ONcore

For Commerical Apple Producers

Volume 29, Issue 2, Spring 2025

Orchard Management

Crop Protection

FORECAST OVER FIXED DATES

HOT TIPS FOR COOL, WET WEATHER:

- Keep up with PGRs to control vegetative growth
- Avoid use of heavy equipment to decrease soil compaction and ruts in the orchard
- Consider nutrient leaching — test leaves to confirm deficiencies before fertilizer applications
- Utilize weather windows — get in when you can
- Be aware of the rainfast window for each product
- Thinning cautions:
  - Avoid thinning below 18˚C
  - Cloudy weather aids in chemical thinner efficacy
  - Anticipate a delayed thinner response
- Watch for extended insect emergence
  - Use degree-day models, traps counts, and scouting reports to fine-tune spray timing
- Be on high alert for conditions conducive to disease development:
  - Maintain protectant programs ahead of unsettled weather
  - Rotate FRAC groups when subsequent sprays are needed
- Adjust your IPM plan accordingly:
  - Scout frequently as conditions may change quickly
- Patience now pays later — hold off on hasty decisions until the weather turns

ANNOUNCEMENTS

- Ontario Pest Management Conference
- AgRobotics Working Group Demo Days
- IFTA Ontario Summer Tour

Stay connected to ONcore

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ORCHARD MANAGEMENT

The 2025 Thinning Story

***Erika DeBrouwer**, Tree Fruit Specialist*

This thinning season was, and continues to be, one for the books, the record-keeping books that is. Thinning is always challenging, particularly this season where many regions had to tackle cool temperatures and drizzly weather throughout weeks of chemical thinning timing. Usually, a visual thinner effect is seen between 5 and 7 days following chemical application, this season took a minimum of 7 and up to 12 days. This delay in visual thinner efficacy seems to have been caused by the slow progression of tree growth.

Timing is Every-thin

Waiting for the right day may or may not pay off when deciding to chemical thin. Consideration of the upcoming forecast, current fruitlet stage, future fruitlet stage (next thinning window), current crop load, cost of spraying (and it not working as effectively), cost of not spraying (and relying on hand thinning more heavily) are commonly thought of before thinners are applied. Additional factors to consider for thinner efficacy can be shown in Table 1.

With those factors in mind, efficacy of the chemical thinner application could be affected by the following:

- **Solar Radiation:** sunny conditions aid in energy availability for leaves and fruit.
  - Prolonged cloudy periods reduces photosynthesis, increasing thinner efficacy
- **Temperature:** warm conditions aid in absorption of plant growth regulators.
  - Temperatures between 18 and 29˚C are best for application
  - Warm nights increase respiration and tree stress, increasing thinner efficacy
- **Rainfall:** depending on the amount and the timing, rain can increase or decrease thinner effectiveness
  - Rainfall 24 to 36 hours after application can re-activate blossom thinners
  - Rainfall 6 to 8 hours after application can reduce efficacy of BA thinners and NAA.
- **Humidity:** spray coverage is affected by humidity, which can result in variable thinner effectiveness
  - High humidity softens the cuticle increasing thinner uptake
  - Low humidity makes it more difficult for the product to hit the target due to greater evaporation

If seeking high efficacy of chemical thinners, the following conditions excel thinner effects:

- **Before application**: a few days of cloudy and warm weather (ideally 4 days)
- **During application**: cloudy, warm, and rising temperatures, high humidity (>60%)
- **After application**: clouds persist. rising temperatures, warm nighttime temperatures, and slow dry time

For more predictions based on various weather-related conditions, refer to Table 2.

Table 1. Promoters and suppressors of chemical thinners

Promoters of chemical thinners	Suppressors of chemical thinners
• Lower canopy and shaded fruit spurs with low vigour • Heavy bloom • Fruit set in clusters rather than singles • Inadequate nitrogen • Low moisture • Weak root systems • Young trees with vigorous upright limb growth • Short bloom period	• Fruit set on spurs in well-lit areas (outer and upper canopy) • Light Bloom • Biennial bearing in 'off' year • Fruit set in singles rather than clusters • No mineral deficiencies • Long bloom period

Adapted from William 1979; Williams and Edgerton 1981

Table 2. Climate conditions and resulting predictions of chemical thinners

Climate Conditions	Prediction
Warm Conditions (>18°C)	All thinners work best
Dark Cloudy Weather	• Greater stress • Greater thinning response • Greater drop
High Night Temperatures (>18°C)	• Great stress • High demand and use of energy for night respiration • Greater drop
Very High Day-Time Temperatures (>29°C)	• Great stress • High energy demand • Greater drop
Very Cool Temperatures (<18°C)	• Reduced stress • Reduced energy demand • Greater set
High Light	Increased supply: harder to thin
Low Light	Reduced supply: easier to thin
Low Temperatures	Low demand: harder to thin
High Temperatures	High demand: easy to thin
Low light and warm temperatures	Worst

Adapted from Cornell University and Michigan State University

The Fruit-ure is Forecast

Although there are significant variables to consider when thinning, researchers, industry and growers continue to develop tools to aid you in your thinning decisions.

Carbohydrate Model

This model was developed by Dr. Alan Lakso and Dr. Terence Robinson from Cornell University and has progressed into estimating the timing and amount of chemical thinning applications for improved efficacy.

The model is based on the theory that carbohydrates (energy) are needed to keep fruitlets growing and to remain on the tree. When there is low energy or carbohydrates, fruitlets should thin more easily and drop, where the opposite would occur if generous amounts of carbohydrates are available for fruitlets to resist thinning and set fruit well.

The Carbohydrate Model predicts daily energy supply and demand to determine fruitlet sensitivity to chemical thinning. This is why the model can be applied throughout the season, utilizing knowledge of growth habits and staging within apples. This model assists in predicting how sensitive fruitlets will be to thinning strategies.

The carbohydrate model can be used in Canada through RIMpro, where bud break date and access to a weather station or a subscription based satellite imagery platform is required.

> The **carbohydrate model** is especially informative in determining when to thin, specifically in cloudy and cool conditions.

Fruitlet Growth Model

This tool is utilized to help predict thinning efficacy 7 to 9 days after thinning application. The Fruitlet Growth Model was developed by Dr. Duane Greene from the University of Massachusetts and utilizes the growth rates of fruitlets to determine chemical efficacy. This assumes that the fruitlets that will not abscise will be growing at a faster rate than the abscising fruitlets.

In the past, growers have found that two measurements separated by 3 to 5 days suffices, but this can change based on the season and growth rate of the fruitlets. This model can be used at multiple points during the season and can be continuously used with other tools and modelling systems.

Using the model in the fruitlet growth model in the field, a spreadsheet and two apps have been developed for easier integration.

Fruit Growth App: Joseph and Tom Ferri

The Fruit Growth app was developed to give growers a better idea of fruitset after thinning. Developed by our own Ontario apple growers, Tom and Joseph Ferri, this application gives real-time answers during collection measurements. to replace the excel spreadsheet utilized in the fruitlet growth model. This is currently only available on apple products.

Orchard Tools App: Perennia

The Perennia: Orchard Tools Application was developed to capture data for the fruitlet growth rate model. This application assists with collecting data but would have to be exported into an excel sheet or the MaluSim application to fully utilize fruit set prediction. This application can be used in the orchard to collect fruitlet sizes and is currently only available on apple products.

Thinning by Numbers

Better data now means fewer surprises later. Collecting your fruitlet data tells you how effective your thinner application was AND could tell you ***days earlier compared to visual assessments***. Below are a few strategies:

Tagged Cluster Monitoring

- Select 5 trees per block
- Tag 5–10 representative limbs per tree
- Count and measure fruitlets (diameter in mm) before and 7–10 days after application
- Calculate % fruit drop

Note that this method may be less time consuming but will be delayed in showing thinner efficacy in comparison to the fruitlet growth rate analysis.

Fruitlet Growth Rate Analysis

- Select 5 trees per block
- Mark and number 14 to 15 clusters per tree
  - 7 per side on trellised system
- Begin measuring at 6 to 7mm
- Measure fruitlets at 2-4 day intervals and enter into app or spreadsheet
  - Measurement intervals may have to change based on weather and/or chemical applications
- Run the fruitlet growth rate model in database of your choice (spreadsheet or app)
  - If using Ferri spreadsheet, be sure to enter the amount of remaining clusters with fruitlets for improved accuracy
- Use the predicted fruit set to determine if there is a need for further chemical thinner applications

If you would like further direction Jon Clements has an excellent webpage outlining a how-to approach, background information, and an embedded youtube video for visual learners.

I also want to point out that you do not have to utilize these strategies on every variety – maybe it's only worth the time to perform these data collection methods for high-value or biennial cropping varieties, but that decision is up to you.

Drop Science

Chemical thinners available in Ontario are listed in Table 3, along with application timing, REIs and PHIs.

For more detailed information about volumes and rates, please refer to the following links:

- The Apple Section of the Thinning of Tree Fruit webpage at Ontario.ca
- The Thinning & Plant Growth Regulator Section found in the Apple Landing Page on the Crop Protection Hub
- The Pesticide Label Search for specific product searches

Resources and References

Cline, J. 2021. The Joys of Apple Thinning. University of Guelph

Clements, J. 2021. HRT-RECIPE: Predicting fruit set using the fruitlet growth rate model. UMass Extension Fruit Program

Lakso, A. N., Robinson, T., & Greene, D.W. 2016. Using an Apple Tree Carbohydrate Model to Understand Thinning Responses to Weather and Chemical Thinners. New York Fruit Quarterly.

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Wallis, A., Schwallier, P., & Irish-Brown, A. 2022. Thinning Strategies for 2022. Michigan State University.

Wilton, J. 2012. Chemical Thinning and Application Technology. Future Orchards, APAL.

Table 3. Promoters and suppressors of chemical thinners

Tradename	Active Ingredient(s)	Application Timing	Restricted Entry Intervals (REI)	Pre harvest Interval (PHI)
Accede	1-ACC 1-aminocyclopropanecarboxylic acid	Bloom to 25mm	12 hours	–
Perlan, Promalin	6-BA & GA4,7 6-benzyladenine & gibberellins A4A7	King bloom to early petal fall	12 hours	28 days
Ethrel[1]	Ethephon[1]	Bloom	• Transplanting: 2 days • Hand pruning, scouting, training: 10 days • General: 12 hours	–
ATS[2]	Ammonium thiosulphate[2]	Bloom	–	–
Lime Sulphur[2]	Lime Sulphur[2]	Bloom	–	–
Maintain, Fruitone-L	1-NAA 1-naphthaleneacetic acid	Bloom to fruitlet sizing Bloom to 30 days after bloom	• Maintain: 12 hours • Fruitone-L: when dry	–
Cilis Plus, Maxcel	6-BA 6-benzyladenine	Petal fall to fruitlet sizing, up to 20mm	12 hours	28 days
Sevin XLR	Carbaryl	Petal fall to 25 days after bloom	• High density systems • Hand thinning, hand-line irrigation: 14 days • Hand pruning, scouting, pinching, tying, training: 4 days	75 days

[1] Note that Ethrel (ethephon) can only be applied to non-bearing apple trees

[2] ATS (ammonium thiosulphate) and Lime Sulphur are fertilizers and therefore will not be found in the pesticide label search

Spring's Cold Shoulder

***Erika DeBrouwer**, Tree Fruit Specialist, OMAFA*

As with most seasons, this spring has been no exception to the ever-changing cropping environment. Every season bears its challenges, and this spring has shown to be one of them. Generally, this spring has been cool, cloudy and/or hazy, with consistent drizzle. These weather conditions have impeded timely orchard access for preventative applications, along with prompting questions of thinner efficacy due to cooler temperatures. For more details on thinning efficacy and information please refer to The 2025 Thinning Story article.

GDDs base 10˚C

Table 1 reviews growing degree days (GDDs) in 2025 compared to the 5- and 10-year averages at base 10˚C starting March 1.

All locations at the end of April (Julian Day 120) were either met or were higher than 5- and 10-year averages.

- Harrow showed the largest change, with 18 GDDs more than the 5-year average and 27 GDDs more than the 10-year average
- Oshawa showed the smallest change, with no difference compared to the 5-year average, but 6 GDDs more than the 10-year average

This trend was reversed by the end of May (Julian Day 151), where GDD accumulations were beneath the 5- and 10-year averages.

- Vineland had the most change, with 43 and 40 GDDs less than the 5- and 10-year averages, respectively.
- Goderich has the least change, with 25 and 12 GDDs less than the 5- and 10-year averages, respectively.

An average spring week (April, May & early June) will accrue **7 GDDs** at a base temperature of 10˚C.

GDDs base 5˚C

GDDs at base 5˚C showed similar trends across the province, where all locations had a lower GDD accumulation compared to the 5- and 10-year averages at Julian Day 160 (Figure 1).

2025 has shown to be a year below the averages at all locations:

- The largest difference between 2025 and the 5-year average was seen at Guelph at -81 GDD, followed by Goderich at -69 GDD, and Oshawa at -62 GDD
- The largest difference between 2025 and the 10-year average was also seen at Guelph at -40 GDD, followed by Goderich at -17 GDD, and Harrow at -33 GDD

An average spring week (April, May & early June) will accrue **20 GDDs** at a base temperature of 5˚C.

Location Breakdown

Each location's GDDs accumulation over time starting March 1 at base 5˚C is shown in Figures 2 through Figure 9. General trends include:

- Average or slightly above average GDD accrual throughout March
- Average accrual of GDD throughout April
- Higher than average accrual of GDD in May, until Julian day 140, where most location plateau and slowly recede below the averages into June
- All locations observe lower than average GDD accrual in the early portion of June

So What? I'm Still Growing Apples

Lower GDDs affects tree physiology, slowing progression within the orchard, which is why careful monitoring and relying on real-time data rather than calendar-based planning should occur.

These seasonal challenges reiterates the need to have access and understanding of different tactics and tools. You should be able to make effective timely decisions in response to ever changing weather.

Data Resources

Most data shown was collected from Environment Canada with certain locations gaining data through grower access.

Thank You

Special thanks to the growers who have permitted access to weather station data and weather station setup.

Table 1. Ontario apple growing regions cumulative growing degree days (base 10°C) starting March 1

Location	Julian Day 120			Julian Day 151			Julian Day 160		
	2025	5-year average	10-year average	2025	5-year average	10-year average	2025	5-year average	10-year average
Brantford	35	26	20	119	157	154	180	230	219
Clarksburg	25	25	18	97	116	117	155	172	166
Goderich	43	32	22	119	144	131	156	206	183
Guelph	27	22	16	92	134	117	128	198	170
Harrow	62	44	35	172	200	191	236	282	267
London	37	31	25	133	164	164	191	232	229
Oshawa	17	17	11	105	137	123	156	204	176
Vineland	31	21	18	100	143	140	161	220	205

Julian Day breakdown. March: 60-90, April: 91-120, May: 121-151, June: 152-181

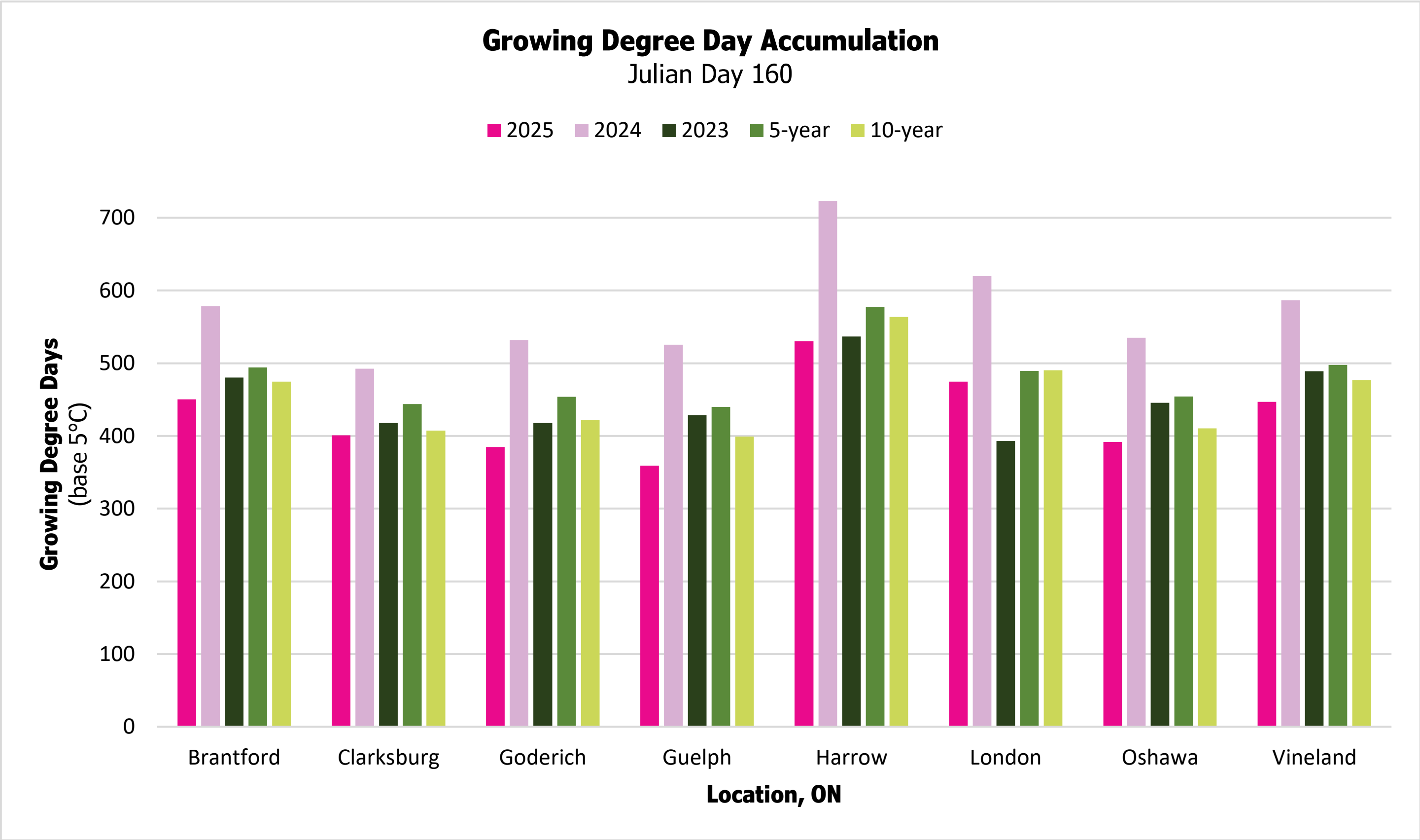


Figure 1. *Growing degree day accumulation at Julian Day 160 starting March 1 (base 5˚C).*

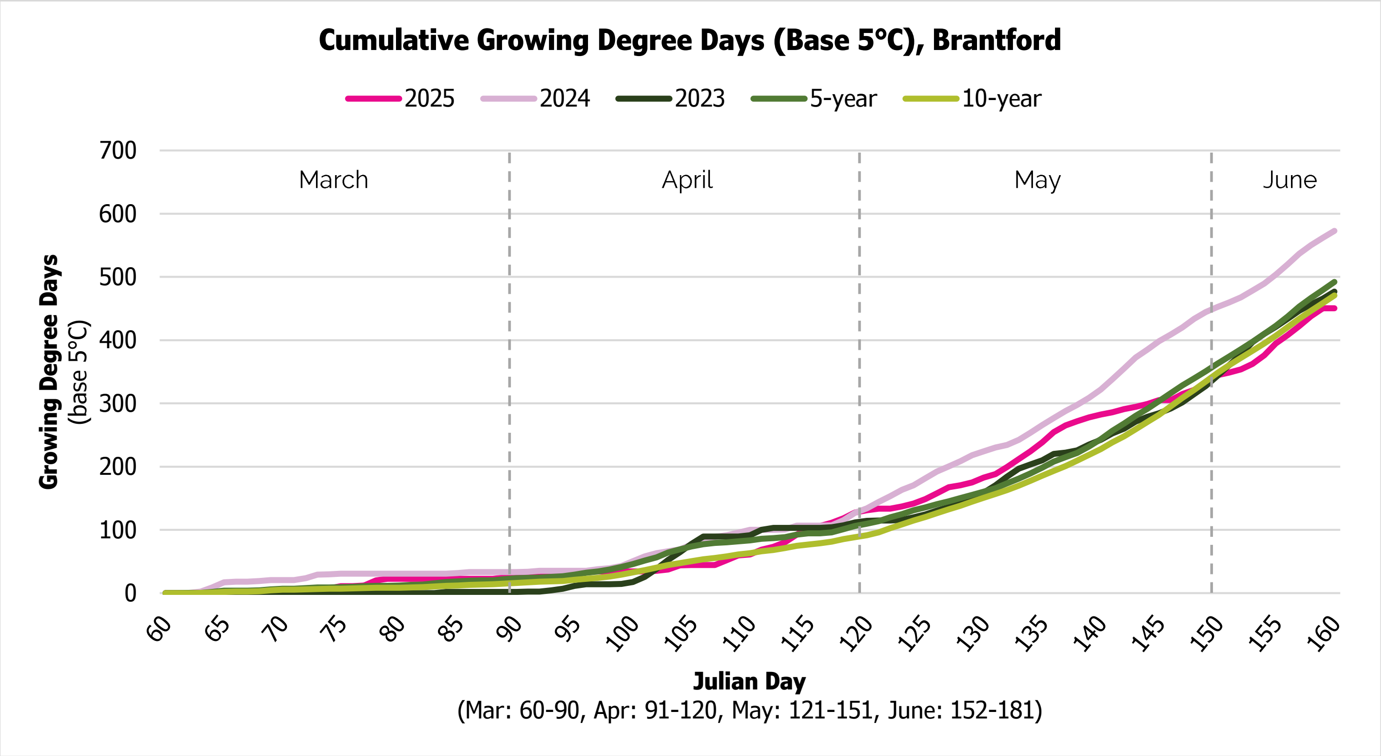


Figure 2. *Growing degree day accumulation at Brantford, Ontario, Julian Day 160 starting March 1 (base 5˚C).*

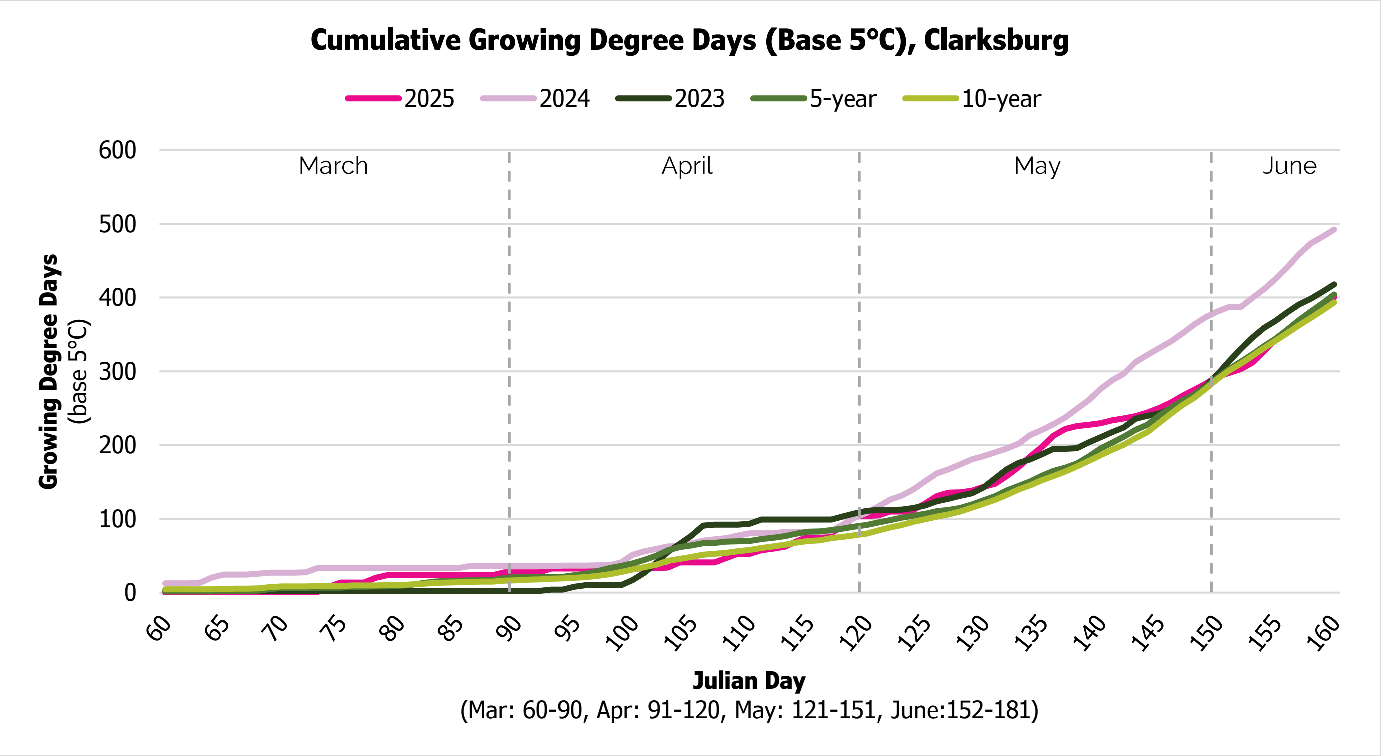


Figure 3. *Growing degree day accumulation at Clarksburg, Ontario, Julian Day 160 starting March 1 (base 5˚C).*

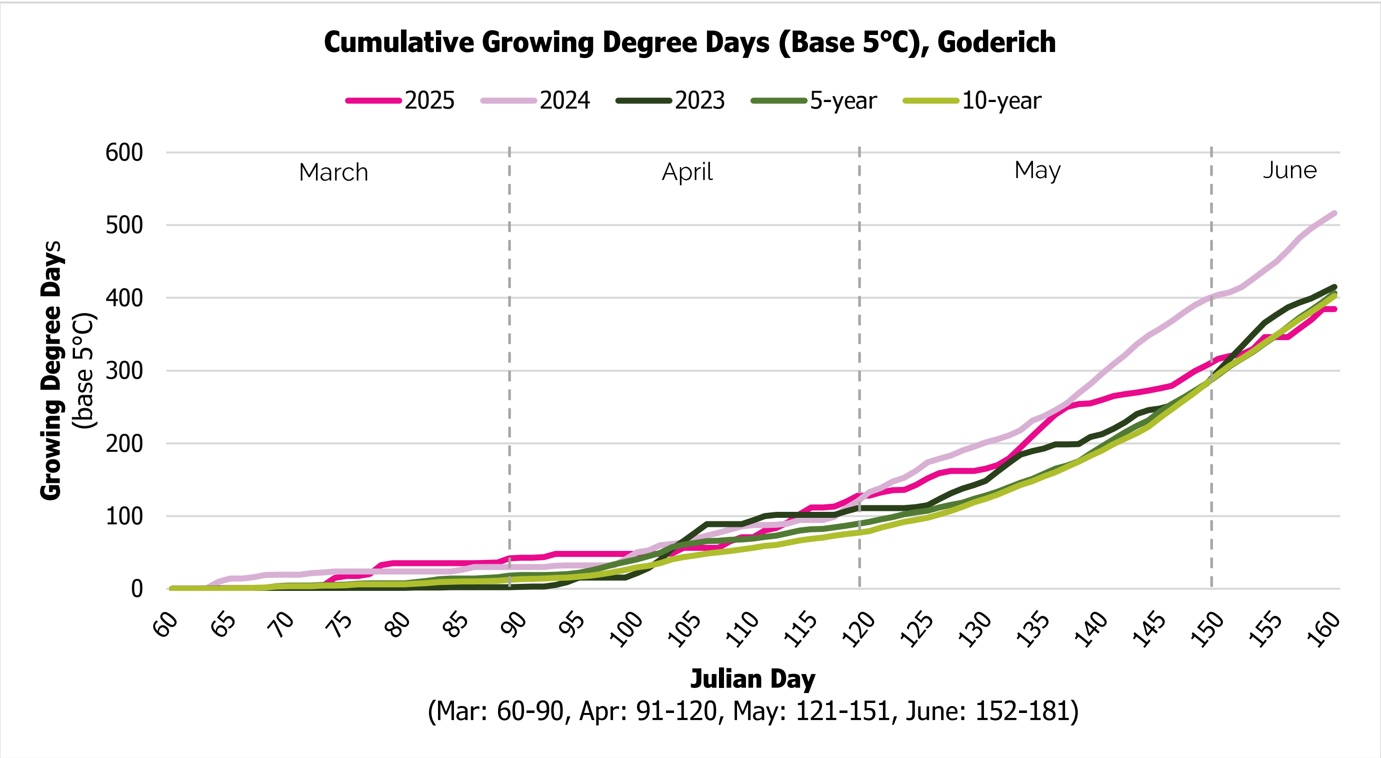


Figure 4*. Growing degree day accumulation at Goderich, Ontario, Julian Day 160 starting March 1 (base 5˚C).*

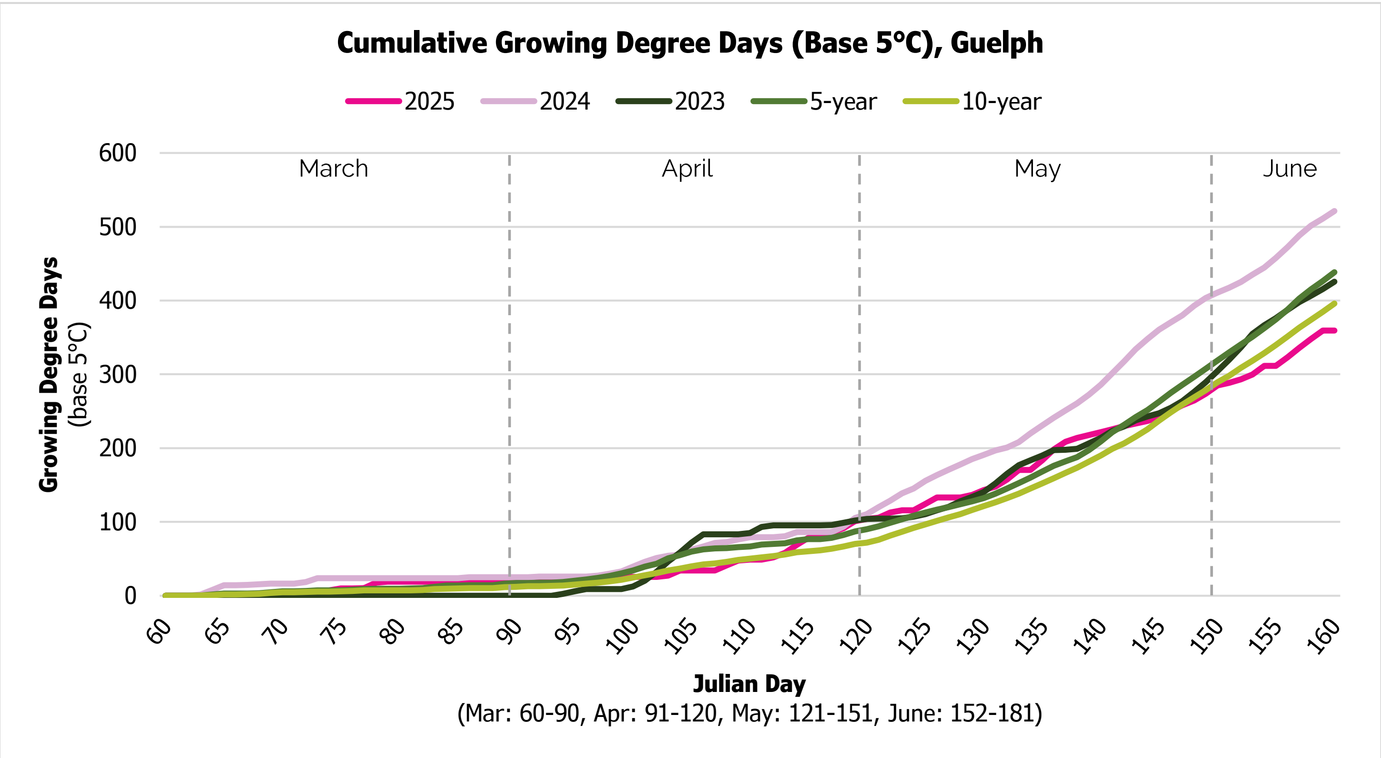


Figure 5*. Growing degree day accumulation at Guelph, Ontario, Julian Day 160 starting March 1 (base 5˚C).*

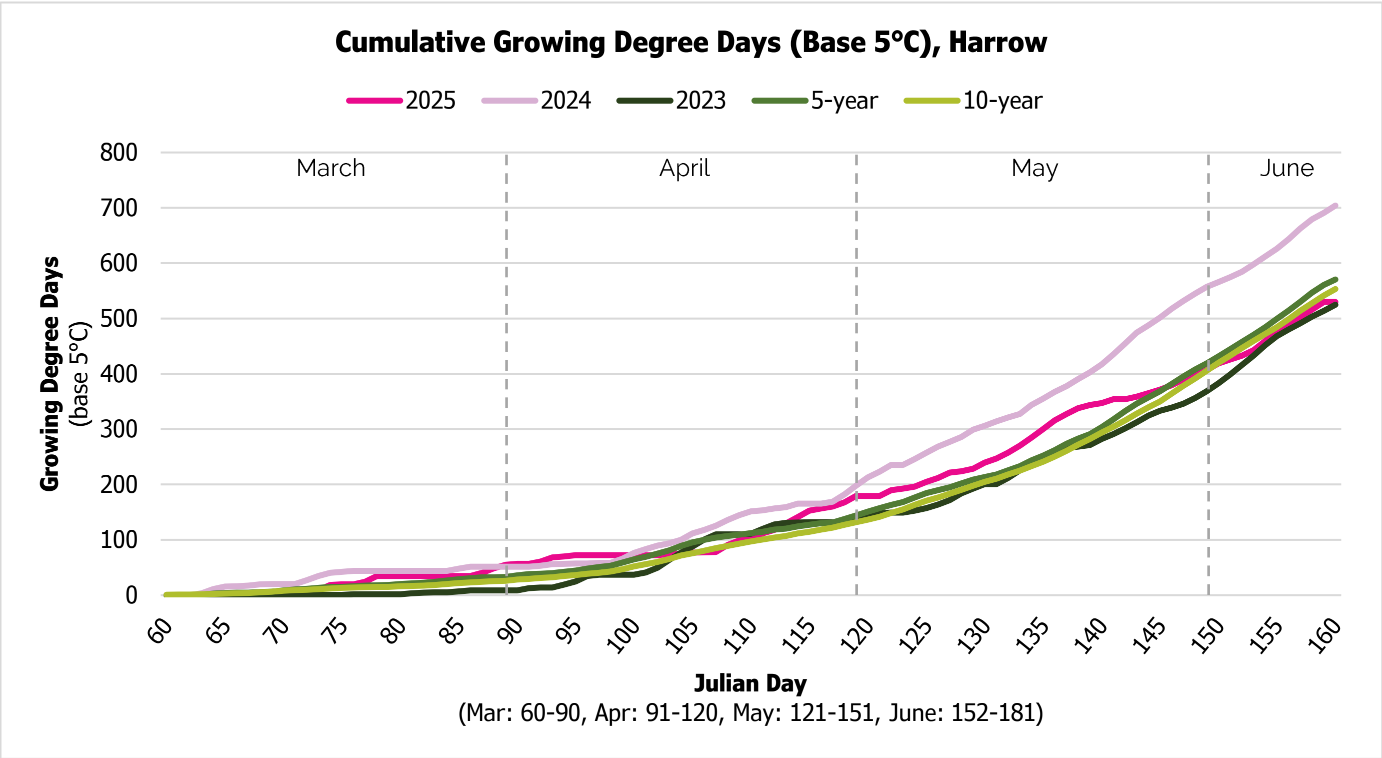


Figure 6. *Growing degree day accumulation at Harrow, Ontario, Julian Day 160 starting March 1 (base 5˚C).*

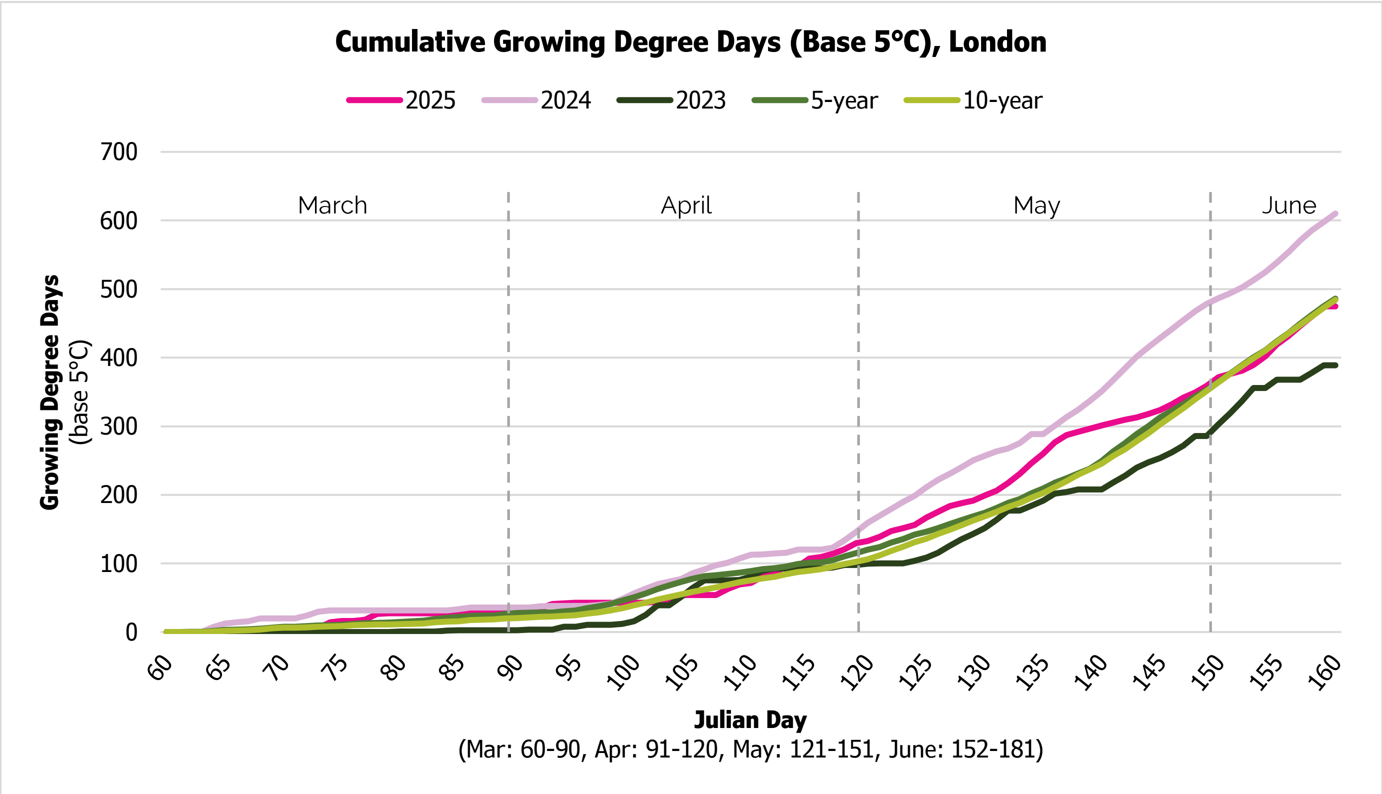


Figure 7. *Growing degree day accumulation at London, Ontario, Julian Day 160 starting March 1 (base 5˚C).*

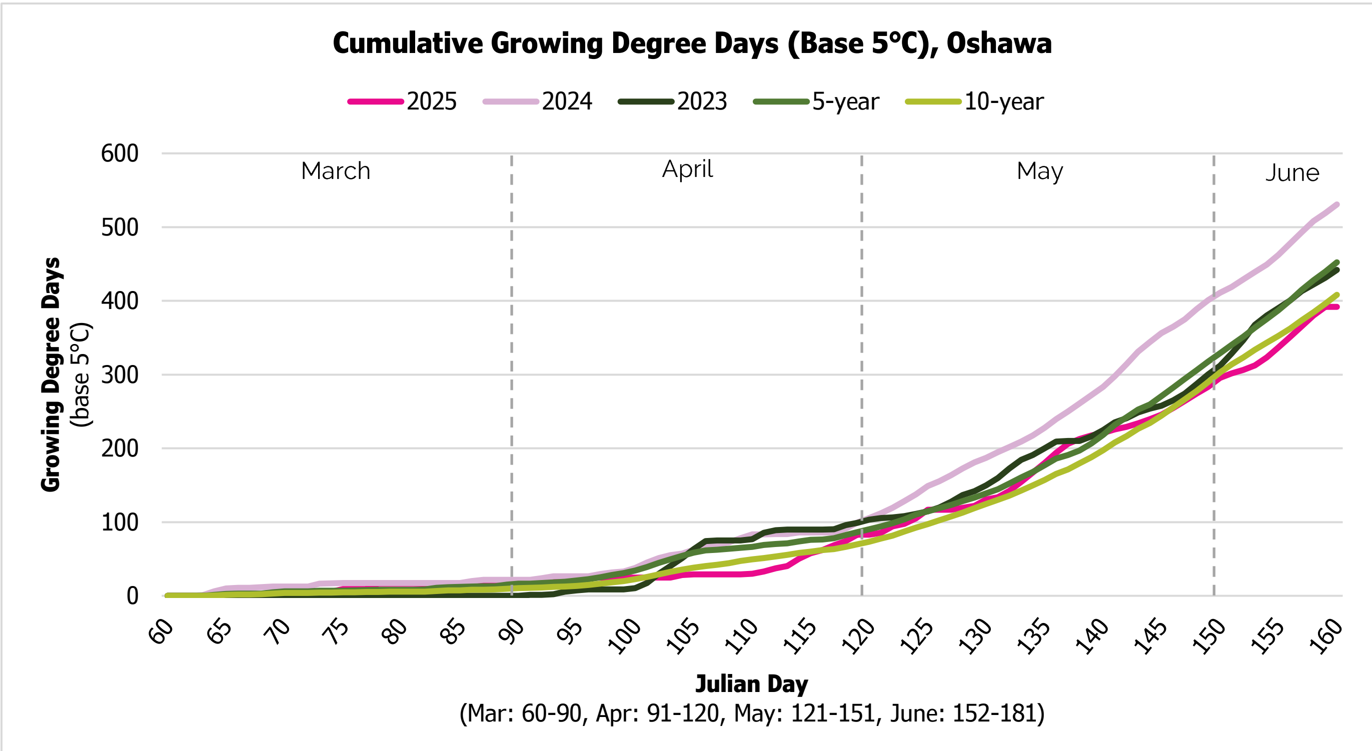


Figure 8. *Growing degree day accumulation at Oshawa, Ontario, Julian Day 160 starting March 1 (base 5°C).*

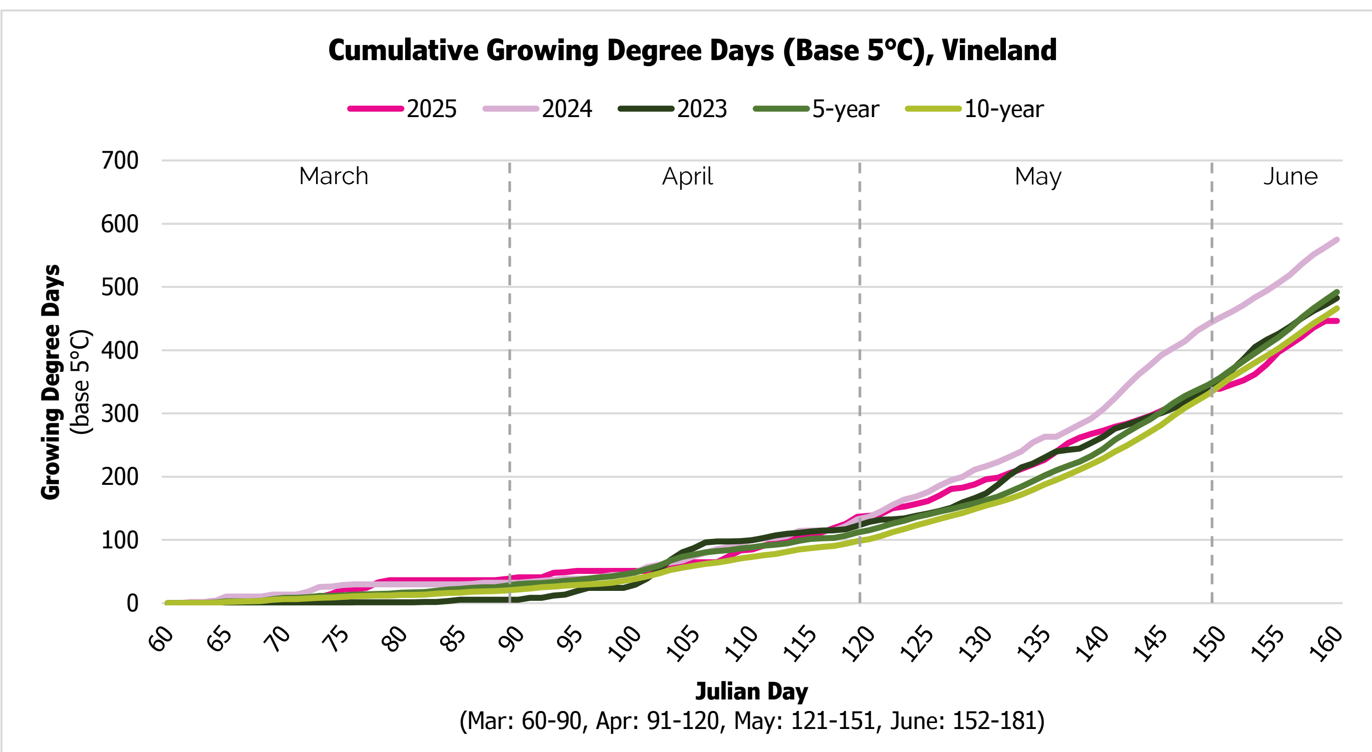


Figure 9. *Growing degree day accumulation at Vineland, Ontario, Julian Day 160 starting March 1 (base 5°C).*

CROP PROTECTION

Cool, Wet and Misleading:
Don't Let the Calendar Drive Your IPM Program

***Kristy Grigg-McGuffin**, Horticulture IPM Specialist, OMAFA*

This spring has brought persistent rain and below-average temperatures across many Ontario apple regions. While it might have seemed like insects and disease were off to a slow start, appearances can be deceiving. Cool, wet springs can delay some threats, intensify others, and/or disguise early pressure, especially if growers follow calendar-based spray programs.

In years like this, calendar sprays can lead to poorly timed applications—either too early, when pests aren't vulnerable, or too late, after infection has occurred or insect populations have already caused damage. Instead, monitoring and forecasting tools are critical towards evidence-based decision-making.

Don't Let the Cool Fool You

Apple scab

Prolonged wetting events — even in cooler weather — fuels primary apple scab infection. While mature ascospores are released more during warm rains than in colder ones, they can still cause infection nonetheless if there is a wetting period long enough for infection to occur. Ascospores begin maturing early spring – especially following a mild winter – as green tissue starts to show. If conditions are right, infection can happen right out of the gate! With the frequent rains and cloudy conditions many regions of the province experienced this spring, it's no surprise some orchard blocks are showing signs of infection.

If you're looking for more information on how temperature and leaf wetness affect apple scab infection, see *Ontario Crop IPM – Apple Scab* and check out the table, *Relationship of Temperature and Moisture to Apple Scab Infection*.

> **Key takeaway** – Delayed maturity doesn't mean delayed sprays! Continue to monitor temperature, rainfall and ascospore maturity. It's better to re-apply fungicides during a break in the rain to provide temporary protection, than not at all.

Fire Blight

Cool conditions slow the build-up of *Erwinia amylovora*, — the bacteria that causes fire blight, but even a short stretch of warmer daytime temperatures (≥18˚C) can result in a flush of infection. For those using the forecasting system, Maryblyt, they likely saw low Epiphytic Infection Potential, or EIP values for most of bloom but with sudden spikes during brief warm periods. Unfortunately, a few spikes can be all it takes!

Research suggests bacteria can survive on plant tissue (i.e., open flowers, developing shoots, etc) for several days. Once temperatures warm up, fire blight populations can multiply to one million cells per flower within only 1-2 days! So, it's entirely possible for infection should a wetting event occur, even after a period of cooler weather. Windy days, pollinator activity and delayed/staggered bloom can all contribute to encouraging spread and occurrence of infection.

> **Key takeaway** – Risk can increase rapidly even after a slow start. Use forecasting tools like the Ontario Fire Blight Prediction Maps to stay ahead of infection events.

Powdery Mildew

Unlike scab, powdery mildew does not require leaf wetness to infect, only high humidity and moderate temperatures (10–25˚C). During cool, damp springs, mildew can sneak in under the radar, especially in blocks with susceptible cultivars or poor air circulation

and following a mild winter.

- Infections begin at tight cluster to pink, and once primary shoots are infected, secondary spread continues all season.
- Protective sprays at early shoot emergence are key, especially during extended cool, cloudy stretches.

Key takeaway – Mildew doesn't need rain to thrive – don't let overcast days lull you into skipping early coverage.

Slowed, But Not Stopped

Cool weather slows down insect development by delaying degree-day accumulation. However, pest populations don't disappear — they simply shift timelines. This creates a risk if sprays are applied based on calendar expectations rather than pest phenology.

Mullein Bug

Mullein bug nymphs typically begin hatching during tight cluster to early pink. Cool weather slows egg hatch and leads to asynchronous activity over bloom and petal fall. This may result in orchard populations remaining below threshold. However, feeding damage to fruitlets can still occur, particularly when bloom stretches out.

For more information on mullein bug and the impacts of cool, wet weather, see the article *Low Counts, High Stakes: Understanding Mullein Bug Risk When Tap Counts Come Up Short* in this issue of ONcore Newsletter.

Key takeaway – Mullein bug is often missed when using calendar sprays. Scout to avoid unnecessary sprays—or to avoid missing an emerging population.

Plum Curculio

Plum curculio adults move into orchards shortly after petal fall, particularly in border rows adjacent to woodlots or buildings. Migration into the orchard really picks up when temperatures exceed 15˚C and light rain. Cool weather may delay movement. In fact, in cooler weather, plum curculio often chooses to crawl instead of fly and may not begin migration until after petal fall. A few warm nights, however, can result in sudden activity spikes.

Key takeaway – Delayed warm temperatures can extend the curculio egg-laying window, making timely coverage critical once conditions become favourable.

Codling Moth

In cool springs, codling moth development is delayed, pushing back biofix and extending flight period. This can result in a staggered or long egg hatch and challenges in determining appropriate management timings. Mistiming the first spray can reduce control – applying insecticides too early (before egg hatch) or too late (after larva enter fruit) dramatically lowers efficacy.

Key takeaway – Don't base spray timing off last year — track degree-day accumulation and trap data to guide application windows

Why Calendar Sprays Miss the Mark

Relying on last year's dates, growth staging or fixed intervals for fungicide or insecticide applications is increasingly unreliable in Ontario's variable spring climate. A single warm week can rapidly change pest dynamics, while a stretch of cool days can delay everything.

This variability means calendar-based programs risk:

- **Mismatched timing** – spraying when pest isn't active or vulnerable.
- **Wasted inputs** – unnecessary sprays increase costs and promote resistance.
- **False confidence** – assuming coverage when

environmental conditions don't match actual pest development.

Instead, make informed and precise decisions by incorporating forecasting and monitoring tools, such as:

- Real-time regional risk models (eg. Ontario Fire Blight Prediction Maps)
- Commercial tool for forecasting multiple diseases and insect development (eg., RIMpro, NEWA)
- Degree-day or infection risk calculators, reference tables or resources (eg., Maryblyt, Cougarblight, apple scab, San Jose scale)
- Pheromone traps, tapping and visual inspections
- On-farm weather stations

Bottom Line

Ontario's wet, cool spring may have slowed down the orchard, but insects and disease are still at work — often out of sight. Staying proactive with forecasting tools, degree-day tracking, and block-level scouting will help ensure you're implementing the most appropriate management tools at the right time, not just on time.

Calendar sprays may feel comfortable, but they're increasingly unreliable under Ontario's variable spring conditions. By shifting toward a monitoring- and model-driven approach, you'll protect yield and fruit quality — even in the face of a cold, wet spring.

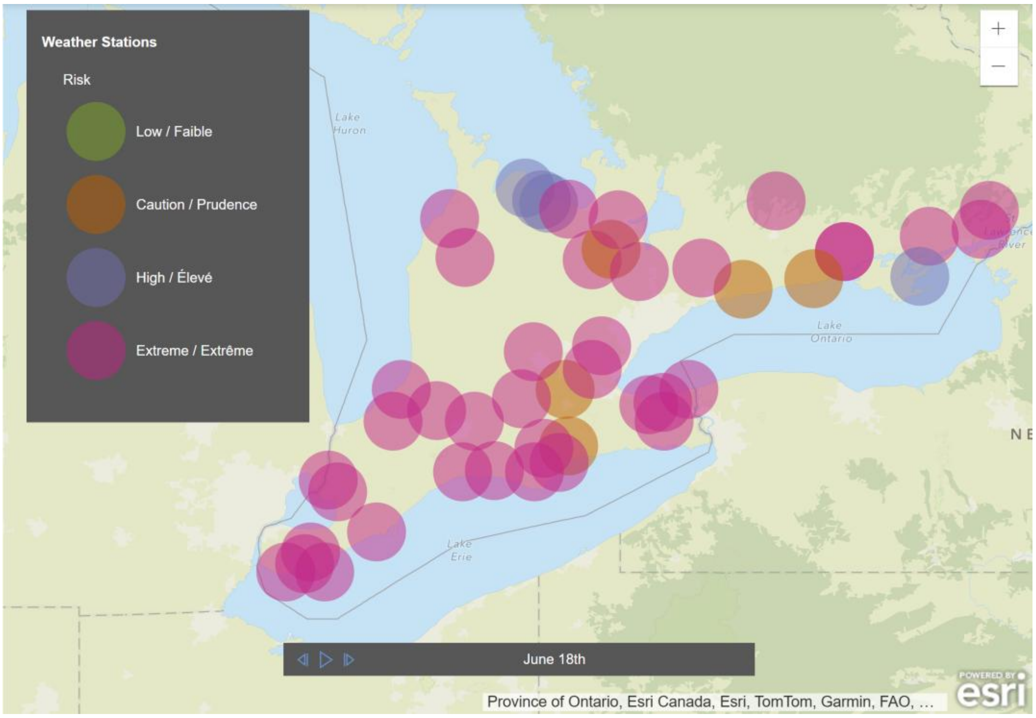


Figure 1. *Ontario Fire Blight Prediction Maps is a forecasting tool available to apple and pear growers to assist in evidence-based management decisions.*

Extended Rain Events

Impacts on Apple Scab Ascospore Discharge

***Katie Goldenhar**, Horticulture Pathologist, OMAFA*

Welcoming me back from a year away was a whole lot of rain; cold, damp, never-ending rain. And while not everyone might enjoy the rain as much as I did given my year living in a desert, the scab pathogen was certainly having a good time too.

An interesting question came up this spring; what happens when there isn't a break in the rain for multiple days? Mature ascospores are released within the first half hour (if rain starts during the day) and are depleted within the first few days of a rain event. However, those remaining immature ascospores continue to develop over time in relation to temperature. Do they get released during extended rains?

First, let's review how ascospores discharge. When the pseudothecia (overwintering structures in leaves) are wet, mature asci (sacks holding the ascospores) expand to twice their length and emerge through the dissolved opening (ostiole) to forcibly eject the ascospores (Figure 1). The mechanism in which the mature ascospores are forcibly ejected is assumed to occur when 3 things happen; the ascus is attached, has absorbed water, and has expanded through the opening (Figure 2). The ascospores are released through hydrostatic pressure but only 6mm into the air. Air movement (wind) is required to move these spores up into the canopy.

Once those ascospores are released and land on susceptible tissue, the length of leaf wetness required for infection will vary depending on temperature – from 40 hours at $0^{o}C$ to only 6 hours at $16^{o}C$. We've certainly had multiple leaf wetness periods that extend past 40 hours, meaning it's no problem how cold it is, that ascospore is going to germinate if it lands on un-protected tissue.

In a paper from 1986, scientists in New England looked at patterns of ascospore discharge. In four of the 6 rainy periods (over 48 hours of leaf wetness), ascospore

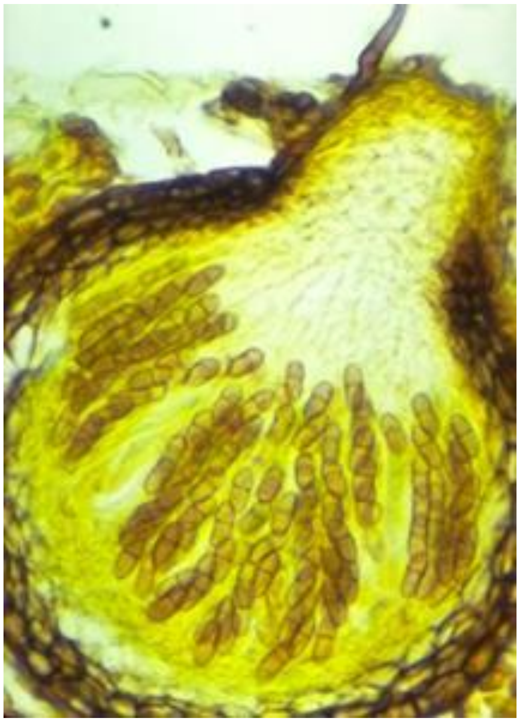


Figure 1. *Cross-section of a pseudothecium of the apple scab fungus with pigmented mature ascospores in rows of eight ascospores per ascus. Credit: J.R. James, PlantwisePlus Knowledge Bank*

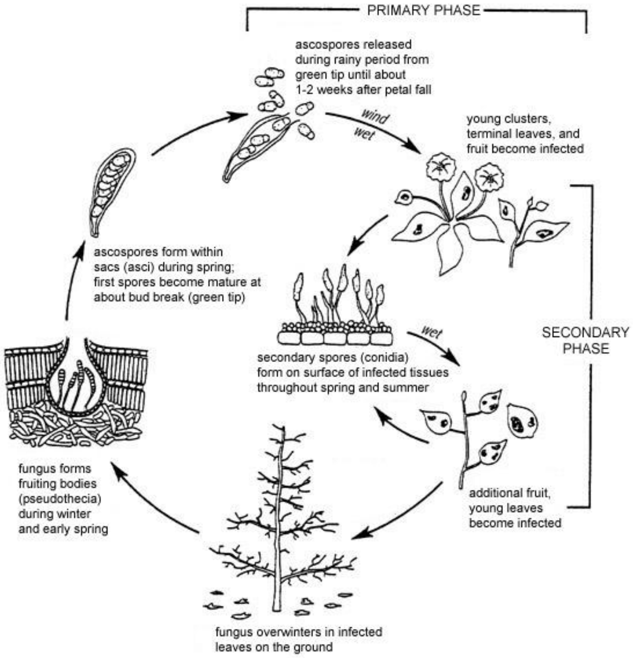


Figure 2. *Lifecycle of apple scab. Credit: N. Gauthier, American Phytopathological Society*

Table 1. Ascospore discharge of apple scab, New Hampshire USA. Spore discharge was monitored during extended wet periods, and the percentage of the total ascospores trapped during the wet period in successive day (0700-1800 hours) and night (1800-0700 hours) intervals was recorded.

Wet interval*				Ascospores trapped	Total ascospores trapped during successive day and night intervals (%)										Spores trapped (%)	
Began		Ended														
Hour	Date	Hour	Date		1800-0700	0700-1800	1800-0700	0700-1800	1800-0700	0700-1800	1800-0700	0700-1800	1800-0700	0700-1800	Night	Day
1700	23 Apr 81	0600	26 Apr 81	51	0	40.4	0	59.6	0	--	--	--	--	--	0	100
0700	29 May 82	1400	2 Jun 82	6,030	--	27.5	0	41.9	0.7	6.4	0.2	7.0	0.2	16.2	1.1	98.9
1300	23 May 82	1000	25 May 82	15,834	--	56.4	3.8	27.0	1.0	11.8	--	--	--	--	4.8	95.2
0600	24 Apr 83	0600	27 Apr 83	44,471	0	71.2	0.1	3.8	0.2	18.0	6.7	--	--	--	7.0	93.0
0900	28 May 84	0700	3 Jun 84	1,741	--	77.5	0	20.2	0.6	0.6	1.1	0	0	0	1.7	98.3
0100	23 May 83	0700	25 May 83	453	2.2	93.2	0	4.5	0	--	--	--	--	--	2.2	97.7

* Wet interval began when the first 0.25 mm of rain was recorded and ended when leaves on trees in the orchard were dry.
Table adapted from MacHardy & Gadoury (1986)

discharged peaked on day 1 and was exhausted by day 2 (Table 1). In one prolonged rain event, ascospores were captured on day 3, 4 and 5 but at significantly lower numbers than days 1 and 2. Researchers in Uruguay studied extended rain events and found similar results. My interpretation of this is that the biggest risk of ascospore release is day 1 and 2 of a prolonged wetting event. Their research does demonstrate that there is the ability for continued ascospore release in a prolonged wetting event.

Temperature will also impact the number of ascospores that mature during the rain event, so cooler, long rains will have less chance of releasing mature ascospores than warm, long rains. Whew, anyone else's head spinning???

TLDR; if you had an effective fungicide applied with preventative activity before the rain event, your highest scab risk is covered. After a long rain (multiple days of leaf wetness), it may be best to cover up with a fungicide that has some post-infection (aka kickback or "curative") action.

Check out the *Ontario Crop Protection Hub* to learn more about fungicides activity on apple scab, including *Characteristics of Apple Scab Fungicides* or read Kristy's article, *Fighting Apple Scab: Making the Right Fungicide Moves* in Oncore Newsletter, Vol 29 Issue 1.

Now that we're into summer, it's important to end on this note. ***It is secondary scab time if you have active scab infections, so you need to manage scab through the season.*** Conidia are the spores we are dealing with now and they can release at any time (not rain dependent) and only need leaf wetness for infection.

References (aka the experts):

Gadoury, David. (1994). Ascospore discharge in *Venturia inaequalis*. Norwegian Journal of Agricultural Science.

MacHardy, W. E., & Gadoury, D. M. (1986). Patterns of ascospore discharge by *Venturia inaequalis*. Phytopathology, 76(10), 985-990.

MacHardy, W. E. (1996). Apple scab: biology, epidemiology, and management.

Martínez, É., Alaniz, S., & Mondino, P. (2021). Release dynamics of *Venturia inaequalis* ascospores in Uruguay. Tropical Plant Pathology, 46(4), 414-421.

Cool, Wet & Weedy:

Adapting Weed Management to Weather Challenges

Cesar Cappa*, Horticulture Weed Management Specialist, OMAFA*

Lower temperatures, precipitation, and cloud cover can influence herbicide performance in various ways. Understanding these effects is important to anticipate herbicide behavior and, in some cases, adjust applications accordingly.

Below are key considerations:

Light-dependent herbicides

Some herbicides require intense sunlight for optimal activity. For instance, one study showed that glufosinate (Ignite) was significantly more effective in controlling Palmer amaranth when applied at noon on a sunny day compared to dusk or dawn.

Delayed symptom expression

Cold, cloudy conditions slow weed growth and delay the expression of herbicide symptoms, especially for highly systemic herbicides like glyphosate, which rely on active plant metabolism for translocation. While this usually doesn't reduce efficacy, weed death may take longer. An important exception is when frost occurs immediately before or after application; in such cases, treated tissue may die before the herbicide translocates, severely compromising control.

Increased risk of crop injury

Cold and wet conditions can increase the risk of crop injury from certain herbicides, such as metribuzin and bromoxynil. This is due to slower herbicide metabolism by the crop and the additional stress imposed by environmental conditions.

Reduced efficacy on stressed weeds

Cold temperatures and excessive rainfall can stress weeds, reducing their growth and herbicide uptake. Since most herbicides rely on active plant growth for efficacy, performance may be diminished under these conditions.

Rainfastness concerns

Under cold conditions, herbicide absorption may be slowed, about rainfall shortly after application, as the risk of herbicide wash-off increases.

Residual herbicide behavior

While moderate rainfall shortly after application can help activate residual herbicides, excessive precipitation may dilute them, reduce efficacy, increase leaching into the crop root zone, and heighten the risk of contaminating surface water.

This is especially relevant for herbicides that are weakly adsorbed to soil particles, such as Lorox, Sinbar, and Sencor, particularly in light soils.

Temperature sensitivity

Some herbicides are inherently less effective at low temperatures. For example, Ignite typically performs better under warmer conditions. However, exceptions exist: one study found that ryegrass control with Ignite was actually more effective at 10–20˚C than at higher temperatures (above 20˚C).

Conclusion

Cold temperatures, precipitation, and low light can alter how both weeds and crops respond to herbicides, sometimes reducing efficacy or increasing the risk of crop injury. However, this doesn't mean herbicide applications should always be delayed until ideal conditions occur, as doing so may result in suboptimal weed control. In most cases, the weed growth stage is a more critical factor than the environmental conditions at the time of application.

Regardless, always consult the product label for any rain, temperature, or moisture restrictions. If you're uncertain about the implications of applying herbicides under unfamiliar conditions, don't hesitate to seek advice from an OMAFA Weed Management Specialist.

Rain Check Please:
Getting the Most from Your Sprays in Wet Weather

***Kristy Grigg-McGuffin**, Horticulture IPM Specialist, OMAFA*

Spring rains might be good for growth, but they can wreak havoc on spray programs. When products don't have time to dry or rain events are heavy and/or prolonged, residues can be washed away – wasting both your money and your time, not to mention putting your crop at risk. Knowing the ability of insecticides and fungicides to withstand rainfall (aka their 'rainfasness') can make all the difference in efficacy and pest management.

Here are some key considerations for improving spray performance in wet conditions:

Know Your Product's Rainfastness

Not all products are created equal. Rainfastness can vary depending on the active ingredient, formulation, adjuvants and length of time since application. Check product labels or consult with your retails / chemical rep for specific guidance.

Fungicides

A general rule of thumb often used is that:

- 1 inch (2.5 cm) of rain removes approximately 50% of protectant fungicide residue
- Over 2 inches (5 cm) of rain will remove most of the residue

During rainy periods, systemic fungicides (e.g. Gr 3, 7 and 11s) tend to perform better than protectant (or contact) fungicides (e.g. captan, folpet, mancozeb) since they are less prone to wash-off.

- Systemic fungicides still need time before rain to absorb and often require 2+ hours to dry fully.
- While contact fungicides tend to wash off easily in heavy or prolonged rains, they do offer good retention and/or redistribution in light, misty rains.
- Similar to other contact fungicides, fluazinam (e.g. Allegro, Vantana) has good sticker properties during times of minor rainfall.
- Biological products (e.g. Buran, Serenade) are prone to wash-off.
  - Do not apply Buran if rainfall is imminent; however, this product can be used as a post-infection treatment for scab.
- SAR/ISR products (e.g. Regalia, Lifegard) are rainfast after 1-3 hours but do not provide immediate protection.

Product absorption is often dependent on weather conditions:

- Contact fungicides are better absorbed during sunny, dry conditions over several days to allow for quick drying on leaves.
- Systemic fungicides are better applied under humid, cloudy conditions as the swollen leaf cuticle allows for quicker absorption.
  - In dry, hot conditions, the cuticle can become less permeable.

Insecticides

An insecticide's performance can be influenced by its penetration, persistance and rainfast rating:

Penetration

- Products like Imidan (Gr 1B) are primarily considered surface materials, while pyrethroids (Gr 3) penetrate the cuticle so provide some resistance to wash-off.
- Translaminar products such as Gr 4, 5, 6 and 28 have stronger rainfastness once absorbed into the plant.
  - Some portion of systemic or translaminar products will always remain on the surface or bound to the waxy cuticle that is susceptible to wash-off.

Environmental persistence vs inherent toxicity

- Despite having shorter environmental persistence (aka residue does not stick around long) or low

rainfastness, Gr 1 and 3s are highly toxic which means reapplication may not be necessary.

Rainfastness

- Length of time since application will affect how well a product can withstand wash-off.
  - In general, most products would need re-application following a 1-inch rainfall with 7+ day old residues, with the exception of Gr 5 and 28.
  - After 2 inches of rain, consider re-application for all products.

For more information, Table 1 can serve as a guide for general characteristics of common insecticide groups.

Table 1. Environmental persistence, plant penetration and rainfastness rating of common insecticide groups.

Group	Persistance	Penetration	Rainfastness
1	Medium-long	Surface	Low
3	Short	Cuticle	Moderate-high
4	Medium	Translaminar, acropetal	Moderate
5	Short-medium	Translaminar	Moderate-high
6	Medium	Translaminar	Moderate
15	Medium-long	Translaminar	Moderate
28	Medium-long	Translaminar	Moderate-high

Table adapted from *Rainfast characteristics of insecticides on fruit* by John Wise, Michigan State University Extension

Watch the Forecast, Not the Clock

If rain is forecast within a short window after your spray, delay or adjust product selection. For many common products, 2-6 hours is sufficient drying time. However, a product with low rainfastness applied 30 minutes before a downpour or one which requires >24 hours for optimal penetration (e.g. neonicotinoids) will offer minimal control. A well-timed break in weather can often be your best application window.

Consider Adjuvants Wisely

Adding a non-ionic surfactant or sticker-spreader may help certain products adhere and absorb faster.

Be cautious, though! Some fungicides (like captan) can cause phytotoxicity due to excessive uptake, especially when mixed with oils or certain surfactants that cause them to penetrate the waxy cuticle.

Rain Doesn't Always Mean Reapply

Don't automatically assume you need to re-spray. Reapplication depends on:

- How long after application the rain occurred
- Product characteristics (contact vs systemic)
- Rain intensity and volume

Consult product labels or retailer / chem rep on recommendations for specific reapplication thresholds.

Build Rain into Your Spray Strategy

In seasons like this one, where frequent showers and short spray windows were the springtime norm, prioritize:

- Products with good residual activity
- Systemic movement
- Kickback, or post-infection activity
- Short rainfast periods (dry times)

When possible, avoid spraying just before heavy rain. Early mornings or late evenings may offer the best chance for adequate drying time.

Bottom Line

Your spray program doesn't need to wash away with the weather! By choosing the right products, timing applications carefully, and knowing your rainfastness windows, you can stay ahead of both insects and pathogens—even when the forecast isn't on your side.

Could Southern Blight Become Northern?

What Ontario Apple Growers Need to Know

***Caio Correa**, Horticulture Pathologist, OMAFA*
***Katie Goldenhar**, Horticulture Pathologist, OMAFA*

Southern blight is a soilborne fungal disease of multiple crops, including apples. It is caused by *Sclerotium rolfsii* and *Sclerotium delphinii.* This disease was thought to be restricted to the southern United States due to the climate, until 2018 when it was detected in Pennsylvania and multiple states since.

Southern blight has **not** been detected in Ontario apples, but growers should be aware of the disease symptoms if it continues to move north.

What Is Southern Blight?

Southern blight is not a new disease. It affects more than 500 plant species, from vegetables to ornamentals and fruit trees. The pathogens are related to the white mold fungi, sharing similar biology and structures, including the ability to form sclerotia –compact survival structures that allow the fungus to persist in soil for years.

On apples, the disease primarily attacks the lower trunk and root systems, especially on young trees (under 3 years old), but older dwarf trees can also be affected under favorable conditions. In Pennsylvania, disease progression was observed after heavy rains and temperatures above 19˚C, with high incidence at summer temperatures of 25-34˚C, in soils with high moisture and abundant organic debris.

Symptoms

Southern blight symptoms in apples are subtle at first but can progress quickly. In the summer, the first symptom you will see is wilting and discoloration of leaves, often red or yellow, suggesting the crown has been girdled. Looking closer at the base of the tree, you might see white, web-like mycelium (Figure 1), especially after rain or irrigation. This mycelium can extend a few inches up the trunk under moist conditions, sometimes forming a fan shape. Look for tan to brown sclerotia at the soil line, on the trunk, or up to 13 cm (5 inches) deep around the roots.

***Figure 1.** Mycelial growth on base of apple tree. Photo credit: Dr. Kari Peter, PennState Extension*

Some of these symptoms can be caused by other pathogens or abiotic stress, therefore if southern blight is suspected, samples should be sent to a diagnostic lab for confirmation.

Management

On-going studies from Dr. Kari Peter's lab in Pennsylvania have shown that some rootstocks have shown higher susceptibility than others in greenhouse trials.

Cultural management strategies include reducing prolonged moisture at the base of the tree by controlling weeds, removing symptomatic trees and not replanting into the same soil where infected trees were present.

Currently there are no fungicides registered for southern blight in apples in the US or Canada. Several products available for other diseases in apples have shown effectiveness against the pathogens, but more research is needed on how to best apply these products.

Growers should be aware of this emerging disease as our winters become shorter and warmer. If you observe symptoms consistent with southern blight or want to discuss further, reach out to your OMAFA specialists.

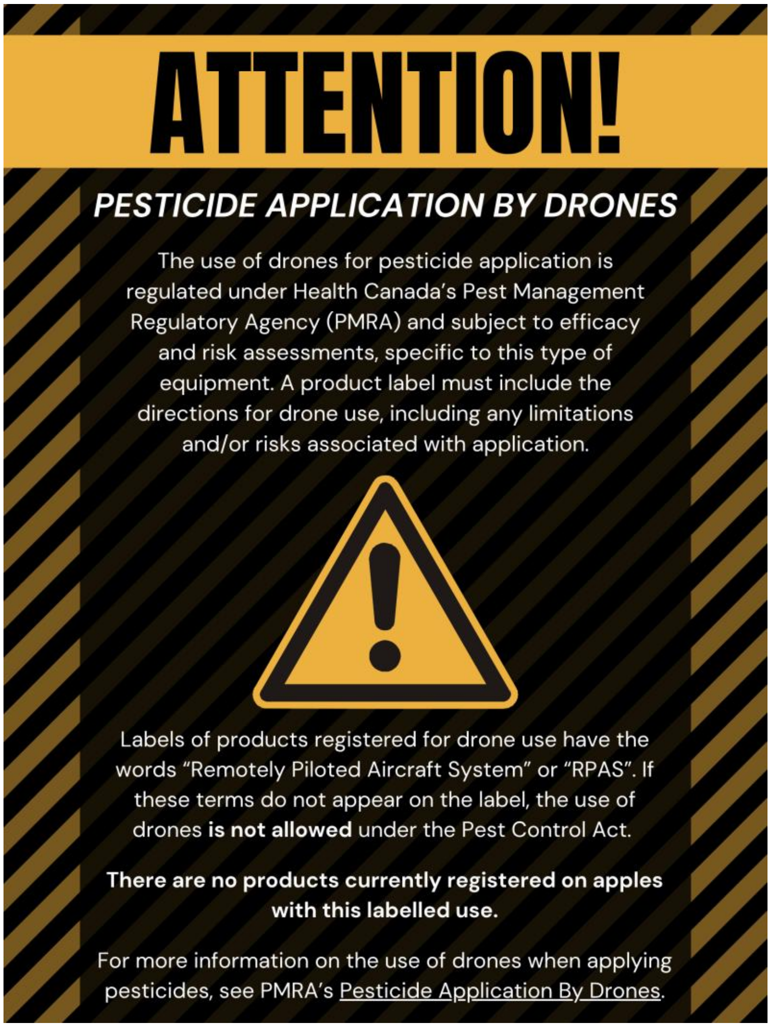
Want More Information?

Extension / Technical Publications

- Penn State Extension (K. Peter) - Apple Disease - Southern Blight
- West Virginia University (A. Biggs) - Southern Blight in Apple Trees
- Horticultural News, Vol 103 (D. Cooley, J. Clements & A. Madeiras) – Southern Blight on Apples – A New Root Disease Problem for Apples in the Northeast

Media

- Country Folks Grower - Southern Blight in Apples
- Lancaster Farming - Southern Blight of Apple Could Infect This Year's Crop



Low Counts, High Stakes:

Understanding Mullein Bug Risk When Tap Counts Come Up Short

Kristy Grigg-McGuffin, *Horticulture IPM Specialist, OMAFA*

Mullein bug (*Campylomma verbasci*) continues to be an unpredictable and costly pest in many Ontario apple orchards. While traditionally considered in petal fall insect management when populations exceed threshold, recent seasons have shown that economic damage can occur even when tapping counts fall below established thresholds.

The variability of this pest, combined with limitations in monitoring accuracy and access during wet springs, means growers should re-evaluate how they assess and manage risk—especially in young, high-density plantings.

Biology & Lifecycle Overview

- Overwinters as **eggs** laid under bark of one- or two-year wood of apple.
  - Eggs begin hatching in early spring — from **tight cluster / pink to over bloom**, depending on spring temperatures.
- **Nymphs** (Figure 1) feed on developing fruitlets (up to 15mm), sap from leaf veins, and blossom parts.
  - Several weeks after petal fall, nymphs become **predaceous** and begin feeding on soft-bodied insects, such as mites, aphids and leafcurling midge (Figure 2)
- **Adults** (also predaceous) migrate in and out of the orchard to alternate hosts such as mullein plants, common along ditches and roadways.
  - Females return to the orchard in **late fall** to lay eggs.
- There are **2-3 generations** per year.

Damage Potential

Nymphs are the damaging stage, feeding with piercing-sucking mouthparts. This damage occurs primarily during bloom to early fruit set, when nymphs puncture the surface of developing fruitlets.

Feeding leads to:

- Small corky, pimples or raised marks ("mullein bug stings") (Figure 3)
- Deformed fruit or cosmetic damage that downgrades fresh market fruit
- Aborted fruitlets

During bloom to 2-3 weeks after petal fall – until fruit are dime- to quarter-sized, or approximately 15mm – mullein bug nymphs cause economic losses to certain cultivars, particularly Red Delicious, Golden Delicious, Spartan, Northern Spy, Empire, Cortland, Gala, Jonagold and Ambrosia.

Understanding Feeding Behaviour

Research has shown that mullein bug populations are not uniform in feeding behaviour. Within a single orchard population, individuals may behave predominantly as:

- **Phytophagous (plant-feeding)** – responsible for economic damage to fruitlets
- **Zoophagous (insect-feeding)** – predate on soft-bodied pests and considered beneficials in an orchard

Key findings from this research include:

- **Feeding behaviour can shift depending on developmental stage, host availability, and temperature.** Nymphs, especially in the early instar stages, tend to be more phytophagous.
  - In cool, wet springs when development is delayed, this can prolong the window when nymphs are active and predominantly phytophagous. In other words, more damage!

Figure 1. *Mullein bug nymph.*

Figure 3. *Mullein bug nymph.*

Figure 2. *Mullein bug nymph within an apple leafcurling midge infested terminal..*

- **Some populations show a higher proportion of phytophagous individuals**, leading to increased risk of fruitlet damage, even if tapping counts are low.
- **Late-season adults are more likely to be zoophagous** and contribute to the biological control in an orchard.

Overall, mullein bug feeding behaviour is variable and context-dependent. This complexity contributes to the inconsistency between tapping/threshold assessments and actual damage observed. **Not all mullein bug nymphs are equally risky**, but we currently lack field tools to distinguish behaviour types.

When Thresholds Fall Short

Conventional thresholds suggest economic damage is likely to occur when tap sampling (using a tapping tray) shows 7-9 nymphs per 25 taps. However, recent experience from Ontario orchards shows:

- Significant fruit damage has occurred even when counts were below 3-5 nymphs per 25 taps.
- Sampling early (tight cluster to petal fall) can miss late-emerging nymphs, especially in cool springs.
- Nymph distribution is often variable within the canopy and across blocks, increasing the chance of under-detection.
- Choosing limbs with fruit clusters or trees with good fruit set will help for early detection as mullein bug are often present on these.
- First emergence and threshold can be missed if only monitoring once a week, and may result in fruit damage.
- Tapping on cold, overcast days or when it is raining can lead to under-detection.
- High-value cultivars are more sensitive to cosmetic damage, lowering the economic threshold.

These findings suggest thresholds may not be universally reliable—especially for fresh-market and high-value cultivar production.

Wet Weather Impacts — and Why It Matters

In cool, wet springs like many Ontario growers have experienced recently, early-season insect scouting is often delayed or less effective, which can directly impact pest management decisions. Here's how:

1. Reduced Scouting Windows

Frequent rainfall and damp canopies reduce the number of dry hours each day when scouting is feasible.

Tapping is less effective in wet conditions, as nymphs can stick to wet surfaces, fall off unpredictably, or go undetected.

2. Suppressed Insect Activity

Mullein bug nymphs may remain sheltered within flower parts or shoot tips during wet, cool weather. These hiding spots make them less likely to appear in samples, even when feeding and fruitlet damage are occurring.

3. Asynchronous Hatch

Most years, mullein bug hatch is synchronized with peak emergence at early petal fall. However, a cool stretch during this time may result in split hatch, making control difficult or activity more spread out.

4. Compressed Decision-Making

Once the weather breaks following a stretch of cooler weather, pest development may surge rapidly, leaving little time for scouting before decisions must be made.

This can sometimes lead to missed timing, especially when trying to juggle other spring tasks like planting, pruning, thinning and orchard floor maintenance.

Even experienced scouts may miss early pressure during prolonged wet weather. Use historical block data, cultivar value, and cultivar susceptibility to target monitoring and make informed risk-based decisions.

Management Considerations

When to Spray

If any nymphs are detected between tight cluster and early bloom, especially in:

- Young or high-density blocks
- Susceptible cultivars
- Blocks with historical damage

Risk is especially high when cool weather delays bloom, extending the vulnerable period.

Product Options

Refer to the Ontario Crop Protection Hub for insecticides effective against mullein bug.

Take-Home Message

Thresholds are a guide, not a guarantee!

- Mullein bug damage can occur even below thresholds, particularly in susceptible cultivars.
- Wet weather can significantly reduce scouting accuracy and delay pest detection.

- Population dynamics matter — orchards with a higher proportion of phytophagous nymphs are at increased risk, even with low tap counts.
- Use historical risk, block-level experience, and market requirements to guide management — even when counts are low.
- Treat early if nymphs are detected and risk is high — don't wait for sampling data to catch up.

Ontario's wet, cool springs can suppress scouting just when timely detection of mullein bug matters most. In years with delayed bloom and inconsistent pest emergence, underestimating early risk can lead to real economic losses. Adjusting management based on cultivar sensitivity, past history, and real-time field conditions — rather than just thresholds — can make all the difference in protecting this year's crop.

References

Alston, D.G., Westigard, P.H., & Hoyer, L. (2005). Campylomma verbasci (Meyer) (Hemiptera: Miridae): An evolving pest in Pacific Northwest apple orchards. Journal of the Entomological Society of British Columbia, 102: 81–89.

British Columbia Tree Fruit Production Guide (2022). Mullein bug management. [https://www.bctfpg.ca]

CABI Invasive Species Compendium (2023). *Campylomma verbasci* (mullein bug) – datasheet. [https://www.cabi.org/isc/datasheet/10612]

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ANNOUNCEMENTS

International Fruit Tree Association Summer Tour – Ontario Canada

July 20-23, 2025

The **International Fruit Tree Association (IFTA) 2025 Summer Study Tour** will be held in Ontario on July 20th to 23rd.

Tour features:

- **July 20th** – Welcome Reception, London ON
- **July 21st** – Harrow ON
  - Don Thompson Orchards
  - AAFC Harrow Research & Development Center
  - The Fruit Wagon
- **July 22nd** – Niagara-on-the-Lake ON
  - Vineland Research & Innovation Center
  - Thwaites Farms
  - Sue Ann Staff Winery
- **July 23rd** – London ON
  - Versteegh Farm
  - Heeman's

Discussions to include experiences with various types of hail nets (including whole orchard, row-by-row, and roll-up systems), cement posts, irrigation sensors and management, Vivid Machines and Provide Agro HSS smart sprayers, homemade orchard platforms, potted nursery trees, leaf blowing, root pruning, reflective mulches, fertigation, mushroom compost, sap nutrient analysis, super spindle/tall spindle/planar multi-leader trellised orchards and more.

For more information or to register, visit ifruittree.org.

Save the Date! Ontario Pest Management Conference

October 24, 2025

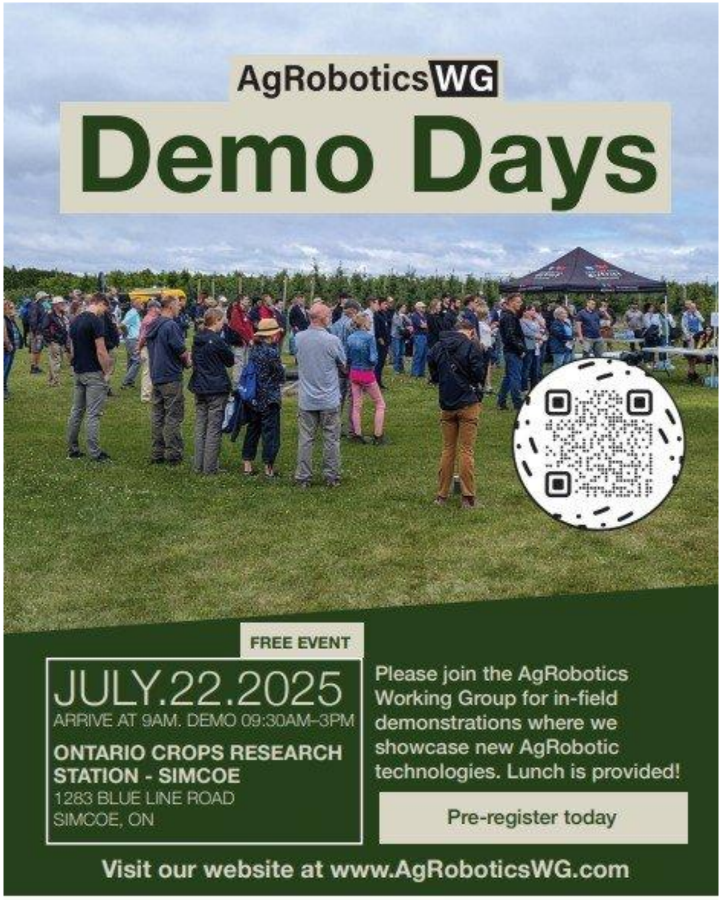
We are excited to announce the **2025 Ontario Pest Management Conference (OPMC)** will be held in conjuction with the Entomological Society of Ontario (ESO) from October 24-26, 2025 at the Royal Botanical Gardens in Burlington ON.

Join us on **Friday, October 24th** for an engaging program for the 22nd Annual OPMC, focusing on drone technology in integrated pest management. Also included in the day is a joint OPMC-ESO Biological Control Symposium and evening social event.

Want more? Join us for all three days of collaboration, research sharing and innovative discussions on pest management and entomology. With this year's special partnership with the ESO, we'll be offering an even broader platform for scientific exchange and networking.

More details on call for submissions, student competition and conference registration coming soon. See ontariopmc.ca for more information.

Mark your calendars! We look forward to seeing you there!



AgRobotics Working Group Demo Day

July 22, 2025

The **AgRobotics Working Group** and **Innovation Farms Ontario** are hosting demo days across the province, where they are focusing on horticulture crops

July 8th, 2025

- Bradford Research Station
- 9:30am – 3:00pm
- Confirmed robots include: Orio, FarmDroid, Picketa, Carbon Robotics*/Ecorobotic, BHF*
- Register here

July 22nd, 2025

- Simcoe Research Station
- 9:30am – 3:00pm
- Confirmed robots include: Vivid Machines, Naio Oz, Finite Farms, HarvestCorp, Burro, Monarch Tractor, Upside Robotics.
- Register here

The AgRobotics Working Group is funded by the Sustainable Canadian Agricultural Partnership (Sustainable CAP).

Innovation Farms Ontario is funded by FCC's AgExpert.
