Rain | | EIP for Biofix Date: (Bloom or spray date) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Date | Max | Min | Avg | In. | Chance of rain | 5/31 | 6/1 | 6/2 | 6/3 | 6/4 | 6/5 | 6/6 | 6/7 | 6/8 | 6/9 | 6/10 | 6/11 | 6/12 |
| Sunday | 6/1 | 87.8 | 64.1 | 76 | 0.02 | -- | 219 | 135 | | | | | | | | | | | |
| Monday | 6/2 | 81.3 | 64.1 | 72.7 | 0.92 | -- | 289 | 206 | 70 | | | | | | | | | | |
| Tuesday | 6/3 | 69.5 | 54.9 | 62.2 | 0 | -- | 217 | 217 | 81 | 11 | | | | | | | | | |
| Wednesday | 6/4 | 73.5 | 49.9 | 61.7 | 0 | -- | 240 | 240 | 105 | 34 | 23 | | | | | | | | |
| Thursday | 6/5 | 71.8 | 45 | 58.4 | 0 | -- | 121 | 121 | 121 | 50 | 39 | 16 | | | | | | | |
| **Today's data: Note: Last time reported by station is (6:55-7:00AM)** | | | | | | | | | | | | | | | | | | | |
| Friday | 6/6 | Forecast: 75 | Forecast: 44 | 59.5 | 0 | 8% | 75 | 75 | 75 | 75 | 64 | 41 | 25 | | | | | | |
| **Forecast Data** | | | | | | | | | | | | | | | | | | | |
| Saturday | 6/7 | 77 | 49 | 63 | -- | 22% | 113 | 113 | 113 | 113 | 113 | 90 | 74 | 49 | | | | | |
| Sunday | 6/8 | 67 | 49 | 58 | -- | 74% | 113 | 113 | 113 | 113 | 113 | 90 | 74 | 49 | 0 | | | | |
| Monday | 6/9 | 71 | 45 | 58 | -- | 19% | 102 | 102 | 102 | 102 | 102 | 102 | 86 | 62 | 12 | 12 | | | |
| Tuesday | 6/10 | 79 | 45 | 62 | -- | 20% | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 62 | 62 | 49 | | |
| Wednesday | 6/11 | 76 | 52 | 64 | -- | 53% | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 86 | 37 | |
| Thursday | 6/12 | 78 | 58 | 68 | -- | 51% | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 148 | 98 | 62 |

Temperatures were in the upper 80s last weekend and growers were concerned about using Kasumin at those high temperatures because Kasumin is an EC formulation that contains oil. We do not know the outcomes of applying Kasumin at high temperatures, but growers should

be aware that oil can cause phytotoxicy in hot conditions. Many growers have used the plant growth regulator Apogee at king bloom petal fall to assist with potential shoot blight infection. Michigan State University recommends a period of 2-4 days between applications of thinning materials and Apogee. In most cases, thinning applications should take precedence over Apogee sprays.

Growers should consider this weekend as an opportunity for thinning with the warm temperatures in the forecast. Thinning materials work better at higher temperatures, but little to no stress is predicted on the carbohydrate model. In this situation, we recommend that growers still take advantage of the warm weather and slightly increase their thinning rates to compensate for the lack of stress. We have talked extensively about the 'nibble' thinning approach, and many growers have been trying to thin at multiple steps (i.e. full bloom, petal fall, etc.) rather than waiting for the traditional timing of 8-12mm. However, some growers in warmer areas are likely approaching the perfect window for thinning, and again, growers should use the warm weather to their advantage and apply thinners under optimal conditions. Warm temperatures are predicted to continue into next week. Lastly, if growers are applying thinners with open bloom, there is potential for fire blight bacteria to be washed into the flowers with thinner applications; protecting against fire blight will be important with the recent warm conditions as the fire blight bacteria are reproducing at these elevated temperatures.

The primary infection period for **apple scab** is ongoing and we are continuing to trap spores at the monitoring field site in Leelanau Co. The NWMHRC's biofix date for apple scab was 9 May, and according to the model for the NWMHRC apple scab spores are 97% mature and 71% have been discharged since that date. Currently, the model is predicting that spores will be 100% mature and 85% discharged by 12 June. The end of primary scab is near but growers still need to protect new foliage for this weekend's predicted rains.

**Cherry leaf spot** lesions on bract leaves and first true leaves have been observed in many orchards across the region. Cherry leaf spot conidia are developing on the undersides of infected leaves and will spread to nearby leaves during wet periods. At this time, cherry leaf spot has two inoculum sources, spores that are being discharged from lesions on last season's infected leaves on the ground and infected leaves in the tree canopy from early infection this season. With rain predicted for Saturday evening, growers should protect from possible leaf spot infection, and growers with lesions already showing up on bract leaves should be diligent about obtaining thorough coverage of the canopy. There is a 10-day reapplication interval for chlorothalonil, and this interval may be too long if multiple rain events and infection periods occur during that interval. If growers applied a full cover of chlorothalonil and need to spray during that 10-day interval to protect for possible rain this weekend, Michigan State University Extension recommends Captan 80 WDG at 2.5 pounds per acre. Please refer to the article "*Controlling cherry leaf spot in orchards with early infections*," for more information on recommendations for cherry leaf spot management at this time.

We have received a few isolated reports of **American brown rot** sporulation on sweet cherry fruit that is visible on last year's mummies. Insect feeding, bacterial canker on green fruits, and other damage to developing sweet cherry fruit make those damaged fruit more susceptible to American brown rot infection. Spores developing on mummies have the potential to infect neighboring fruit.

We have also seen **blossom blight** and **canker** symptoms in sweet cherries. Shoot wilt symptoms as a result of the **European brown rot** fungi are evident in tart cherry, particularly in slow drying areas or orchards that were heavily infected last season.

*Plum curculio* (PC) is the main insect of concern at this time. We have observed PC oviposition scars on apricots and sweet cherries. Many growers sprayed for PC in sweet cherries this week, and tart cherries that are coming out of the shuck should also be protected. We encourage growers to check their 'hot spots' for oviposition scars to help adequately time PC applications. With warm temperatures and rain in the forecast, we predict this weekend will be an optimal time for PC egg laying.

**Codling moth** (CM) are active, and we have received reports of CM catches in Leelanau and Bear Lake. Moth captures seem to be spotty where some traps have many moths (15-20) and others with just a few CM (4+). After two consecutive CM capture dates, the biofix for CM should be set for the first date that moths were caught. Please refer to the article, "*Codling moth is back with a vengeance in 2014*," for more information on codling moth management.

**CODLING MOTH IS BACK WITH A VENGEANCE IN 2014**

***Recent trap data suggests that codling moth populations will be heavy, and management action will be required.***

Posted on **June 3, 2014,** MSUE News**,** by **John Wise**, and Larry Gut, Michigan State University Extension, Department of Entomology

The catastrophic freeze of 2012 resulted in a near collapse of codling moth populations in most regions of Michigan. Codling moth populations remained suppressed through much of the 2013 growing season. The last two weeks of pheromone-baited trap data suggest that codling moth populations are returning to normal levels, thus "pest pressure" will be heavy and dedicated management actions required.

At the Michigan State University Trevor Nichols Research Center in Fennville, Michigan, we set codling moth biofix for May 25, thus with the current weather forecast we can expect continued emergence of codling moth adults and widespread oviposition, or egglaying, and first egg hatch early next week. To get the most benefit from a codling moth control measure, Michigan State University Extension recommends growers treat a block after moth captures have been recorded and the accumulation of growing degree days (GDD) required for a particular action, as indicated in Table 1, has taken place.

**Table 1. Codling Moth GDD Model and insecticide timings for control**

| **GDD base 50 (post-biofix)** | **Event** | **Action** |
|---|---|---|
| Pink bud | Development of overwintering larvae | Set traps |
| 0 GDD = Biofix (~200 GDD after Jan. 1) | 1st sustained moth captures | Set GDD = 0 |
| 100 GDD | 1st generation **egglaying (oviposition)** | Timing for ovicide materials |
| 250 GDD | Start of 1st generation | Timing for larvicide materials |

| | | |
|---|---|---|
| | **egg hatch** | |
| 350 GDD | 1st generation **egglaying & hatch** | Delayed timing if pest pressure is low, or for 2nd treatment if an ovicide was applied at 100 GDD |
| 500-650 GDD | Peak of 1st generation **egg hatch** | Timing for additional larvicide if monitoring of codling moth activity indicates a treatment is needed |
| 1000 GDD | Expected end of 1st generation activity | |

**Egg control**

Although several insecticides have limited ovicidal activity, only Rimon is considered a strong ovicide material, thus codling moth egglaying is the optimal timing for this material (Table 2). Rimon applied at codling moth biofix plus 100 GDD also provides excellent control of obliquebanded leafroller and suppression of plum curculio (sub-lethal effects on subsequent generation).

**Larval control**

The vast majority of insecticides used for codling moth control are aimed at killing larvae, and thus are typically applied beginning at 250 GDD post-biofix (Table 2). Pyrethroid insecticides provide moderate control of codling moth and have a broad activity spectrum, but are generally avoided because their use at this stage that can result in outbreaks of phytophagous mites. Apple growers should be aware that resistance to the organophosphate (OP) compounds has been detected in Michigan orchards throughout the state, such that reliance on OP's for codling moth control is not likely to provide sufficient control. In addition, populations resistant to OP compounds may also be resistant to pyrethroids.

Delegate (spinetoram) is in the Spinosyn class of insecticides and provides excellent control of both first and second generation codling moth. It kills larvae as they hatch and begin feeding, thus should be applied at the larvicidal timings indicated in Table 1. Delegate has very good activity against obliquebanded leafroller, suppression activity on apple maggots, and limited lethal action on plum curculio when ingested (Table 3).

Exirel (cyazypyr), Altacor (rynaxypyr) and Belt (flubendiamide) belong to the Diamide class of insecticides that work on the insect by activating ryanodine receptors, thus depleting internal calcium and preventing muscle contraction. They provide excellent control of both first and second generation codling moth, as well as obliquebanded leafroller. Exirel and Altacor also provide suppression activity on AM, Exirel reportedly better than Altacor (Table 3).

The neonicotinoids Assail and Calypso will provide very good control of codling moth with a residual action of 10-14 days. These compounds are primarily larvicidal, but also have some ovicidal activity when applied over the top of the egg. Field trials have indicated that use of Assail in combination with pyrethroids or carbaryl can result in outbreaks of phytophagous mites. Assail and Calypso are fairly broad-spectrum materials. In contrast to the insect growth regulators and Diamides, the major secondary targets of these neonicotinoids are the sucking insects, specifically aphids (green apple aphids and rosy apple aphids) and leafhoppers (Table 3). The initial application of Assail or Calypso targeting first generation codling moth will also

provide control of plum curculio, oriental fruit moth and spotted tentiform leafminer, and they will control apple maggots.

Belay, another neonicotinoid registered for use in pome fruits, is a broad-spectrum material targeting codling moth as well as aphids, leafhoppers, plum curculio, spotted tentiform leafminer, oriental fruit moth and pear psylla. Research trials have indicated that Belay is not as effective as Assail or Calypso for second generation codling moth.

Proclaim is a codling moth control material in the Avermectin class of insecticides. It has provided good control of first generation codling moth in trials at the Trevor Nichols Research Center and in on-farm demonstration trials. Proclaim also has very good activity against obliquebanded leafroller.

There are several new pre-mix insecticides labeled for codling moth control, including Voliam flexi (thiamethoxam + chlorantraniliprole), Tourismo (flubendiamide/buprofezin), and Leverage (imidacloprid + cyfluthrin) that combine two active ingredients as pre-mix formulated compounds. When these are used for codling moth control, care must be taken **not** to use a product in the following generation that is in the same insecticide class as either of the pre-mix active ingredients.

**Table 2. Chemical class, activity and timing of insecticides used for CM control.**

| Compound trade name | Chemical class | Life-stage activity | Optimal spray timing for codling moth | Mite flaring potential |
|---|---|---|---|---|
| Guthion, Imidan | Organophosphates | Eggs, larvae, adults | Biofix + 250 GDD | L - M |
| Asana, Warrior, Danitol, Decis, Baythroid XL | Pyrethroids | Eggs, larvae, adults | Biofix + 250 GDD | H |
| Rimon | IGR (chitin inhibitor) | Eggs, larvae | Biofix + 100 GDD Residue under eggs | M* |
| Delegate | Spinosyn | Larvae | Biofix + 250 GDD | M |
| Altacor, Belt, Exirel | Diamide | Eggs, larvae | Biofix + 200-250 GDD | L |
| Assail, Calypso, Belay | Neonicotinoid | Larvae, eggs & adults (limited) | Biofix + 200-250 GDD Residue over eggs | M* |
| Proclaim | Avermectin | Larvae | Biofix + 200-250 GDD | L |
| Granulovirus | Biopesticide | Eggs, larvae | Biofix + 250 GDD Residue over eggs | L |
| Voliam flexi | Diamide + Neonic. | Eggs, larvae | Biofix + 200-250 GDD | L-M* |

| | | | | |
|---|---|---|---|---|
| | | | Residue over eggs | |
| Tourismo | Diamide + IGR | Eggs, larvae | Biofix + 200-250 GDD | L |
| Leverage | Pyrethroid + Neonic. | Eggs, larvae, adults | Biofix + 200-250 GDD | H |

* May cause mite flaring in combination with carbaryl or pyrethroids that kill predacious mites.

**Codling moth granulosis virus**

Growers should not overlook including granulosis virus in their codling moth management program. This is a naturally occurring virus that goes by the scientific name of *Cydia pomonella* granulovirus (CpGV). Both of the two commercially available products, Cyd-X and Carpovirusine, are effective. Optimal use of the virus is against young larvae before they penetrate the fruit. The best way to target young larvae is to have the virus present on the surface of the eggs when they begin to hatch. Hatching codling moth larvae will ingest the virus as they consume their eggshells.

There are many options for incorporating virus into your codling moth management program. Deciding how much, when and how often to apply product can be quite confusing. Keep in mind the following factors when trying to sort things out:

- CpGV must be ingested by the codling moth larva and may not kill it immediately.
- The virus breaks down in the environment, thus a spray may only be effective for a week or so.
- The virus is highly lethal, a few OB's are all that are required to cause death.

Our overall experience is that frequent application of a low rate of product is the best approach for using this biopesticide.

Growers can opt to use the virus as part of a multi-tactic codling moth control program. Rotating it with chemical insecticides is a good means of combating resistance. We suggest the following approaches to incorporating codling moth virus into a management program. If you want to restrict your use to a single generation, target the first generation. Some virus-infected larvae will not die immediately, allowing them to cause fruit damage and even complete larval development. Fortunately, stings or deeper entries in small fruits attacked by first generation larvae often fall off the tree or are removed by thinning. Additionally, research conducted in 2003 revealed that less than 4 percent of the individuals that managed to complete larval development survived to pupate and emerge as summer generation adults. Thus, applications against the first generation can greatly reduce the size of the summer generation that will need to be controlled.

Regardless of the generation targeted, it is best to make at least two applications. If you want to rotate a CpGV product with other controls, try applying a chemical insecticide as the first spray at the start of egg hatch (250 GDD) and the virus as the second spray. This is because more eggs will be present and covered by the virus spray at the later timing. The insecticide and virus could then be rotated again, or the virus could be applied weekly at a low rate for the remainder of the egg hatch period.

**Table 3. Relative activity spectrum of compounds against spring and early summer apple pests**

| Insecticide | Primary pests | | | | | Secondary pests | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CM | OFM | OBLR | PC | AM | STLM | GAA | RAA | LH | SJS |
| Delegate | *** | *** | *** | * | ** | ** | | | | * |
| Rimon | *** | *** | *** | * | | ** | | | | |
| Exirel | *** | *** | *** | * | ** | ** | | | * | |
| Altacor | *** | *** | *** | | * | ** | | | * | |
| Belt | *** | *** | *** | | | ** | | | | |
| Proclaim | ** | ** | *** | | | *** | | | | |
| Beleaf | * | * | | | | | *** | *** | | |
| Actara | * | * | | *** | *** | *** | *** | *** | *** | ** |
| Calypso Assail | *** | *** | | *** | *** | *** | *** | *** | *** | ** |
| Clutch | ** | ** | | *** | ** | *** | *** | *** | *** | |
| Guthion Imidan | *** | *** | | *** | *** | * | | | | |
| Pyrethroids | ** | ** | ** | ** | ** | ** | * | * | * | ** |

CM-codling moth, OFM-oriental fruit moth, OBLR-obliquebanded leafroller, PC-Plum curculio, STLM-spotted tentiform leafminer, GAA/RAA-green/rosy apple aphid, WALH-white apple and potato leafhoppers, SJS-San Jose scale, TPB-tarnished plant bug
* some activity, ** better activity, *** best activity relative to other insecticides

*Drs. Wise and Gut's work is funded in part by MSU's AgBioResearch.*

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## USE OF APOGEE FOR SHOOT BLIGHT CONTROL IN 2014

George W. Sundin, Plant Pathology, MSU

Fire blight shoot blight infections can trigger epidemics because the pathogen will ooze out from strikes and spread rapidly to new shoots. Even trees and orchards not showing blossom blight symptoms can still be suffer significant shoot blight infection. On highly-susceptible cultivars (Gala, Jonathan, etc), shoot infection rapidly results in bacterial ooze production and further pathogen spread even before the symptoms are readily present. Furthermore on younger trees (~ < 8 years old) on fire blight-susceptible rootstocks, the pathogen can quickly move systemically downward through the tree and cause rootstock blight, killing the tree.

Apogee (prohexadione-calcium; BASF) is a growth inhibitor that we have known for years to provide excellent control of the shoot blight. Apogee is the best (only) material currently available for shoot blight control. Apogee is a growth inhibitor that provides excellent control of

shoot blight. The first timing for an Apogee spray is at king bloom petal fall. This timing coincides with the beginning period of rapid shoot growth of the tree. The “Apogee effect” on shoot growth inhibition takes about 10-14 days to become established.

Most growers prefer to space Apogee applications out using 2, 3, or 4 applications (once every two weeks) to take advantage of disease control as well as horticultural benefits of Apogee use. This strategy is effective for shoot growth control and fire blight management in typical years. See the 2014 Michian Fruit Management Guide (pgs. 102 and 243) for more specific information on Apogee use rates. However, without Apogee use, early shoot infections can lead to significant fire blight infection and risk for epidemics if fire blight conducive weather becomes prominent or if trauma situations occur in specific blocks.

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’, ‘Winesap’, or ‘Winesap’ because of the potential for fruit cracking.

**CONTROLLING CHERRY LEAF SPOT IN ORCHARDS WITH EARLY INFECTIONS**

George W. Sundin, Plant, Soil, and Microbial Sciences
Nikki Rothwell, Northwest Michigan Horticultural Research Center

*Cherry leaf spot infection has already occurred in many northwest Michigan tart cherry orchards. It will be critical to protect new leaf growth with fungicide applications with tightened spray intervals to prevent a wide-scale CLS epidemic.*

With this slow start to the season, we have observed early growth of tart cherry bract leaves that were open prior to bloom. These leaves can be a critical starting point for cherry leaf spot (CLS) infection because the stomates on bract leaves are open and can be infected by the CLS fungus. We have observed widespread bract leaf infection and infection of the first true leaves in tart cherry orchards throughout NW Michigan. It is critical to realize the significance of these early infections and their potential detrimental impact on CLS this season.

Once infection occurs on new leaves in the tree, visible CLS lesions will produce tremendous spore numbers that can readily infect new tissue. In most cases, there are more spores developing from these lesions than ascospores that are shot up into the developing canopy from leaves overwintering on the ground. In addition, spores from lesions on the leaves are much more likely to find new leaf targets within the tree than spores coming up from the ground -- the distance from one leaf to another leaf is minimal, and the potential for spores to infect by moving from one leaf to an adjacent leaf is ‘easier’ than for spores shot from ground level to hit the leaf target up in the tree canopy. The relative ease with which the fungus spreads from infected leaves within trees can lead to significant disease spread even under marginal CLS infection conditions.

*With CLS infections already present in trees, it is extremely important to protect new leaf growth*. The goal is to minimize CLS infection to keep a full canopy of leaves on the trees to adequately ripen the crop. Fruit will not ripen evenly on trees with significant infection and resulting defoliation that happens before harvest. If CLS lesions are present on bract leaves or new leaves at this time, trees will require more frequent fungicide applications (tighter spray intervals), and it will be critical for growers to adequately cover foliage prior to rain events.

Prior to shuck split, the recommended fungicide for CLS management is chlorothalonil (Bravo and generics). This fungicide is a multi-site protectant and is excellent for leaf spot control and

is not at risk for fungicide resistance development. However, according to the label, chlorothalonil applications must be spaced a minimum of 10 days apart. This 10-day spray window may be too long if rains and CLS infection conditions occur within this interval because new leaves are growing rapidly and this tissue will be unprotected. With the CLS fungus already present in trees, fungal spores can readily infect this unprotected tissue.

If growers did apply a full cover of cholorothalonil, and need to spray within the required 10-day interval to cover for the rains predicted this Sunday, a good fungicide option is Captan 80WDG at 2.5 lbs./A. We have observed excellent control with Captan in CLS trials conducted at the Northwest Michigan Horticultural Research Center over the past several years. As with chlorothalonil, Captan residues must be present on leaves prior to arrival of spores of the CLS fungus. After the Captan application, an additional chlorothalonil application can be put on within 7-8 days at shuck split.

Unfortunately, this season seems to be shaping up to be a significant disease year. Therefore, it will be especially critical to utilize the best possible CLS fungicide combination at the 1st cover timing. The recommended cover would be either Luna Sensation (5 fl. oz/A) + Captan (2.5 lbs./A) or Merivon (5.5 fl.oz/A) + Captan (2.5 lbs./A). The advantages of using Luna Sensation or Merivon are that these fungicides have the best activity against CLS and also they are partially systemic and more persistent in controlling CLS. However, the risk of fungicide resistance development is possible with these fungicides, so these chemistries should not be overused. Therefore, the best timings for Luna Sensation or Merivon are 1st cover and pre-harvest. In addition, at the 1st cover spray timing, these fungicides will also control powdery mildew, and at the pre-harvest timing, these fungicides will also control American brown rot.

## MANAGE CROP LOAD OF YOUNG TALL SPINDLE APPLE PLANTINGS

***Adjust crop load of Honeycrisp and other apple varieties in high density plantings in years two through four to reduce negative impact on canopy vigor and subsequent cropping.***

Posted on **June 4, 2014, MSUE News,** by **Ron Perry**, Michigan State University Extension, Department of Horticulture

A large number of growers are establishing tall spindle apple plantings at spacings of 3 x 11 or 12 feet. Research has shown these plantings to be extremely productive, which has provided the incentive to give it a try. Michigan State University Extension cautions growers to be aware that developing a narrow profile tall (12-13 feet) tree on dwarfing rootstocks calls for judicious crop load management.

The yield potentials of these trees in the first five years can be impressive. Remember not to get greedy. I know that you may be anxious to begin getting a return on the large investment if you have established one of these plantings. I can remember establishing a vertical axe planting in the 1990s, where in the third growing season I mistakenly cropped the trees at 0.5 to 1 bushel per tree after hand-thinning 50 percent of the crop, thinking I had taken enough off. The Jonagolds in that planting, a strong grower that tends to biennial bear, were over-cropped and cropping in subsequent two years was reduced along with growth. Fortunately, by the sixth leaf, the trees recovered and performed well for the remaining life of the plot. The Galas and Empires in that planting were unaffected as they crop annually with little problem. I remembered my mistake.

These days, growers are planting varieties like Honeycrisp in tall spindle systems on M.9 or B.9 rootstocks. Understand that Honeycrisp is a weak growing variety with high tendency to alternate bear. If you over-crop them in years two or three, don't expect much of a crop the next year and secondly, expect "stunting" in subsequent years.

The key to productivity in tall spindle plantings is reaching a goal of balanced vegetative growth and cropping. By year four and five, the tops of these trees should be reaching 12-14 feet. Over-cropping in years two and three restricts tree height, but with it also canopy volume which equates to productivity. If your goal is 1,100-1,300 bushels per acre by year five, limit cropping in the earlier years.

Terence Robinson of Cornell University, along with collaborators in the testing project NC 140, found through crop load studies that the optimum crop load ratio in years two through four should be four to six fruits per 1 centimeter squared trunk cross sectional area (trunk measurements at 1 foot height). So basically, you can assess how much crop to leave based on average trunk size. This stands to reason that more crop can be left on more vigorous trees, etc.

Rather than trying to provide growers with the TCSA metric information, I have provided a table converting these values based on trunk diameters in inches. Note that in the table provided, I suggest for Honeycrisp to be in the 4-5 fruit column. Avoid columns headed by 7 or 8 unless your trees are at least six or seven years old or with vigorous canopies. In the table below, a 1-inch diameter trunk tree of Honeycrisp in the second year should have no more that 20-25 fruit.

You can allow cropping in year two at the 4-5 fruit per 1 $cm^2$ TCSA level, which can help settle trees down, especially on vigorous soils. If I can add a little caution, cropping in the lower part of the canopy will have less impact on tree vigor and linear leader development than fruit hanging in the upper portion of the tree.

**Recommended crop load associated with trunk diameters of young apple trees in high density systems. Headings for each column are calculated as ratios of numbers of fruit per 1 $cm^2$ TCSA.**

| Trunk diameter (inches) | Diameter (squared inches) | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|
| 0.50 | 1.3 | **5** | 6 | 8 | 9 | 10 |
| 0.75 | 2.8 | **11** | 14 | 17 | 20 | 23 |
| 1.00 | 5.1 | **20** | 25 | 30 | 35 | 41 |
| 1.50 | 11.4 | **46** | 57 | 68 | 80 | 91 |
| 2.00 | 20.3 | **81** | 101 | 122 | 142 | 162 |
| 2.50 | 31.7 | **127** | 158 | 190 | 222 | 253 |
| 3.00 | 45.6 | **182** | 228 | 273 | 319 | 365 |
| 3.50 | 62.0 | **248** | 310 | 372 | 434 | 496 |
| 4.00 | 81.0 | **324** | 405 | 486 | 567 | 648 |

* Number of fruits recommended based on research fruits per 1 $cm^2$ TCSA = 0.155 $in^2$ TCSA

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## APPLE THINNING POINTS FOR 2014

***The 2014 apple thinning season factors are unique, as always, and will need consideration before performing thinning.***

Posted on **June 4, 2014, MSUE News,** by **Phil Schwallier**, and Amy Irish-Brown, Michigan State University Extension

It is particularly noted that this long, extreme cold winter may cause some winter damage. Michigan State University Extension recommends making multiple thinning treatments this year to achieve your target crop load, and plan on starting your thinning early at petal fall. We have a good bloom this year, better than expected after the large crop last year. Some varieties have no or only light return bloom, such as Goldens, Fuji and Honeycrisp.

Trees appeared weak up until the warm weather moved in which greatly improved the appearance of the bloom and the foliage. Some trees are showing signs of a lighter set, such as Empire and Reds. Frost damage is not present this year and Kings are all alive. Bee activity, pollination and even fertilization were wonderful.

**Thinning factors:**

- Heavy crop in 2013 means easier to thin in 2014.
- Good bloom, many large, showy flowers.
- Abundant leaves; “green” snowball bloom, strengthens set.
- Good bee activity, predicted good pollination and fertilization.
- No frost damage, but considerable tree winter damage.
- Some varieties and trees with areas of reduced bloom.
- Leave CHECK trees.
- Use precision crop load management or “nibble” thinning, thin early and often to gradually reduce the crop.
- Multiple thinning.

**Precision crop load thinning or nibble thinning**

Precision crop load management thinning is a strategy to chemically thin often and multiple times throughout the bloom and fruit set window. Technically, nibble thinning begins with blossom thinning (lime-sulfur and oil or ATS). This treatment seems to be less successful in Michigan and thus is not practiced very much. The real first thinning period occurs at petal fall to 6 millimeters. At petal fall, trees are not very sensitive to thinning, and most years no significant thinning occurs.

This year, with warm temperatures forecasted for the next several days, some good thinning is predicted, perhaps perfect thinning. This first thinning will remove off perhaps up to half of the target thinning crop load. Usually additional thinning will be required at the 10-millimeter stage. The next chance to thin will occur at the 10- to 12-millimeter stage and the last will be at 18

millimeters. This process of reducing the crop gradually will result in a better consistent thinning with a reduce risk of over-thinning or under-thinning.

**Other considerations:**

- **Oil** can be added to thinners to increase the thinning by 10 percent.
- **Oil** is not compatible with Captan and Sulfur. Where this is a concern, use a surfactant instead of oil.
- Agri-Mec and **oil** can cause additional thinning when mixed with thinners.
- Cloudy, warm weather will increase fruit drop.
- Sunny, cold weather will increase set.

**Thinning materials and recommendation for multiple thinning**

| Variety | | Petal fall to 6 mm | 10 to 12 mm stage | | Variety comment |
|---|---|---|---|---|---|
| | | | If needed | If more aggressive thinning is needed | |
| **Frost damage** | **Kings dead** | Sevin or NAA 10 ppm | Standard Rates | | |
| | **Significant damage** | Wait to access set. | Tops only, mild rates | Standard Rates | |
| **Easy to thin varieties** | **Cortland, Gingergold, Ida Red, Jonathan, Jonagold, McIntosh** | Use Standard Rates Sevin or NAA 10 ppm | NAA 10 ppm | Sevin + NAA 5 ppm | Easy to thin |
| | **Jonathan with MaxCel** | Sevin | Sevin | Sevin + MaxCel 50 ppm | Small fruited and easy to thin |
| **Intermediate to thin varieties** | **Empire** | Sevin + MaxCel 100 ppm | Sevin + MaxCel 100 ppm | Sevin + MaxCel 150 ppm | Small fruited |
| | **Honeycrisp** | Sevin + NAA 10 ppm | Sevin + NAA 10 ppm | Sevin + NAA 15 ppm | Tend to set multiple fruits/cluster, biennial |
| | **Reds** | Sevin + MaxCel 100 ppm | Sevin + MaxCel 100 ppm | Sevin + MaxCel 150 ppm | Biennial, sensitive to NAA |
| **Difficult to thin varieties** | **Gala** | Sevin + MaxCel 100 ppm | Sevin + MaxCel 100 ppm | Sevin + MaxCel 150 ppm | |
| | **Goldens, Paula Rred** | Sevin + NAA 10 ppm | Sevin + NAA 15 | Sevin + NAA 15 ppm | Biennial |

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|---|---|---|---|---|---|
| | | | ppm | | |
| | **Rome** | Sevin + NAA 10 ppm | Sevin + NAA 15 ppm | Sevin + NAA 20 ppm + 1 qt Oil | Tend to set multiple fruits/cluster |
| | **Fuji** | Sevin + MaxCel 100 ppm | Sevin + MaxCel 150 ppm | Sevin + MaxCel 150 ppm + 1 qt Oil | Biennial, sensitive to NAA |

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