



ORCHARD NETWORK

For Commercial Apple Producers

VOLUME #24, ISSUE #2

April 2020

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Orchard Management

Working with a Reduced Labour Force in Apple Orchards

Amanda Green, Tree Fruit Specialist, OMAFRA

With a delay in the arrival of workers from the Seasonal Agricultural Worker Program and a 14-day self-isolation period, many growers are finding themselves working with a reduction of workers. Some growers may have brand new workers who came from alternative, local sources who are on steep learning curves and may not be as quick as their usual crew members. There could also be situations that could occur later in the year where some crew members fall sick and aren't able to work. Prioritizing tasks and blocks of high-value cultivars and being strategic will be crucial for getting the most impact from the labour put into your orchard and the least impact on your final crop value.

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Pruning

As pruning is needed now, this hand labour task may be the most impacted. Prioritization is key this year. Take some time to walk through some blocks and evaluate which blocks need the most pruning. Put more focus on your higher value cultivars. Also take the time to critically think about which cuts will make the most impact for your canopy. Also consider the skills of labour that you have currently and the skills of the labour force that you will expect in the following weeks.

Making Each Cut Count

- Each cut costs money. Train your crew to make the cuts that will be most impactful to your canopy management; e.g., renewal cuts that remove the largest diameter branches that will also open up the canopy. Perhaps take 2-3 big cuts per tree (or less, depending on your time and resources) to cover more orchard in a limited amount of time.
- If there is extra time, go through and make those fine-tuning cuts e.g. simplifying branches or “click-pruning” cuts.

Working with New Employees

Here are some great tips I have heard from growers who are working with new local employees while waiting for their crew to arrive:

- “Have new workers do the pruning from the ground. Save the pruning that requires platform use or ladder use for workers who will be arriving later who have more machinery experience and safety training.”
- “Walk through the orchard and mark the branches that you want pruned out with a spray can. It reduces the time to train new workers who may only be here just for the season. It also reduces the thinking time involved in deciding which branches to prune out for the new workers on a steep learning curve.”

Accurate Chemical Thinning to Lessen Hand Thinning Labour Requirement

If there is less of a labour force by the time of thinning, this may be the year to be more aggressive with your chemical thinning. Aim to hit your thinning-target or overshoot it, it will hurt more if you under-thin when you don't have the labour to hand thin. Also remember that if you do thin off too many fruitlets it will result in a smaller number of bigger fruit at harvest which takes less labour to harvest than a greater number of small fruit. Nibble thinning and the Fruitlet Growth Model are some approaches that can help you to thin to your target more accurately.

Thinning an Unpruned or Poorly Pruned Orchard

- If you were unable to get all of your orchard blocks pruned you will need to take in account the effect of extra foliage on the ease of fruitlet thinning. When buds are more shaded they will thin more easily than fruit buds that are more in the open.

Setting Your Crop Load Target

- Setting your crop load target is the first step towards precision thinning. A target will help you know how much thinning you can be comfortable with and will help you to determine whether it is worth putting that additional thinning application to save you the hand labour cost later on. There are two methods that you could use to help you to determine your crop load targets.

- Base it on the trunk cross-sectional area of the tree (Table 1).
- Base it on the desired yield and desired fruit size. Base the desired yield on the history of the orchard block and its yield potential. See Table 2 and 3 and formula below.

$$\text{Fruit/tree} = \frac{\text{Desired yield (bu/acre)} \times \text{desired tray size (apples/ bu)}}{\text{trees/acre}}$$

Example

Desired yield= 1000 bu/acre

Desired tray size= 88 bushel count fruit

Trees/ acre= 1210

$$\text{Fruit/ tree} = \frac{1000 \text{ bu/acre} \times 88}{1210}$$

Fruit/ tree= 73

Table 1. Crop load recommendations for apple trees based on the trunk diameter (Adopted from Robinson, 2008)

Trunk diameter (cm)	Trunk Cross- sectional Area (cm ²)	Recommended Number of Fruits/ Tree ^a		
		Weak Growing Biennial Varieties (Honeycrisp)	Strong Growing Biennial Varieties (Fuji, Golden Delicious, Crispin (Mutsu), Northern Spy)	Annual Varieties (Gala, Empire, McIntosh, Idared)
0.6	0.3	1	2	2
1.3	1.3	5	6	8
1.9	2.9	11	14	17
2.5	5.1	20	25	30
3.2	7.9	32	40	48
3.8	11.4	46	57	68
4.4	15.5	62	78	93
5.1	20.3	81	101	122
5.7	25.7	103	128	150
6.4	31.7	127	158	190
7.0	38.3	153	192	230
7.6	45.6	182	228	274
8.3	53.5	214	268	321
8.9	62.1	248	310	372
9.5	71.3	285	356	428
10.2	81.1	324	405	486
10.8	91.5	366	458	549
11.4	102.6	410	513	616
12.1	114.3	457	572	686
12.7	126.7	507	633	760

^a For Honeycrisp, the recommended crop load = 4 fruits/ cm² trunk cross-sectional area (TCA). For other biennial bearing varieties, the recommended crop load = 5 fruits/cm² TCA. For annual varieties the recommended crop load = 6 fruits/cm² TCA.

Table 2. Effect of Apple Fruit Size on Tray and Bin Requirements

Minimum fruit size			Tray size	Number of apples per bin ²
wt (g) ¹	mm	inch		
102	57	2 ¼	196	3,920
114	60	2 ⅜	175	3,500
123	64	2 ½	163	3,260
133	67	2 ⅝	150	3,000
145	70	2 ¾	138	2,760
160	73	2 ⅞	125	2,500
177	76	3	113	2,260
200	79	3 ⅛	100	2,000
227	83	3 ¼	88	1,760
250	85	3 ⅜	80	1,600
278	89	3 ½	72	1,440
313	92	3 ⅝	64	1,280
357	95	3 ¾	56	1,120
417	98	3 ⅞	48	960
¹ These values are approximate as fruit of the same diameter can differ in weight. ² 20-bushel bin capacity.				

Table 3. Effect of Fruit Size in Relation to Crop Load

Minimum size		Number of apples required per tree for given tree density, desired yield and fruit size							
		Tree density (trees per acre)							
		272	500		1,000		1,500		
		Projected yield (bu/ac)							
mm	inch	400	600	500	750	750	1,250	1,000	1500
57	2 ¼	320	480	218	327	163	272	145	218
60	2 ⅜	286	429	194	292	146	243	130	194
64	2 ½	266	400	181	272	136	226	121	181
67	2 ⅝	245	368	167	250	125	208	111	167
70	2 ¾	225	338	153	230	115	192	102	153
73	2 ⅞	204	306	139	208	104	174	93	139
76	3	185	277	126	188	94	157	83	126
79	3 ⅛	163	245	111	167	83	139	74	111
83	3 ¼	144	216	98	147	73	122	65	98
85	3 ⅜	131	196	89	133	67	111	60	89
89	3 ½	118	176	80	120	60	100	53	80
92	3 ⅝	105	157	71	107	53	89	47	71
95	3 ¾	92	137	62	93	47	78	41	62
98	3 ⅞	78	118	53	80	40	67	36	53

Nibble Thinning

- This approach involves applying thinners at multiple times: blossom thinning, petal fall/ early fruitlet thinning and fruitlet thinning. The goal is to take some of your crop load off at each application to get closer and closer to your target. With this approach you are not relying on a small number of applications, waiting for the perfect thinning weather within a certain fruitlet size window. Another benefit is you'll get the positive effects from some of the crop load being removed with the earlier bloom applications, like improved size and improved return bloom on biennial bearing varieties like 'Honeycrisp'.
- For information on blossom thinning, there is an article included in this April issue of the Orchard Network by Dr. John Cline titled *Blossom Thinning Apples with ATS and Lime Sulphur*.
- For petal fall/ early fruitlet thinning timing, two active ingredients are registered: NAA (Fruitone-L ®) and 6-BA (Maxcel® or Cilis Plus®)
 - **NAA** is registered to be applied as early as full bloom at a rate of 1.2-9.7 ppm (39-310 ml /1000 L of water)
 - **6-BA** is registered to be applied as early as petal fall for **improved fruit size** at 10-50 ppm (0.55-2.65L of MaxCel /1000 L of water or 0.5-2.5L of Cilis Plus/ 1000L of water); some fruit thinning may occur at this rate and timing on easy-to-thin varieties or if conditions are quite favorable for thinning. For early **fruitlet thinning**, apply as early as 5 mm king fruitlet size at 75-200 ppm (3.95-10.65 L/ 1000L of water) of MaxCel or 50-200 ppm (2.5-10.1L/1000L of water) of Cilis Plus.

- For regular fruitlet thinning timing, use what you know that works well from past experience. This would be the year to be a touch more aggressive with your products and rates. To help determine if you have hit your thinning target earlier than visual inspection you could use the Fruitlet Growth Model mentioned below in this article. For information on products, rates and timings; as well as conditions that effect efficacy [see the OMAFRA webpage on Thinning of Tree Fruit](#)

Fruitlet Growth Model

- The Fruitlet Growth Model is a very useful tool that has been adopted by some growers to help predict thinning efficacy 7-9 days after thinning application based on the growth rate of fruitlets. This would be much earlier than visual inspection and is also more accurate. This model was developed by Dr. Duane Greene from the University of Massachusetts and is based on the assumption that the fruitlets that will remain/persist will grow faster than the fruitlets that will abscise and drop. This model can be found on Malusim.org and does not require weather station data to be run. More information on this model can be found in the April 2018 issue of the Orchard Network Newsletter in the article titled [Using the Fruitlet Growth Model in Your Orchard](#).
- This model does involve a lot of measuring and data entry but the time required will pay off later with a more accurate thinning job and less reliance on hand thinning. If this is your first year trying the model, try it on 3-4 key cultivars for your operation in representative blocks.

Once June Drop has occurred inspect your orchard blocks' crop load and prioritize hand-thinning the blocks that have the heaviest crop load first and the cultivars that you may usually struggle with size with ie. 'Gala'. Also take in account that you may want to prioritize the cultivars that give you the most value.

Harvest

If you find yourself with a reduced work crew when harvest arrives, again you will have to prioritize your blocks. Focus on harvesting the blocks that will give you the most value for your labour i.e. blocks with larger fruit and blocks with high value cultivars. You could also use plant growth regulators such as ReTain® or Harvista™ to manage your harvest and stretch out the window for picking your higher value cultivars. See the OMAFRA webpage on [Plant Growth Regulators](#) for guidance on how to use ReTain or Harvista.

Blossom Thinning Apples with ATS and Lime Sulphur

Dr. John A. Cline, Pomologist and Tree Fruit Physiologist, University of Guelph

Apples trees typically produce an excessive number of flowers, however only a fraction are required to produce a commercial crop. Thinning practices are therefore critical to maximize returns by optimizing fruit size and quality, return bloom, and prevent biennial bearing. Hand thinning is the most effective method to thin, but there are three significant disadvantages. First, it's done toward the end of the fruit cell division stage, hence has less impact on size at harvest than thinning earlier. Secondly, because it's done after flowering initiation has started, hand thinning has less impact on promoting flower development and return bloom for next season's crop. And thirdly, it is labour intensive and therefore an expensive management practice. Given the uncertainty of labour availability through the Seasonal Agricultural Worker Program for hand thinning this season (or the cost of labour in general), growers may consider methods to reduce the need for hand thinning.

Blossom thinning has been practiced more widely in regions, such as the pacific north-west, where spring weather is more predictable/less variable and the risk of frost injury to flowers is minimal. However, more emphasis is being placed on 'precision thinning', which employs various strategies to reach a target crop load early with minimal hand thinning. The primary advantages of blossom thinning is that it is quick, inexpensive, and is done very early during fruit development and, theoretically, should provide greater benefit on fruit size at harvest. Two disadvantages, however, are the risk of frost damage after blossom thinning (which can cause additional thinning) and that some chemicals can cause mild to severe phytotoxicity under certain environmental conditions.

Several years ago, we conducted several experiments on apple blossom thinning compounds that included highly refined (low sulphur) mineral oil (Purespray Green Spray Oil 13E), lime sulphur (LS), ammonium thiosulphate (ATS; Oligo S – ATS), citric acid, and some specialty detergents and surfactants. In a two-year trial on 'Empire' we found benefits in one of two years with a single application of ATS and LS.

One of the additional benefits of lime sulphur is that it has about 24 hours of kick-back after the pollen grain germinates, according to Yoder et al. (2009). This post-germination activity extends the time for making an effective thinning spray. Lime sulphur is also a photosynthetic inhibitor and a temporary reduction in leaf photosynthesis can also contribute to thinning by causing a brief period of carbon stress. Spray oil, such Purespray Green 13E, can be added to LS to enhance its penetration and boost its efficacy. When tank mixed with spray oil, LS should be used at a lower concentration.

The aim is to apply these compounds after the king flower has been pollinated by inhibiting growth and fertilization of

the pollen grains on lateral flowers. To be successful, precision timing and use of an efficacious caustic compound is required.

A majority of blossom thinning studies on apples have focused on, and shown the greatest benefit with, sprays of lime sulphur/oil and ATS.

Spray volumes

Thorough coverage is essential in order to target the style of the flower. For well-pruned dwarf and semi-dwarf trees, use 800-1000 litres/ha. Avoid excessive spray volume to minimize leaf damage and fruit russetting. The action of LS is based on its concentration, not on the rate per acre. Do not concentrate the chemicals when spraying at a lower volume.

Products

- Liquid lime sulphur (for example, Loveland lime sulphur, 30% calcium polysulfide) is applied at 1-5% (v/v) when used alone. When mixed with oil, use LS at 1.5 to 2% (v/v). Oil options include dormant petroleum oil at 1%, or summer oil, for example Purespray Green 13E at 1% v/v (mineral oil); the mineral 'summer' oil may be the safer alternative. Trials conducted in the mid-Atlantic (USA) have demonstrated that the LS plus oil as a tank mix combination is more effective than LS alone.
- ATS (Oligo S ATS or similar product) is applied at 1-2% (v/v) alone. It is not recommended to combine it with oil

Because the king and lateral flowers open at different times, and there are hierarchies in flowering on the tree, two applications of LS or ATS during the bloom period are suggested. If weather conditions are not conducive to a second application or if less aggressive blossom thinning is desired, a single application may still be of benefit in multi-step thinning programs. In years of a protracted bloom period, a third application may be necessary, but there is less data currently available to support this recommendation.

Application

Application of LS as a blossom thinner has a very small and precise window of application. There are models to assist with application timing, but these are not commercially available in Ontario at this time (but we are working on this). The timing of blossom thinners must be done by visual estimates of the percentage of open blossoms. Typically, two sprays, one at 20-30% bloom followed by a second spray at 80-100% bloom. Models like the pollen tube growth model (from the USA) help improve precision of timing the sprays, but blossom thinning can still be done without this model with satisfactory results.

Precautions

When applied properly under favorable weather conditions, LS and ATS have been used safely as blossom thinners. Both can cause apple leaf burn and fruit russet. Avoid use of LS and ATS when a high temperature is forecast to exceed 27°C within 24 hours. The potential for injury is greater under slow drying conditions (low light, high humidity). Avoid spraying under these conditions and use the lowest effective rate and spray volume if you must thin when high temperatures and poor drying conditions are imminent. Tender foliage that grew under cool, cloudy, damp conditions is tender and more likely to show symptoms.

Do not tank mix other spray materials when thinning with LS or ATS. Immediate repeat applications of LS or ATS are very likely to increase the thinning response. Also, oil and captan fungicides (eg, Maestro) should never be applied in close proximity; leave a two- to three-week interval between the last spray containing oil and the first captan spray. If there is a high risk of severe frost or freeze damage during the bloom period, consider delaying or avoiding application of LS and ATS bloom thinners.

What to expect after thinning with Lime Sulphur and ATS?

Petal browning is common and can be observed within a day of application (Figure 1). Sometimes minor leaf phytotoxicity (leaf curling, yellowing, marginal necrosis) may occur. If LS and ATS are applied under suboptimal weather conditions or at too high a concentration, significant damage to spur leaf tissue can occur. Excessive damage to spur leaves is undesirable as spur leaves are important in promoting fruit growth and enhancing fruit calcium. Injury (phytotoxicity) to spur leaves will have a negative effect on fruit size, fruit set, and fruit mineral content.

Since LS and ATS inhibit flower fertilization, their effects on fruit drop can be observed shortly after petal fall. An advantage of bloom thinning is that a clear size difference between setting and shedding fruit can be observed in advance of making a subsequent fruitlet thinning application at 8 to 12 mm fruit diameter. Growers can therefore adjust rates of post-bloom thinners based on the efficacy of the blossom thinning application(s).

Bloom thinning with ATS and LS may increase fruit russet. Therefore, avoid blossom thinning cultivars sensitive to russet: Golden Delicious, Gingergold, etc.

Final Comments

Consider incorporating blossom thinning in your overall crop load management strategy. Don't expect or try to accomplish all your thinning at bloom. Plan to follow up with petal fall and fruitlet chemical thinners where necessary with the overall goal of reducing hand thinning.

Cultivars that are good candidates for blossom thinning include those that are more difficult to thin, those that tend to be small sized (eg, Gala) and those that require early thinning to enhance return bloom (eg, Honeycrisp, Fuji, Northern Spy)

If you are new to blossom thinning, consider trying it on a small block, especially if its an “on” year. Be sure to leave some trees untreated for comparison purposes. Lastly, be sure to check product labels – as any information provided therein supersedes comments or suggestions in this article.



Figure 1. Response of Empire apple flowers to sprays of 2% lime sulphur approximately 24 hours after application. (Photo: J. Cline)

Reference

Yoder, K., R. Yuan, L. Combs, R. Byers, J. McFerson and T. Schmidt. 2009. Effects of temperature and the combination of liquid lime sulfur and fish oil on pollen germination, pollen tube growth, and fruit set in apples. *HortScience* 44(5):1277-1283

Any mention of products or company names does not imply any affiliation with or endorsement of them. I have no actual or potential conflict of interest in relation to this article, nor any financial interest with manufacturers or any commercial products mentioned in this article.

The March of Spring

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Everybody talks about the weather, but nobody does anything about it. (Mark Twain)

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Everyone loves to talk about the weather. Arguably, agricultural producers are most vocal when it comes to weather, because it affects their very livelihood. On February 2nd, Ontario's prognosticating rodent, Wiarton Willie, forecasted an early spring. In early and mid March, this forecast seemed to be holding. Some may be asking

how this spring is shaping up, but others may ask why this matters. While the warm weather is a delight to many, early warm temperatures are a harbinger of spring frosts - and potential crop losses.

While the SARS-CoV-2 virus hasn't affected the weather, it has raised immense grower concern regarding the availability of labour through The Seasonal Agricultural Worker Program to plant and manage crops. Producers of apples and tender fruit are particularly affected, because if their current order of trees cannot be planted, or established orchards cannot be properly managed, it will have a profound effect on this year's crop and lasting effect on the crops in years to come.

The objective of this article is to investigate and interpret the weather data this spring (up to April 3, the time of writing) at the Simcoe Research Station to predict how the heat accumulation this season compares with recent past springs. To do this, it is important to explain my methodology.

Growing Degree Days

Plants develop and grow in response to the temperature of their environment. Many meteorological elements influence the well-being of a plant, but temperature is the single most important factor contributing to plant response. Because of this, and because information on air temperatures is readily available, plant development can be fairly accurately estimated using heat units -- expressed as growing degree days. The concept assumes that each plant has its own particular base or threshold temperature below which growth does not occur, much like insects. For fruit trees, 5°C is widely used as the base temperature. The amount of heat accumulated during the day can be obtained by simply subtracting the plant's base temperature from the mean temperature for the day, and is referred to as *growing degree-day* accumulation.

Results

As of April 4, 2020, 39 growing degree days (GDD) have been accumulated (as of April 4) at the Simcoe Research Station, Simcoe (Figure 1). This is approximately 15% of what is required to reach bloom. In comparison with the past four years, the season has accumulated a similar quantity of GDD as 2017. In 2016, 39 GDD were accumulated by March 14, while in 2018 and 2019, this point was not reached until April 30 and April 13, respectively.

It is important to recognize that most of the GDD accumulates after mid April – the time when temperature impacts plant development the greatest in the march toward bloom.

Using temperature forecasting data, as of April 5 full bloom for apples should occur close to May 20th. Note that this prediction is only as good as the daily temperature data it relies on– and it is generally difficult to accurately estimate data six weeks in advance.

In summary, based on the observation using GDD, the

2020 spring growing season is shaping up as fairly 'normal'.

It is my sincere hope that you will be able to complete your winter pruning, spring fertilizer and spray programs and planting on schedule and have the sufficient help to achieve this in these uncertain times.

Select resources you may wish to investigate

Online Weather Data and Forecasting

- Weather and forecasting (<https://farmwest.com/climate>)

- Environment Canada -current weather, past weather (https://climate.weather.gc.ca/historical_data/search_historic_data_e.html)
- Accuweather (current weather and forecast 30-60 days (<https://www.accuweather.com/en/ca/canada-weather>))
- Weather Underground – useful interface (<https://www.wunderground.com/weather/ca/collingwood>)

Growing Degree Resource:

- A useful interface for calculating growing degree days for various locations in Ontario (<https://farmwest.com/climate/gd>)
- Farmzone.ca

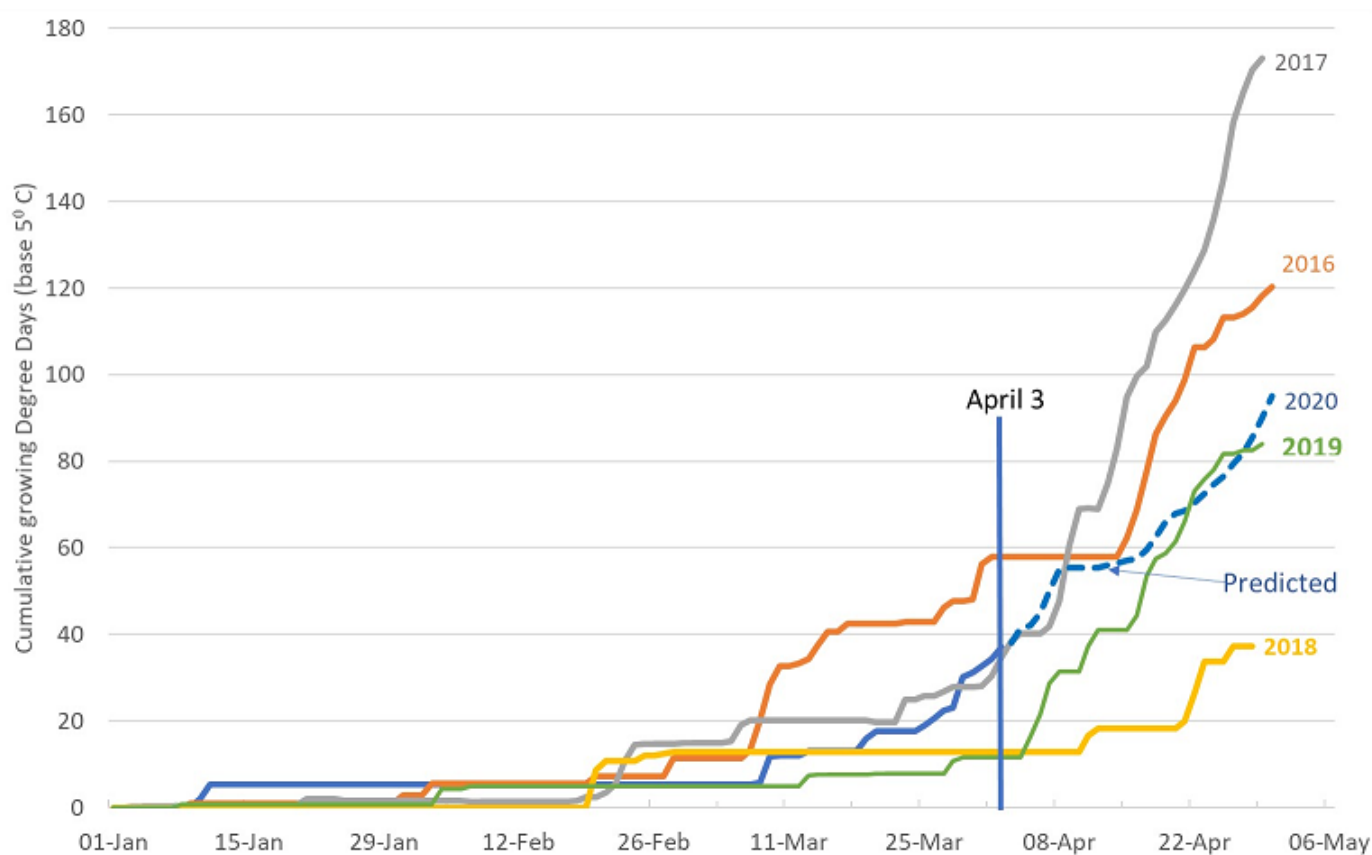


Figure 1. Heat accumulation from Jan 1 – April 30 at the Simcoe Research Station, as express by growing degree days (base 5°C), for the 2016 - 2020 growing seasons. The data from April 3 – 30, 2020 (dashed blue line) has been estimated based on predicted daily minimum and maximum temperatures.

Crop Protection

Diagnostics in a World of Social Distancing

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Adapted from Dr. Sarah Jandricic, OMAFRA Greenhouse Floriculture IPM Specialist and Dr. Chevonne Dayboll, OMAFRA Greenhouse Floriculture Specialist

How do you get help in this day and age when your extension specialist or consultant can't just stop by and look at a problem with you? Although nothing can replace seeing an issue first-hand, **there is still a way to get help with your pest and production issues** from a distance.

The following are some tips on key information you need to send and how to take good photos to make getting quick and accurate answers from experts easier via email or messaging.

1. Provide Detailed info on What's Happening Now AND the Crop History

Although extension specialists, consultants and company reps are pretty good at drawing on personal or shared experience to diagnose a problem, we can't do that in a vacuum. What we need is information - and LOTS of it - to do some deduction. Here are the kinds of details we need when it comes to disease, pest OR production issues.

Describe the issue you're currently seeing, including:

- **The cultivar(s), rootstock(s) and growth stages affected** - Is it in just one cultivar or rootstock? On young trees?
- **Symptoms** - This includes a description of the **plant tissue affected** (leaves, blossoms, fruit, branches, trunk, roots) as well as their **location on the plant** (e.g. lower leaves only, growing tips, upper canopy, near pruning cuts) and your best verbal or written description of it.
- **Distribution** - Is the problem scattered throughout the orchard, appearing in patches or affecting the whole block evenly? Is the problem along the orchard perimeter or near a woodlot?
- **When you started seeing problems** - Try to note if this was **before or after any significant treatment** (e.g. PGR or pesticide application) **or environmental event** (e.g. heat wave, heavy rain, hail).
- **Any corrective actions** you have taken to date, since this could affect test results (more on this, below).

Describe the specifics of the crop history, including:

- **What was planted on the land previously** - This is important to include if you've had issues with poor

vigour or low yields.

- **Soil type** – Are there any drainage issues or concerns?
- **Whether your orchard is irrigated** – If it is, where is the water coming from (e.g. irrigation pond, city water)? What is the pH, hardness and turbidity?
- Results of any recent **soil, fruit or leaf nutrient tests**.
- **Sprayer practices** – This includes type of sprayer, typical water volumes used, water quality (pH, hardness, turbidity) and sprayer calibration.
- The low-down on your **nutrition and IPM programs** (remember to BE HONEST about the chemicals you're using so we can help you better).

2. Take Good Quality Photos Showing the Scope of the Problem

It's an old adage, but it persists because it's true: a picture really is worth a thousand words. Since we can't be in the orchard with you, you'll need to be our eyes.

The types of pictures that help with diagnosis and identification are:

1. **Scope of the problem across the block**
2. **As much of the whole tree as possible** to show where the symptoms are. Photos of the graft union and/or roots might be necessary if vigour or dieback is an issue.
3. **Close-ups of the specific problem**. Take more pictures than you think you will need – we'd rather have more than not enough!

Ensure pictures are clear and in focus. If you are using your phone, make sure you tap the screen on the subject in question to get it into focus, especially if you've zoomed in. Placing your hand, a leaf or a piece of paper behind the subject can help with focus by reducing the background images.

Avoid taking pictures in direct sunlight. If it is a sunny day, keep the sun behind you. You may even try to block the subject in question with your shadow to avoid overexposure. However, make sure there are no uneven shadows across the subject.

3. Get Up Close and Personal Shots

While broad problems such as nutritional or environmental issues can be relatively easy to get good pictures of with a standard cell phone, what's much harder (but just as critical) is GOOD photos of any insect pest.

If you are really keen, the easiest way to do that is by buying a microscope with a built-in camera that can easily connect to your computer. This ensures good magnification, lighting and an easy way to email pictures. There are relatively cheap (\$50-\$100) hand-held microscope cameras available through most major online retailers such as Amazon.

No microscope? Try holding a hand lens over your smartphone camera. Figure 4 is an example of a photo taken with my smartphone at a regular distance (left) versus a close up (right). It may take some playing around to find the optimal distance that works for your particular hand lens – they are not all made equal! Take a LOT of photos to be sure you get a clear one. I always check by zooming in on the picture on my phone first before I send it to anyone.

4. Send Reports from Diagnostic Labs

In a situation where your consultant or extension specialist can't make it in person, results from diagnostic labs are even more important. These include:

- DNA analysis of plant tissue, soil and/or water for pathogens
- Plating on agar to confirm live pathogens
- Insect identification
- Nutritional analyses

Most labs provide detailed guidelines for sampling and shipping, such as the [University of Guelph Agriculture & Food Laboratory](#).

Your consultant or extension specialist can help interpret these results, put them in the larger context of the damage you're seeing and provide some direction for a management program.

5. Be Forthcoming!

Make sure to tell us as much detail as you can – even if you think you may have messed something up or used something you probably shouldn't have! It's far easier to deduce your problem that way, then to make us try and guess the issue (or test our knowledge from a photo out of context). Many symptoms (e.g. wilting trees, russetting, necrotic leaf spots) can look similar even if they're a result of different causes (disease, phytotoxicity, environmental stressors). Consultants and extension specialists often need the "big picture" from you before we can narrow down a specific problem.

6. Don't Hesitate to Reach Out

We are still here to help and provide support via email, phone, text or virtual meeting. If you are experiencing a problem in your orchard or need guidance with an issue, please reach out.

For a full list of OMAFRA specialists, visit the [Agriculture Development Branch Staff Directory](#).

For apple pest related issues, you can reach me by:

- phone or text at 519-420-9422
- email at kristy.grigg-mcguiffin@ontario.ca
- follow or DM me on Twitter / Instagram at @AppleOfMyIPM
- send me a video message via Marco Polo



Figure 1. Getting the full picture of the orchard issues includes photographs of (**left**) the scope of the problem across the block, (**middle**) as much of the whole tree as possible, and (**right**) close-ups of the specific problem. As you can see in this photo series, the affected trees are in patches throughout the block with full tree death occurring. The close-up photo of a collapsed tree shows necrosis occurring at the graft union.



Figure 2. Examples of good close-up pictures of apple pest issues. Placing a hand, leaf or paper behind subject can help with focus.



Figure 3. Photo of mullein bug nymph taken in the orchard using a hand-held microscope linked up to a smart phone.



Figure 4. Left - Picture of San Jose scale on Ambrosia at a regular distance using just a smart phone camera has a resolution that is generally too low to identify immature crawlers. **Right** - Picture taken using a smart phone camera and a hand lens in combination. Here, it's easy to tell the orange immature crawlers are still active in the orchard.

Breaking Bud: Timing Dormant Oil

Kristy Grigg-McGuffin, Horticulture IPM Specialist

Spring-applied dormant oil can seem at times a risky game to play, hoping the right growth stage will align with the right weather conditions. However, by preparing early for this spray and following the forecasted weather, dormant oil can be an effective tool for managing some rather difficult-to-control pests. Insect development and activity is driven by temperature; the milder it is, the faster the insect matures. This improves the efficacy of how oil works as well ensures a lower risk of phytotoxicity concerns.

Over the years, there has been some question whether oil may reduce the overall health of the trees. To date, there is **no scientific evidence** to support these claims. Oil has been used for many years across apple growing regions of the world to control various overwintering pests with no ill effects on the health of the tree when properly applied.

How Does It Work?

Oil sprays work mainly by suffocation. Coating the insect – which means in a high-volume spray to reach all the cracks in the tree bark – prevents normal respiration from the air holes (spiracles) where they breathe. This works best on the immobile and immature stages where: 1) the insect can't move away to avoid the spray, 2) the scale coverings have still not hardened and oil can penetrate, and 3) respiration rate is the highest. However, oil can also interfere with egg development, prevent settling of scale crawlers and deter feeding by pests such as aphids.

If applied properly, the use of dormant or delayed dormant oil can sufficiently reduce the amount of miticides or insecticides that may be used for scale or mites later in the season. Early season oil sprays also fit well into IPM programs because the product is applied before predatory mites and other beneficial insects are present.

What Pests Does It Target?



Figure 1. Overwintering San Jose scale on limb of apple tree

There are several species of scale insects affecting apples; **San Jose scale** (SJS) is the most common in Ontario orchards. This insect overwinters as an immature scale under bark and emerges just prior to bud break. As the immature scales feed, they exude a waxy substance that forms a protective layer. Dormant oil sprays are the best timing for this pest before they develop that waxy covering.



Figure 2. European red mite eggs under bark of apple tree

Without the foliage to block the spray, dormant oil applications can get reasonable coverage of limbs and trunk where the overwintering SJS population is located. Targeting individuals at this stage will help reduce the population that will produce the summer generation crawlers. Postbloom management targets these crawlers which move from the infested area to maturing fruit. These sprays can be very effective at reducing the amount of fruit damage; however, they do not always provide good control of the crawlers that move elsewhere such as to new branches, a different spot on the trunk or to an adjacent tree. In other words, you could find yourself in a continuous cycle of managing fruit damage if

the SJS population is not suppressed. While it may be hard to find time and good weather early season, an oil application is well worth it.

European red mites overwinter as eggs on roughened bark around the bases of buds and spurs, or in the inner parts of the tree close to the main trunk and branches. Oil sprays should be applied before egg hatch, between half-inch green and tight cluster. Some growers in Ontario, who have used dormant oil with good water volumes and good coverage, have achieved excellent mite control with few summer escapes and no need for summer miticides.



Figure 3. A) Apple leafcurling midge eggs in newest leaves of terminal. B) Healthy (left) and powdery mildew infected (right) apple buds.

While delayed dormant oil applications primarily target scale and mites, you may see some additional efficacy against other pests at this timing including impeding egg hatch and movement of **aphids** and some **spring feeding caterpillars**, interfering with egg laying and development of **apple leafcurling midge** and preventing release of overwintering **powdery mildew** spores as infected buds open.

Is It Too Late for Dormant Oil?

Depending on the target pest, the term “dormant” oil can be rather misleading as sprays can be applied from the true dormant state prior to bud break up until pink. Unfortunately, optimal dormant timing for scale is not necessarily the same for mites.

If monitoring indicates scale is a bigger issue in the orchard, oils need to be applied before or shortly after bud break. This efficacy against scale is significantly reduced with later oil applications for European red mite as they develop a waxy protective layer that impedes the oil from effectively penetrating and preventing respiration.

However, if European red mite populations are the problem, sprays can be delayed. Ideal timing is half-inch green to tight cluster but can be delayed to pink; however, blossoms can be quite sensitive to oil under adverse conditions so consider using a lower rate at this timing.

Precautions

Original precautions around the use of dormant oil were

developed prior to the refinement processes that are carried out now with the commonly registered products. Most impurities that were associated with phytotoxic effects with some of the older “heavy” horticultural oils are removed through extra filtration and distillation. If you have concerns with using oil, especially with sensitive varieties like Red Delicious, Empire, Mutsu and Ambrosia, consider a product such as Purespray Green Spray Oil 13E as it is registered for both dormant and summer use.

However, even highly refined “summer” oils can cause crop injury when they are applied:

- when temperatures are consistently below 4°C
- within 48 hours before or after a freezing event
- in slow drying or prolonged wet conditions
- with or too close to products containing sulphur or captan
- do not apply oil within 14 days before or after these products
- above label rate
 - 2% solution (20L/1,000L) for dormant sprays
 - 1% solution (10L/1,000L) for summer sprays
 - High water volumes are essential for good coverage
- to plants that are under moisture stress
- when temperatures are very high (above 25°C)

Always read the product label for additional instructions and precautions.

Prebloom Timing for Woolly Apple Aphid Control

Kristy Grigg-McGuffin, OMAFRA Horticulture IPM Specialist

The woolly apple aphid (WAA), *Erisoma lanigerum* has historically been considered an occasional apple pest in Ontario, but is now seen more frequently in orchards. The transition away from broad-spectrum insecticides such as organophosphates is believed to be associated with the increased pressure from this pest. High density orchard systems may also be favouring its survival with tender, more succulent shoots and close tree spacing facilitating crawler migration.

Feeding damage forms knots or galls on twigs (Figure 1) and roots. This can lead to stunting of new growth, especially on young trees. Areas damaged by WAA are also more sensitive to frost and winter injury.

Aerial colonies overwinter as eggs in bark cracks and crevices (Figure 2). In the spring, nymphs migrate up to apple shoots and tender bark areas. Colonies covered in a white, waxy coating are typically first observed in June on pruning cuts (Figure 3), around wounds of limbs and trunks and at the base of young shoots. As the summer progresses, infestations increase and spread to growing twigs and leaf axils of water sprouts (Figure 4). Failure to control aerial infections



Figure 1. Woolly apple aphid feeding forms knots or galls on succulent growth.



Figure 2. Aerial colonies of woolly apple aphid overwinter as eggs in bark cracks and crevices.

can result in underground infestations on susceptible rootstocks such as M9 and M26.

Typically, WAA management doesn't begin until aerial colonies first start to appear in the summer. While Movento is very effective against this pest, it is slow acting. Therefore, efficacy is best when this product is applied proactively around petal fall or shortly after.

Until recently, Closer and Twinguard were registered for suppression only of WAA. However, both products have now received registration for WAA control at a higher rate than what was previously on the labels. Since these products are not restricted to a postbloom timing like Movento, a tight cluster to pink application could be applied to target the spring nymph activity in high pressure blocks. Keep in mind this may impact

the developing beneficial insect populations which can play a key role in late season management of WAA and other pests.

For more information on rates and restricted entry intervals, refer to the product labels and the 2020-2021 Publication 360A, Crop Protection Guide for Apples.



Figure 3. Woolly apple aphid colonies can be first observed in June on pruning cuts.



Figure 4. As summer progresses, woolly apple aphid colonies spread to growing twigs and leaf axils of water sprouts.

Life After Group M: Fungicide Considerations for Apple Scab Management

Kristy Grigg-McGuffin, Horticulture IPM Specialist, OMAFRA

Pesticide Re-Evaluation

Under the *Pest Control Products Act*, the Pest Management Regulatory Agency (PMRA) is required to re-evaluate all registered pesticides every 15 years. As new science, methodology or technology becomes available, a registration status or use pattern on a crop can change. Special reviews can also be initiated at any time for a particular pesticide when there is reason to believe human health or environmental risks are unacceptable, e.g., neonicotinoid insecticides and pollinator health. All information on past and present re-evaluations can be found in the [Pesticide Product Information Database](#) on PMRA website.

A significant number of Group M fungicides that are key products for apple scab management have recently gone through the re-evaluation process. The final decisions for products being phased-out are summarized in Table 1 below.

A requirement of the final decision for captan was for the change of all formulations to a water soluble packet which is why Maestro 80 DF and Supra Captan 80 WDG are listed for phase-out in Table 1. The new WSP formulations have different PCP numbers. It has been confirmed with PMRA, that any existing stock of the old formulations can be sold until May of this year and can still be used **as per the label on the container** until May 2021. This includes a 48-hour re-entry interval, 7-day preharvest interval and no restrictions to the number of applications per year.

However, if using the new formulations, Maestro 80 WSP or Supra Captan 80 WSP, you are **legally** required to follow the new use patterns based on the final re-evaluation decision and stated on the label. These new patterns are summarized in Table 2.

On a lighter note, the final re-evaluation decision released in February 2020 for another registered Group M fungicide, folpet (Folpan 80 WDG) maintained all uses on apples. The new restricted entry interval will be 6 days for hand thinning with a maximum of 6 applications per year. While this is not a strong stand-alone product for scab, especially under moderate to high pressure, this could be used as a tank-mix alternative for resistance management. Be sure to read the label carefully as there are phytotoxicity risks over bloom to early cover on Delicious varieties.

Lastly, the mancozeb re-evaluation decision is anticipated to be released June 2020.

Table 1. Date of last sale and use for registered apple fungicides being phased-out based on recent final re-evaluation decisions

Active Ingredient	Trade Name	Last Date of Sale	Last Date of Use
metiram	Polyram DF	June 21, 2020	June 21, 2021
thiram	Granuflo T	December 14, 2020	December 14, 2021
ferbam	Ferbam 76 WDG	December 14, 2020	December 14, 2021
captan	Maestro 80 DF Supra Captan 80 WDG	May 10, 2020	May 10, 2021

Table 2. New use pattern requirements for Maestro 80 WSP and Supra Captan 80 WSP.

Label Specification	High Density (tree canopy width <2m/tree)	Low Density (tree canopy width >2m/tree)
Rate (per application)	2.4 kg a.i./ha, or 3 kg/ha	2.4 kg a.i./ha, or 3 kg/ha
Maximum applications per year	10	2 (if hand thinning, max. 1 before and 1 after thinning)
Restricted entry interval	15 days (hand thinning/harvest) 6 days (hand pruning/training) 2 days (all other activities)	24 days (hand thinning) 19 days (hand harvest) 4 days (hand pruning/training) 2 days (all other activities)

Why Are Group M Fungicides Important?

The Group M fungicides mentioned in the previous section are important disease management tools for several reasons:

1. **Multi-site, contact fungicides** – Products in this group have multiple modes of action targeting a pest which means the resistance potential is very low. If one mode of action is ineffective on a pest, the fungicide still has activity from other reaches which keeps the pest population (and those resistant individuals) below the economic impact threshold.
2. **Broad-spectrum pest range** – In general, the Group M fungicides target a wider range of apple pests compared to some more recently registered target-specific products and/or fungicide groups.
3. **Relatively inexpensive** – Some newer fungicides on the marketplace are 2-3x the price of many Group M fungicides on a \$/ha basis. Buying in bulk, some Group M fungicides can be quite cost effective.
4. **Critical component to resistance management** – The majority of fungicide groups that remain, including Groups 1, 3, 7, 9, 11 and U12, require a tank-mix with a protectant fungicide. Group M fungicides not only manage many diseases, but also maintain the life of other products.

Dormant

The efficacy of dormant copper sprays to reduce the spread of fire blight inoculum from overwintering cankers has often been debated. Its effectiveness really comes down to how it is applied and post-application weather. Copper provides an unfriendly environment over the bark and bud surfaces of the tree, preventing bacteria from getting established or spreading. Thus, it must be applied as a high-volume spray to ensure sufficient coverage.

Copper sprays applied to green tissue may also provide some protection against apple scab overwintering in buds equivalent to mancozeb applied at this stage.

Dormant copper such as Copper Spray, Copper 53W, Cueva and Parasol can safely be applied up to ¼" green (possibly ½" green) without risk of phytotoxicity. However, the use of a softer copper registered for season-long control such as Cueva could be extended in those early spray timings to ½" green or tight cluster in blocks with low scab inoculum (ie., free of scab last year). Residual activity typically lasts about 7-10 days under ideal spring conditions. However, once rainfall exceeds 3" from last copper application, it should be assumed all residue has been washed off.

Using 1-2% dormant oil, unless the label states otherwise, will act as a sticker/spreader as well as provide efficacy on scale, European red mite and suppression of powdery mildew. Cueva is formulated with a fatty acid so there is little benefit to adding oil as a sticker. If using dormant oil, do not apply captan or sulphur products within 14 days of application. Oil can enhance penetration of these products into sensitive tissue, resulting in phytotoxicity issues.

Green Tip to Tight Cluster

Unfortunately, the cool temperatures we often experience in early spring do not kill scab spores. Spores will continue to mature in overwintering leaf litter and release so long as there is a wetting period long enough for infection to occur. While mature spores are released more during warm rains than in colder ones, they can still cause infection, nonetheless, if they land on green tissue.

Green tip to tight cluster is a period of extensive new growth. Keep covered with a good protectant fungicide program and re-apply fungicides every 5-7 days during periods conducive to disease development or following heavy (greater than 1") rain.

A protectant program consists of contact fungicides such as captan or mancozeb and does not provide effective post-infection or anti-sporulant activity. That means if sprays are applied in less than ideal conditions, i.e., windy, alternate rows, or washed off in rain, the risk of scab infection is increased. The redistribution characteristics of a fungicide are often considered when selecting appropriate control products. See Table 3-9. [*Characteristics of Apple Scab Fungicides* in the 2020-2021 Publication 360A, Crop Protection Guide for Apples](#) for more information on redistribution of registered scab fungicides. However, it is important to also consider leaf growth since last application, scab pressure and residue wash off when determining an appropriate chemistry, dose and spray interval.

During cool, wet springs, protectant fungicides may not be enough. Consider tank-mixing with one of the products listed in Table 3 that provide post-infection activity. Syllit and Scala should be used early season only, up to tight cluster and pink, respectively. As you approach tight cluster, consider any issues with powdery mildew and/or rust in previous years. If these have been a problem, use a Group 9-containing product that also has activity on these diseases as well, such as Inspire Super or Luna Tranquility. Buran (garlic extract) which is registered for scab and powdery mildew can also be used as an eradicant, or for early post-infection activity following a rain event when protectant efficacy may be reduced. This product does not have pre-infection activity.

In warmer, dryer springs, you could also consider products such as Fontelis or Aprovia Top at the tight cluster stage, both of which have efficacy on scab, powdery mildew and rust.

It is important to note protectant fungicides do not control powdery mildew. Include 3-5 kg/ha sulphur (Microthiol Disperss, Microscopic Sulphur, Kumulus, Cosavet DF

Edge) with the protectant sprays until tight cluster when more effective mildew products will be used. Keep in mind mildew does better in dry conditions with high relative humidity. Protectant sprays may be needed during dry periods when there is little risk from scab. During wet springs like 2019, powdery mildew escapes can happen relatively quickly during breaks in rain events if fungicide residues are washed off.

Pink to Petal Fall

By tight cluster or pink, apples are typically entering a time of critical infection period for scab and powdery mildew with higher daily temperatures, large amounts of lush growth and rapid maturation of spores. Management programs at this point should begin incorporating systemic fungicides (Groups 1, 3, 7 and 11). However, keep in mind that unlike protectant fungicides, which have multi-site activity and low resistance potential, systemic fungicides are typically single-site and are at high risk of resistance development. For resistance management:

- Include at least half rate protectant fungicides with all applications.
- Do not use products containing the same chemical group in consecutive applications.
- Do not use Group 3 fungicides including Nova, Fullback and Inspire Super after bloom as they are weak on fruit scab.
- Do not use systemic fungicides for post-infection activity.

While captan does not provide effective rust control, mancozeb does. Be sure to keep mancozeb as the protectant tank mix particularly at petal fall if rust is a concern in your orchard. It's best to avoid the use of captan in general during this growth period to avoid phytotoxicity by complicated tank-mixes, use of adjuvants or other incompatibility issues. Instead, save captan for summer disease control.

While this section does not focus on Buran, the use of this product as a post-infection and/or tank-mix option would still be effective against scab during this timing until the first summer covers.

The remainder of this section and Table 4 look at systemic fungicides registered for control of apple scab in more detail.

Methyl benzimidazole carbamate (MBC) fungicides

The fungicide Senator belongs to the MBC fungicides (Group 1) and is registered for control of apple scab and powdery mildew. This product may also have efficacy on black rot, fly speck and sooty blotch if applied for scab when these pests are active.

Historically, Benlate-resistant forms of apple scab have been present in Ontario. Senator belongs to the same chemical group as Benlate. Use caution if Benlate was used in your orchard in the past. For resistance management, tank-mix with a compatible protectant scab fungicide from a different group. See label for more information on suggested tank-mix partners.

Succinate dehydrogenase inhibitor (SDHI) fungicides

The SDHI fungicides (Group 7) are the newest group of systemic fungicides including Fontelis, Aprovia Top (Group 3+7), Sercadis, Kenja, Luna Tranquility (Group 7+9) and Pristine (Group 7+11). These products are registered for control of apple scab, powdery mildew and rust (Fontelis, Aprovia Top only). Some formulations within this group contain mineral oil or require a surfactant, which can result in injury under certain conditions if used in combination with captan. Always refer to the label.

At the present time, there is no known resistance to any Group 7 product in Ontario. For this reason, more applications of these products can be used compared to the Group 3 and 11 fungicides. A maximum of 4 applications of Group 7 fungicides is allowed each season, with ideal placement between tight cluster and first covers. However, Pristine is also a very effective product for the control of fruit rots. Since this pre-mix product includes Group 7, it may be worthwhile to save 1-2 applications for summer use.

As with all sound resistance management practice, do not apply consecutive sprays from the same fungicide group. This is where other fungicide groups can come into play with product rotation.

Sterol Inhibitor (SI) fungicides

The SI fungicides (Group 3), now including Nova, Fullback, Cevya, Aprovia Top (Group 3+7) and Inspire Super (Group 3+9) have been a standard for control of apple scab, powdery mildew and rust for many years. Resistance to Nova has been documented in Ontario scab populations and suspected in powdery mildew populations. For this reason, SIs should not be used in

orchards with resistant scab populations and should always be tank-mixed with a protectant fungicide, including the recently registered product, Cevya. The benefit to keeping Group 3 fungicides in rotation is the good powdery mildew and rust control they offer (so long as resistance is not present) as well as to help reduce resistance pressure for the SDHI fungicides.

Strobilurin fungicides

Similar to the SIs, the strobilurin fungicides (Group 11) such as Flint, Sovran and Pristine (Group 7+11) have been used for many years for control of apple scab, powdery mildew and rust. Scab resistance to Flint has also been documented in Ontario to this group so tank-mixing with a protectant fungicide is critical. Where strobilurins are working, an ideal fit may be at petal fall to first covers as this group has good efficacy on summer diseases such as fruit rots, fly speck and sooty blotch.

Resistance management

One key strategy to good resistance management is rotating between products of different chemical groups. This does not just mean rotating from one product to another. Fungicides are grouped based on their mode of action, or how the product actually affects the disease. For example, all products in Group 3 have the same mode of action, so using one product is virtually the same as using all other products within that group. In pre-mix fungicides, both groups need to be considered in all rotation decisions. Figure 1 shows which fungicides belong to Groups 3, 7, 9 and 11. For instance, since Aprovia Top belongs to Group 3 and 7, it should not be followed by Cevya, Nova, Fullback, Inspire Super, Fontelis, Sercadis, Kenja, Luna Tranquility or Pristine.

Table 4. Efficacy of registered systemic fungicide groups on apple scab, powdery mildew, rust, black rot, bitter rot and fly speck/sooty blotch on apples.

Fungicide Group	Scab	Powdery mildew	Rust	Black rot	Bitter rot	Fly Speck / Sooty Blotch
1 (Senator)	+++	+++	--	+++ ¹	+ ¹	++++ ¹
3 (Cevya, Fullback, Nova, Aprovia Top, Inspire Super)	+++ ²	++++	++++	--	--	--
7 (Fontelis, Kenja, Sercadis, Aprovia Top, Luna T, Pristine)	++++	+++	+(+)	--	--	+++ (Aprovia only)
11 (Flint, Sovran, Pristine)	++++*	++++	++	+++	+++	++++

+ = poor control or partial suppression; ++ = suppression; +++ = good control; ++++ = excellent control

¹ Not registered on this disease.

² Resistance is present in ON to some products from this group.

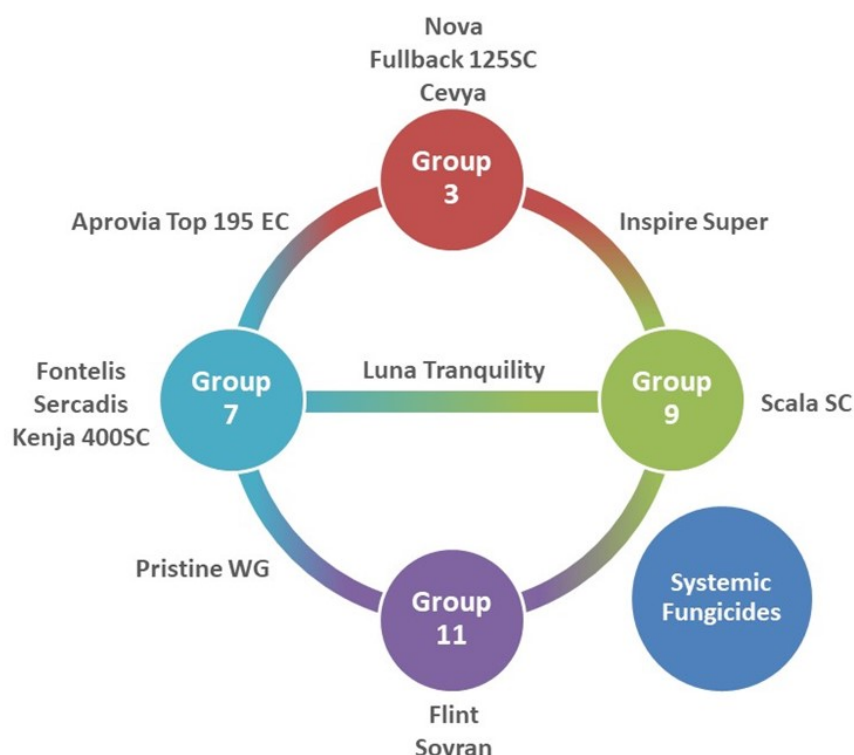


Figure 1. Schematic diagram of Group 3, 7, 9 and 11 fungicides, including pre-mixes registered for use on apples.

Summer Sprays to Harvest

The end of primary scab season can be determined through the use of the ascospore maturity degree-day model as described in the apple scab module on [Ontario AppleIPM](#). At 418 DDC (degree-days Celsius), over 95% of the ascospores supply should be depleted if sufficient rain has occurred. After this point, wait 2 weeks and then check the trees for scab. It can take up to 14 days for lesions to appear after a scab infection period. Be sure to check the top of standard trees or anywhere else spray coverage may not have been adequate, such as a thick tree canopy. Primary scab is often overlooked in these areas and can come as a surprise when lesions suddenly show up on the fruit late season.

If primary scab was controlled, the rates of fungicides may be reduced and the interval between sprays may be lengthened for the remainder of the growing season. Following first or second cover, mancozeb is no longer an option due to the preharvest interval. Summer applications of captan, however, will only provide efficacy on scab, black rot, bitter rot, fly speck and sooty blotch if the full rate is used. Remember, if using the new captan WSP formulations, low density orchards with a canopy width of 2m will be restricted to a maximum of 2 full rates of captan at 3 kg/ha and a 19-day PHI. Rotation with alternative products effective against summer diseases such as Allegro (28-day PHI) or Pristine (5-day PHI) will be necessary to compensate for the limited captan allowance. Regardless, if summer oil or other tank-mixes that are

incompatible with captan are used, rotation with the above mentioned products will be important. Allegro will also provide mite suppression.

Following harvest, scab management can continue by reducing the amount of overwintering inoculum and pressure you'll be starting out with in the orchard next season. Applying urea fertilizer at 45 kg/ha (mixed with 1,000 L of water/ha) and/or shredding fallen leaves with a flail mower are two practical and inexpensive methods to minimize scab pressure. Ideally, these practices should be done in the fall and/or before green tip if possible, but there may still be some benefit if this is delayed shortly after bud break. For more information, see the Orchard Network Newsletter article titled [Reduce Apple Scab with Orchard Sanitation](#).

Summary

The following description and Figure 2 summarizes many points from this article but is only an example scab management program and does not include all control options available. **Select products that fit best for your operation, cultivars, resistance management program and disease pressure as well as current weather conditions.** Product choices in this example were based on a hypothetical cool, wet spring followed by a warm, humid summer and used a somewhat "worst-case scenario", or combination 7x ½ rate mancozeb (77-day PHI) and 2x captan (19-day PHI).

An effective scab management program should begin with a delayed dormant copper application between silver tip and ½" green. This will have efficacy on any early season activity of overwintering fire blight cankers or scab infection periods. From green tip to pink consider a protectant fungicide program consisting of a combination of half-rate mancozeb (especially at pink for rust control) and half rate protectants (mancozeb, folpet, captan) tank-mixed with Sylitt, Scala, Inspire Super or Luna Tranquility. Over the bloom period into the first and second cover, incorporate systemic fungicides belonging to Groups 1, 3, 7 and/or 11 tank-mixed where possible

with half-rate mancozeb. A rotation of Pristine or Senator tank-mixed with half-rate captan or folpet and Allegro as summer cover sprays will provide good control of scab, fruit rots and fly speck/sooty blotch. Allegro can be used up to 3 consecutive sprays before rotating to another fungicide group. A late season application of full-rate captan within the required pre-harvest interval followed up with a Pristine just before harvest will protect against pinpoint scab and any other fungal infections that may occur. Reduce inoculum by applying urea and/or flail mowing in the fall following harvest or as soon as the orchard can be entered in the spring.

Example Apple Scab Program

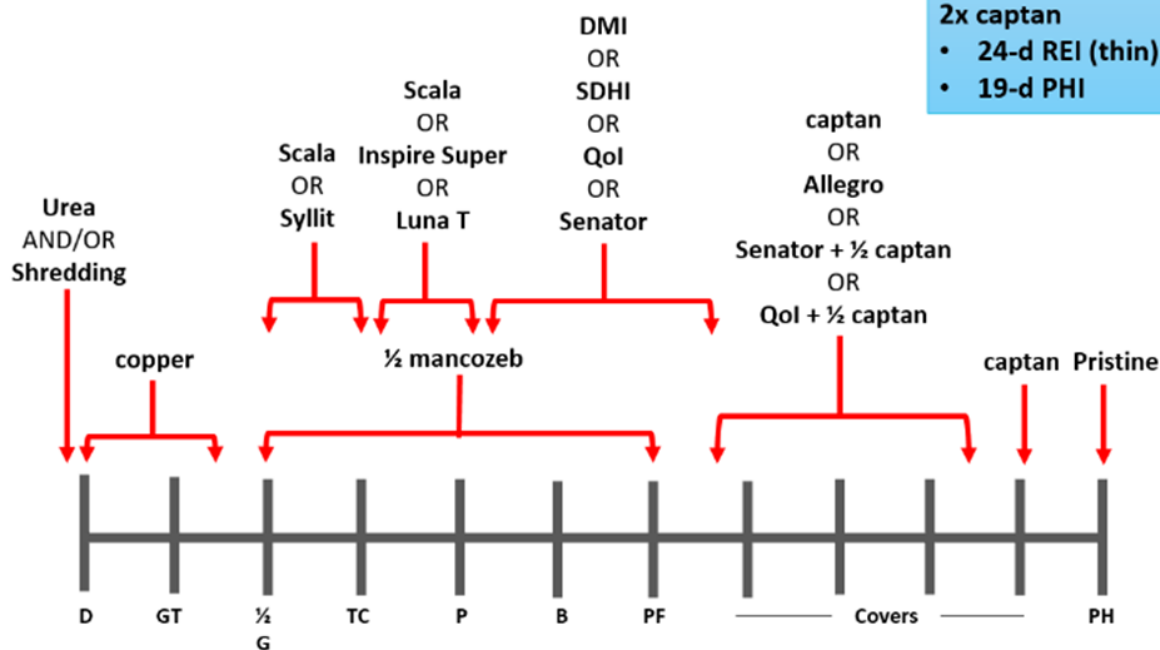


Figure 2. Example of a full-season apple scab management program during a cool, wet spring followed by a warm, humid summer. Fungicides or groups highlighted from tight cluster through summer covers may also provide efficacy on powdery mildew, rust, fly speck, sooty blotch, black rot and bitter rot.

Post Harvest

Storage Regimes to Allow Softening in 'Northern Spy' Processing Apples Treated with 1-MCP

Dr. Jennifer DeEll, Fresh Market Quality Specialist – Hort Crops, OMAFRA

High fruit firmness retention during storage due to 1-methylcyclopropene (1-MCP) treatment is not always beneficial, especially in apples destined for processing. The objective of this study was to investigate the effects of storage regime and postharvest 1-MCP treatment

timing on the softening of 'Northern Spy' apples, to determine if ideal firmness for processing could be achieved after storage while at the same time maintaining fruit quality and extending storage life.

Over four years of study, 'Northern Spy' apples with or without 1-MCP (1 ppm) were held for up to 12.5 months at 0-1°C in the following regimes: (1) controlled atmosphere (CA, 2.5% O₂ + 2.5% CO₂) with or without 2 weeks post-storage ambient air; (2) ambient air or CA; (3) CA with up to 6 months delayed 1-MCP treatment; (4) delayed CA establishment for up to 4 months; (5) delayed 1-MCP treatment in combination with delayed CA establishment for 1 or 2 months.

- 1-MCP treatment at harvest consistently enhanced firmness retention, which remained too high for processing.

- Delayed 1-MCP treatment allowed more firmness loss but fruit remained firmer than those not treated, and these apples would be acceptable for subsequent processing (~14-16 lb).
- Delayed CA within any regime did not result in apples with firmness values acceptable for processing, and additional air storage for 2 weeks at 0 °C after CA had no significant effect.
- Overall, delayed 1-MCP treatment with no delay in CA provided the most acceptable apple fruit firmness for processing.

1-MCP treatment reduced the development of storage rots during long-term storage, compared to apples not treated. Conversely, 1-MCP-treated fruit developed higher incidence of core browning than those not treated, especially after 6 months of storage. However, this is not a major problem for processing because the core tissue is removed. Skin disorders are also not important for processing apples since the peels are removed during the process.

For further information please refer to the following paper - Jennifer R. DeEll and Geoffrey B. Lum. 2020. Storage regimes to allow softening in a processing apple treated with 1-methylcyclopropene. *Canadian Journal of Plant Science*, 100(2): 226-238, <https://doi.org/10.1139/cjps-2019-0235>

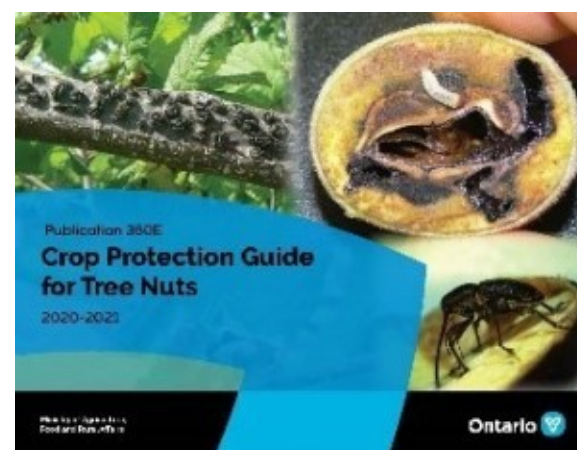
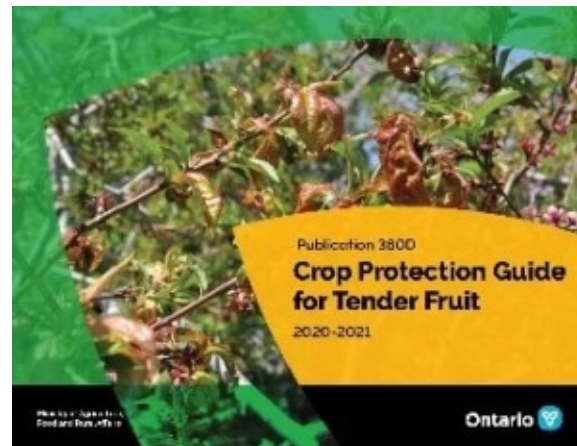
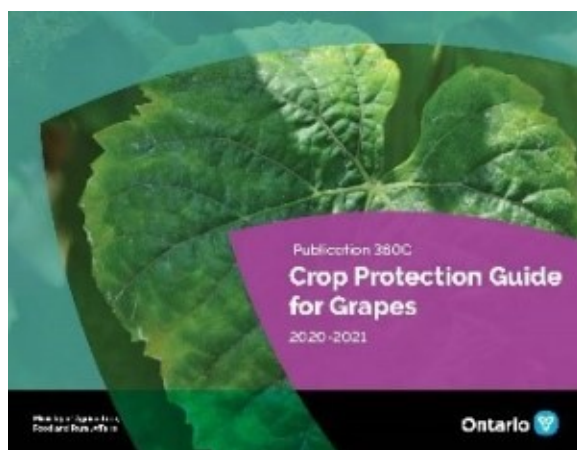
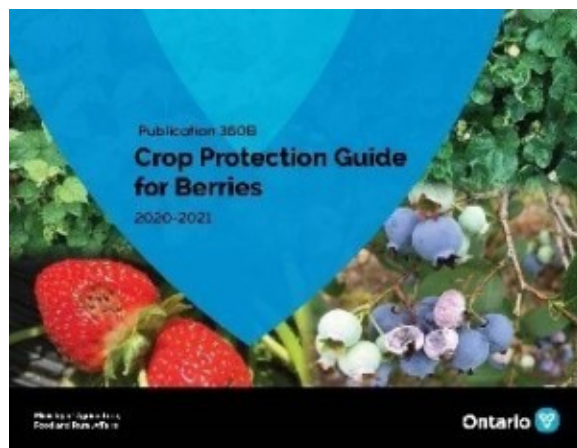
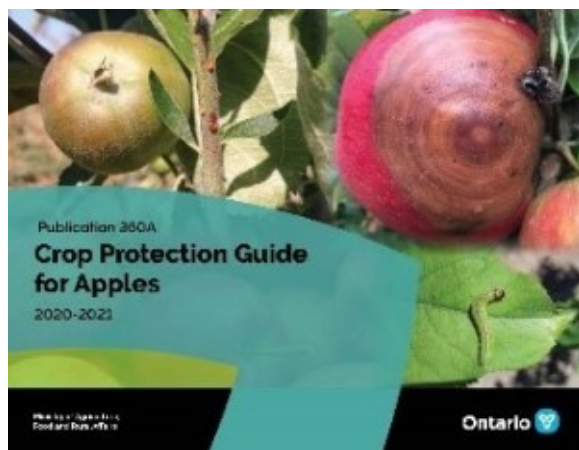
Thanks to AgroFresh Inc., Ontario Apple Growers, Norfolk Fruit Growers Association, Pommes Philip Cassidy, and Storage Control Systems Inc. for their support of this research.

Announcements

Updated OMAFRA Publication Guides Available

The following updated crop protection guides now available for download and/or print may be of interest to fruit growers:

2020 Fruit Crop Protection Guides

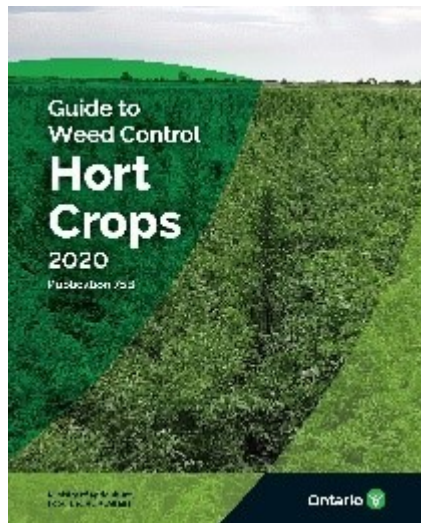


Available free online on the OMAFRA website at [Fruit Crop Protection Guides 2020, Publication 360A, 360B, 360C, 360D, 360E](#). **These are early release drafts of these publications. The final English versions will be posted when ready.**

Publication 360 is now offered as 5 stand alone crop publications: 360A Apples, 360B Berries, 360C Grapes, 360D Tender Fruit and 360E Tree Nuts. These publications provide pest control information for the commercial production of fruit crops. Pest management guidelines are presented in a calendar format and some publications include information on integrated pest management, thinning of tree fruit, plant growth regulators and nematodes. Technical information on products is easy to look up in the many tables in this publication.

Download your copy free [online](#). Print copies of Publication 360A, 360B, 360C, 360D, 360E should be available to order from ServiceOntario Publications in May for \$10 each or \$35 kit of all 5 plus shipping and handling. Order online at [Ontario.ca/publications](#) or by phone 1-800-668-9938 Toll-free across Canada. For a complete list of OMAFRA publications visit [omafra.gov.on.ca](#) and click on 'Publications'. Given the current situation availability of print publications could be delayed.

2020 Publication 75B: Guide to Weed Control Hort Crops



Available free online on the [OMAFRA website](#). Publication 75B has been the definitive source of weed control information for more than 50 years. It has the latest information on managing weeds in all crop and agricultural situations. This guide contains:

- A number of new products and tank-mixes in various horticultural crops;
- Updated Weed Control Rating Tables;
- The latest information on confirmed populations of herbicide resistant weeds in Ontario.

Download your copy free [online](#). Print copies can be

ordered from ServiceOntario Publications at a cost of \$25 plus shipping and handling. Order number 300190. Order online at [Ontario.ca/publications](#) or by phone 1-800-668-9938 Toll-free across Canada. For a complete list of OMAFRA publications visit [omafra.gov.on.ca](#) and click on 'Publications'.

We're from the Government. We're still here to help!

In response to the COVID-19 outbreak, and to respect physical distancing measures, all our fruit specialists will be working remotely but are still available to assist you. We will continue to support the sector's needs by providing services via email, phone and virtual meetings where possible. We understand these are trying times for most and so we want to assure everyone that we are continuing delivery of information in a timely manner through these alternative channels.

We will continue to provide the sector with the support we've always given. Thank you for your understanding.

Visit Ontario's [website](#) to learn more about how the province continues to protect Ontarians from COVID-19.

Sincerely,

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