ISSN 2291-5907



ORCHARD NETWORK

For Commercial Apple Producers

VOLUME #20, ISSUE #4 December 2016

In this issue...

Orchard Management

Life with Limited Carbaryl Use

Amanda Green, Tree Fruit Specialist

As of September 20th, 2016 the label for carbaryl (Sevin XLR) changed to meet the PMRA re-evaluation decision. Carbaryl was under evaluation due to the post application risk to growers. Changes to the label are listed in the **New Products for Ontario Apple Growers in 2017** article in this newsletter. The most impactful change to the label is that only one application is allowed. This is going to cause great difficulty with thinning programs as many growers use at least two applications. With this label change, other options and thinning programs will need to be considered with less reliance on carbaryl. Perhaps we will have to think beyond chemical fruitlet thinning and look at blossom thinning through caustics like ATS or mechanically.

Alternative Fruitlet Thinning programs

Thinning with only one application of carbaryl will pose difficulty for growers. Even with full use of carbaryl, fruitlet thinning is very stressful with planning on when to apply, number of applications and how much product to apply based on the weather, fruitlet stage and crop load. If you thin too much, you have a reduced crop. If you thin too little, your crew spends many hours hand thinning, raising your cost of production. Future thinning programs will have to rely less on carbaryl and more on other thinning products available in Ontario:

Ministry of Agriculture, Food and Rural Affairs

Ontario

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This issue of the **Orchard Network Newsletter** was compiled by Carolyn Prieur, Client Service Representative, OMAFRA, Vineland Station

- **NAA (Fruitone) -** The application window for NAA is from petal fall (3-7 mm) to early fruit set (8-10 mm) with NAA being most effective when the king bloom is at 5-10 mm. One application can provide adequate thinning but if needed, make a second application. NAA can be tank mixed with carbaryl on hard-to-thin cultivars but there is risk of pygmy or small fruit on some cultivars like Delicious and Fuji. Do not apply NAA during the same growing season as MaxCel or Cilis Plus as pygmy fruit may result.
- **6-BA (Maxcel or Cilis Plus) -** Apply 6-BA at 5-15mm. Apply up to two applications for fruit thinning and apply up to 4 applications for improving fruit size. When applying 6-BA to improve fruit size, begin applications at petal fall. 6-BA can be tank mixed with carbaryl on hard-to-thin cultivars.

With only application of Carbaryl allowed, you will have to be strategic with when you should apply it; perhaps as a final spray or with 6-BA or NAA to give those two products more strength.

Chemical Blossom Thinning

Thinning at blossom time is a widely used technique to manage crop load and improve fruit size in Washington State. Chemical blossom thinning would not be the only method to thinning but a tool in the whole program followed by fruitlet thinning and hand thinning. The advantage to thinning a portion of blossoms off is that earlier on, more carbohydrates will be allocated to the remaining developing fruitlets going through cell division. Caustics are used to thin blossom; ammonium thiosulfate is quite commonly used as well as lime sulphur. The goal of blossom thinning is to apply the product once the king bloom has been fertilized but before the side blooms have been fertilized. Blossom thinning in Ontario and other areas in eastern North America isn't widely adopted because we have a higher risk of frost, as is evident in recent history; having as many blossoms as possible through the bloom period acts as insurance. With limited use of carbaryl, though, it may be a method to consider.

Mechanical Blossom Thinning

In trials in New York State by Mario Miranda Sazo from Cornell Cooperative Extension and in Ontario by Dr. John Cline and Kendra McClure from the University of Guelph, mechanical blossom thinning (MBT) was evaluated and shown to effectively reduce fruit set. In both of these trials, a Darwin string thinner was used and was also on display at the most recent International Fruit Tree Association (IFTA) Study Tour (Figure 1). It was recommended by Miranda Sazo to use the string thinner at 180 and 200 RPM, not at 240, to reduce damage to spur leaves, reproductive and vegetative structures. Also, allowing the strings to reach into the canopy so that the strings are hitting the trunk and branches, will slow down the momentum of the strings and cause less damage. MaxCel was applied after MBT when fruitlets were 8-10 mm, to improve fruit size in Gala. A main concern to MBT is the spread of fire blight throughout the orchard. At the IFTA Study Tour in New York, Miranda Sazo found that the incidence or severity of fireblight did not increase with MBT.

Figure 1. A Darwin string thinner used to mechanically thin blossoms

Thinning Presentations at the Ontario Fruit and Vegetable Convention

At the Ontario Fruit and Vegetable Convention, the Apple Program will have Zac Farmer and Charles Stevens, two growers from Durham Region and Sean Bartlett from N.M. Bartlett Inc. speak on their experience and viewpoints on how to manage thinning programs with new carbaryl label changes. Following the panel and lunch, Dr. John Cline will also be speaking on thinning apples without carbaryl.

New Rootstocks for Honeycrisp – A focus on select Vineland and Cornell Selections

John A. Cline, Tree Fruit Physiologist, Pomology Research Program, University of Guelph, Simcoe

When establishing new orchards, apple growers must consider the cultivar and rootstock combination one to two years prior to planting, depending on the method of propagation and availability of rootstocks. The rootstock choice is important as it has economic and orchard management consequences, and there are currently a great number of rootstocks being promoted (several on two-year or longer waiting lists). However, many are not suitable for our climate, cultivars, or orchard systems.

The pomology research program at the University of Guelph, Simcoe has been actively involved in long-term rootstock research to determine the size, disease and adaptability of a number of rootstocks from around the world. The information gathered from these experiments, some affiliated with the NC-140 technical committee, is extremely useful in determining the environment-genetic interactions rootstocks have on yield, precocity, tree performance, longevity, resistance to disease and winter injury, and tendency to sucker. This article will provide an update on some of our most recent results from studies conducted on Honeycrisp.

Methods

Ten Honeycrisp trees on 16 different rootstock (B.10, G.11, G.202, G.214, G.30, G.41, G.5890, G.935, G.969, M.26 EMLA, M.7, MM.106, M.9 T337, V.5, V.6, and V.7) were planted in the spring of 2014 at the University of Guelph, Simcoe Horticultural Experiment Station. Trees were planted using a 'tall spindle' system at a 1.2 x 3.6 m spacing (2342 trees/ha). Trees are trickle irrigated with 2 L/hr pressure compensating emitters and scheduled to deliver approximately 25 mm of water per week. Trees are planted using a completely randomized design with single trees serving as experimental units. Pollinizer trees were placed uniformly through each planting. At planting, initial trunk diameter was measured 30cm above the graft union as well as the number of side branches >10 cm. Annually, the following are being recorded: trunk circumference in the fall of each year to gauge tree vigor, tree status at the end of each growing season, the number of root suckers per tree, total number and weight of fruit harvested.

Trees established well, however initial tree size varied by rootstock as some trees were better feathered and had more extensive root systems than others. At planting, there were significantly more branches on V.5, V.6, and V.7 as well as G.214. This may be more a function of nursery propagation technique (tissue culture vs. stool bed rootstock) than rootstock directly.

Results

Vigor: Honeycrisp/V.5, V.7, and V.6 had the greatest trunk circumference while G.202, G.11 and G.41 had the smallest trunk circumference. Honeycrisp/G.41 had the highest relative growth rate since planting, indicating they were growing the fastest. M.26, M.7, MM.106, G.969 and B.10 had intermediate vigor (Figure 1).

Figure 3. Honeycrisp rootstock planting in their third leaf (August 2016). Trees are trickle irrigated and supported by wire trellis, spaced 3.7 x 1.2 m (4 x 12 ft). University of Guelph, Simcoe [Photo J. Cline]

Yield: G.935 had the highest crop load and yield at harvest followed by G.969 (Figure 2). Trees on G.202, G.41, and M.7 have produced the fewest number and cumulative yield to date.

Figure 1. Tree vigor of Honeycrisp on various rootstocks after three growing seasons at the University of Guelph, Simcoe.

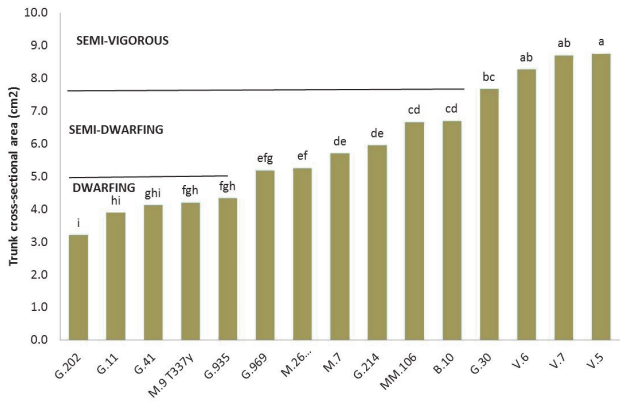
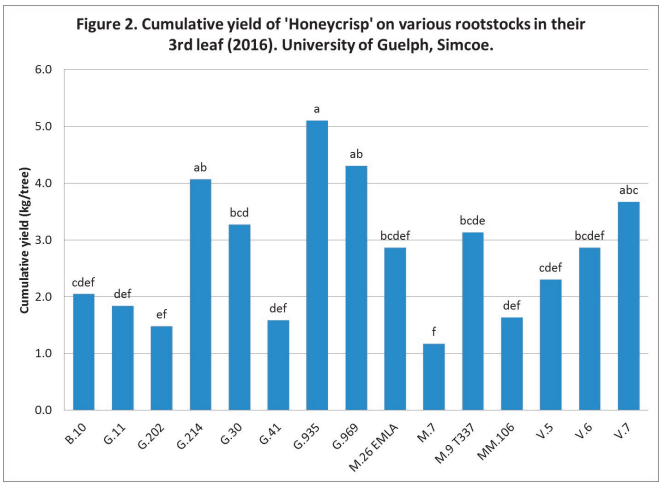


Figure 2. Cumulative yield of 'Honeycrisp' on various rootstocks in their 3rd leaf (2016). University of Guelph, Simcoe.



Suckering: rootstock suckering has been minimal on Honeycrisp

Tree mortality: At the end of the 2014 growing season, the year of planting, tree mortality was 20% for G.41, 10% for G.935, and 12% for V.7. There was no mortality on any of the other rootstocks.

Other notes: in August, 2016 several Honeycrisp trees on G.202 showed signs of stress with pale yellow leaves and a wilted appearance. Trees were trickle irrigated Honeycrisp trees on the other rootstocks appeared normal.

Summary
Apple producers have a wide selection of rootstocks from which to choose. The decision of rootstock selection should be based on a number of factors including growing availability of virus certified trees (rootstock and scion), growing region (hardiness zone), soil fertility, orchard system, cultivar, tree spacing, replant disease and prevalence of disease. Specific replant disease (SRD) is 'silent' malady that many are recognizing affects tree performance and production more than once thought. Planting a more vigorous rootstock with proven performance in SRD sites is a good strategy with few soil fumigants now available. Our preliminary results indicate G.935 to be very precocious rootstocks in the M.9 size category. V.5, V.6, and V.7 appear to be more vigorous and slightly less yield efficient, but offer cold hardiness and resistance to fire blight (rootstock not scion resistance). M.9 and M.26 remain productive size-controlling stocks with several positive attributes, however their primary weakness is a high susceptibility to fire blight and lack of cold hardiness. In addition, M.26 is prone to fungi in the genus *Phytophthora* that cause root death and decay.

Acknowledgements
The technical assistance of Amanda Gunter and Cathy Bakker in this project is gratefully acknowledged.

This project is generously funded through the Canadian Agri-Science Cluster for Horticulture 2, in partnership with Agriculture and Agri-Food Canada's AgriInnovation Program, a Growing Forward 2 initiative, the Canadian Horticultural Council and industry contributors, including the Ontario Apple Growers.

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Growing Forward 2

Promalin Label Changes

Amanda Green, Tree Fruit Specialist, OMAFRA

Russeting
Promalin is now registered to reduce russeting. Russeting can occur during cool wet or humid extended periods of times during bloom and early stages of fruit development. Golden Delicious is a variety that is particularly prone to russeting during these favourable conditions. Promalin cannot reduce russeting caused by frost damage, disease, herbicide drift, or phytotoxicity.

Improve Apple Shape in all Varieties
Promalin is now registered in all varieties to improve fruit shape by elongation of the fruit and development of more prominent calyx lobes ("typiness"). Promalin can be used on fruit that has natural typiness like Red Delicious, Golden Delicious, Ambrosia and Gala.

Modifying Young Tree Growth
For nursery stock and non-bearing apples, Promalin can be used to stimulate lateral bud break and additional branch growth, resulting in improved branch angles, and providing a better tree structure for early cropping. Apply Promalin once trees have reached a terminal height at which lateral branching is desired. For orchard trees, apply Promalin when new terminal growth is approximately 2.5 to 8 cm long (approximately king bloom to 1 week after petal fall).

Promalin can also be mixed with latex paint and applied directly to buds of apples (nursery and orchard). Paint should be applied in the spring when terminal buds have started to swell, but before shoots emerge. Do not apply after bud break. Application after bud break may result in injury to tender shoot tips and prevent shoot growth from that point. Notching the bark above the bud with a hacksaw blade prior to treatment will greatly increase efficacy.

Call Before You Cut!

Jennifer Jarvis, Stakeholder Communications and Marketing Advisor, OMAFRA

Municipalities are responsible for developing their own by-laws. Your municipality may have passed by-laws that determine if you can remove a tree from your land or woodlot. These by-laws may include conditions that affect how you carry out the work, including the need for a qualified professional and/or a permit to complete the work.

Tree protection by-laws and the requirement for permits, including the types of conditions within them, can differ between municipalities. Save yourself from costly fines or legal fees – talk to your municipality **first** before removing trees. In areas where there is an upper-tier municipality, you may need to talk to both the upper-tier and the lower-tier municipality.

Municipal authority for tree protection by-laws is outlined in the Municipal Act, 2001, administered by the Minister of Municipal Affairs. As a starting point, refer to sections 135 -141 of the Municipal Act for more information about the powers of municipalities respecting tree cutting by-laws.

The Municipal Act does not explicitly provide exemptions for agriculture. Municipalities, however, commonly include exemptions in their by-laws for horticultural operations, such as:

- Commercial fruit and nut orchards
- Christmas tree production
- Commercial tree nurseries
- Commercial sugar bush and maple syrup operations

Visit the Ontario Woodlot Association's website for additional information.

Removal of trees from the edge of a woodlot

Crop Protection

Effect of Calcium Chloride on Bitter Rot in Apples

Michael Celetti, Plant Pathologist Horticulture Crops, Kristy Grigg-McGuffin, Horticulture IPM Specialist, Amanda Green, Fruit Tree Specialist, OMAFRA

Bitter rot was a serious disease in many Ontario apple orchards this past season. The disease is favoured by very warm or hot weather with occasional rainy periods similar to the conditions experienced in 2016. Initial infections can occur as early as late bloom or petal fall but the pathogen can infect fruit at any time during the growing season. Early symptoms appear as small grey, reddish or brown spots (Figure 1) that quickly enlarge into circular sunken light to dark brown rots on infected fruit (Figure 2). Symptoms can appear as early as mid-July but often the disease is not noticed in Ontario orchards until early August or later depending on environmental conditions. Warm temperatures hasten the rotting process until the fruit becomes shriveled and completely rotten. Severely rotten fruit often fall from the tree prematurely. During humid conditions, cream to salmon-coloured masses of sticky spores are produced on the surface of the sunken lesion which is very diagnostic (Figure 3). The sticky spores are rain splashed or carried by insects to other fruit resulting in further spread and more rotten apples (Figure 4).

Figure 1. Bitter rot initially appears as a small grey, reddish or tan brown spot on fruit.

Figure 2. Bitter rot develop into a circular sunken lesion.

The pathogen can overwinter in infected mummified fruit left on trees or on the orchard floor. It can also colonize cankers caused by other pathogens such as fire blight or black rot. Research at the University of Guelph has shown that the pathogen can also survive and produce a few spores on the surface of weed leaves for several weeks without infecting or causing disease of the weed.

Bitter rot management starts with good orchard sanitation. Removing old fire blight, black rot and other cankers reduces the overwintering source of this disease in the orchards. Mulching or removing infected fruit from the orchard floor will also help reduce inoculum and the potential of spreading the disease. Allegro, Granuflo T and Pristine fungicides are registered for the control of bitter rot in Ontario apple orchards. However, other fungicides registered for the management of apple scab and other summer diseases may provide some protection against infection from the bitter rot fungus.

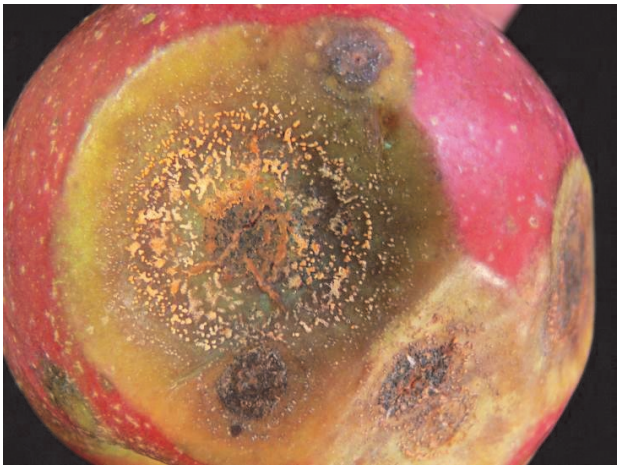


Figure 3. Cream to salmon -coloured spore masses develop in the sunken bitter rot lesion during humid conditions.

Figure 4. Insects that visit bitter rot lesions can pick up the sticky spores and carry them to other fruit.

The application of calcium salts and particularly calcium chloride ($CaCl_2$) have been shown to reduce bitter rot incidence and severity in apple trials conducted in West Virginia during the late 1990's. In 2016, OMAFRA set up a trial in a block of Empire apple trees to further investigate the potential of $CaCl_2$ for controlling bitter rot under Ontario conditions. The trees were sprayed with either $CaCl_2$, Pristine WG or Allegro 500F on a 10-14 day schedule throughout the season. Untreated trees were left for comparison.

Both Pristine WG and Allegro 500F significantly reduced the incidence of bitter rot and number of lesions/fruit at harvest. $CaCl_2$ applied at 3.9 kg/ha (1.4 kg Ca/ha) suppressed the incidence of bitter rot and significantly reduced the number of lesions/fruit. $CaCl_2$ did not appear to cause damage to the Empire trees or increase Ca levels in fruit or leaf tissue at harvest. Results of this trial will be presented in a poster at the 2017 Ontario Fruit and Vegetable Convention in Niagara Falls, Ontario on February 22-23, 2017.

Apple Tree Collapse: What we know (and don't know)

Kristy Grigg-McGuffin, Horticulture IPM Specialist, Michael Celetti, Plant Pathologist- Horticulture Crops, OMAFRA

Grower reports of young apple trees collapsing first started coming in shortly after bud break this past year. The number of Ontario orchards affected steadily increased throughout the season to over 20 sites across the province documented by OMAFRA, with many other growers describing similar issues.

In all cases, seemingly healthy young trees were breaking bud or growing normally, then suddenly dying in a matter of time that felt like almost overnight. Samples submitted to the University of Guelph Pest Diagnostic Laboratory were coming back with various pathogens, mainly phomopsis, cytospora or black rot canker. However, these are all weak and opportunistic pathogens that can infect wounds or injured, stressed and weakened trees. What was causing these trees to be weak in the first place remained a mystery.

While attending the New England, New York and Canadian Fruit Pest Management meeting in October of this year, I was surprised to hear many regions in the northeast were experiencing the same issues. Following that meeting, Ontario has joined forces with researchers and extension specialists from many areas including Penn State University (PSU), Cornell University, North Carolina State University, Virginia Tech, and University of Massachusetts to attempt to find some answers.

Kari Peter from PSU has referred to this issue as Rapid Apple Decline (RAD) or Sudden Apple Decline (SAD) due to the sudden collapse of apple trees from the time first symptoms appear to tree death. A recent article of Peter's summarizes what we know (and don't know) about RAD/SAD, which can be found here: http://extension.psu.edu/plants/tree-fruit/news/2016/having-rad-is-also-sad

Similar to the symptoms Peter describes in her article, what was typically seen in Ontario this year included:

- Young (3-6 year old) dwarf trees, typically Gala/M9 rootstock though some collapse on M26 rootstock was observed later in the season.
    - Other regions in the northeast were seeing symptoms on 2-8 year old trees. Gala/M9 rootstock was mostly affected, though collapse was also reported on Fuji and Golden Delicious on M9, too.
- Dead or declining trees were intermixed in a block with healthy trees (Fig 1).
- Purplish canker present with necrosis, or dying tissue occurred at the graft union and extended up the trunk (Fig 2).
- Below the graft union, rootstock and root system appeared healthy and often sent out a large number of root suckers (Fig 3).

- Leaves had a pale yellow hue, and then rapidly turned purple or reddish just before the tree collapsed.
- Collapse occurred in blocks as early as bud break to trees with a full fruit set and normal crop load (Fig 4).

Figure 1. Dead (center) or declining (far right) trees in block with healthy trees (far left).

Figure 2. Dead trees with bark removed. Note necrotic tissue at graft union and extending up trunk with healthy green tissue above.

Figure 3. Collapsing tree with large number of root suckers. Note purple canker at graft union.

Figure 4. Collapsing tree with full crop load. *Photo: K. Peter, PSU*

Figure 5. Presence of borer holes in declining tree.

What could be causing this collapse?

- ***Weather-related injury*** – As OMAFRA's plant pathologist Michael Celetti cautioned in his April 2016 ONNL article, Alert: Cankers in Apple Orchards, cankers can show up in orchards 1-2 years after a severely cold winter. With the cold winters experienced in Ontario during 2014 and 2015, canker -causing pathogens that infected through the cold injury wounds could result in noticeable symptoms by 2016 and even possibly cause tree decline. Trees that are 3-6 years old now would have been newly planted or in their first years during the 2014/2015 winters and therefore, extremely vulnerable to cold injury during those severe cold snaps.

  There is also a good chance the dry conditions experienced across the province this year may have helped push already weakened trees over the edge. It is hard to know whether collapse would have been as extensive in some blocks had there been adequate moisture. It is possible that the combination of the winter injury in 2014/2015 and subsequent infection by weak pathogens, followed by the dry conditions in 2016 exacerbated tree decline.

- ***Pest-related injury*** –Typical pathogens such as fire blight and Phytopthora that often cause tree collapse were ruled out in the majority of the cases in Ontario. In most orchards with RAD/SAD, no bacteria were isolated from affected tissue submitted to the University of Guelph Pest Diagnostic Laboratory. However, there has been quite a bit of discussion in the research community, as of late, whether the fire blight pathogen can go undetected at times and cannot be ruled out as part of the cause in some orchards. That said, symptoms caused by these pathogens often occur at ground level just below the graft union in the rootstock part of the tree, whereas trees with RAD/SAD had symptoms (necrosis) extending upward only from the graft union.

  As mentioned earlier, fungal pathogens were detected in practically all orchards where samples of affected trees were submitted to the lab. These fungi included *Phomopsis* spp., *Cytospora* spp. and *Botryosphaeria obtusa* (black rot). While these pathogens would have likely contributed to the tree decline, they were likely a secondary infection entering a pre-existing injury.

  In some cases, wood-boring insect infestations were found in affected trees (Fig 5). However, borer issues were not identified in all orchards with tree collapse. The most likely scenario is that the borers came in after the tree was already stressed.

  Damage from herbicides on the base of young trees has not been looked at extensively in Ontario due to the longevity that is required for such a study. Impacts from grower-applied herbicide may not manifest for years after treatment, so pin-pointing the cause in a commercial orchard can be very difficult. However, herbicide application has the potential of wounding a young tree and increasing its susceptibility to secondary infection.

- ***Site or cultivar selection –*** Many questions have been asked whether the tree collapse is a site selection or replant issue. In Ontario, tree collapse was reported across the province in all growing regions on both virgin and old orchard land. As well, only certain varieties in a block were typically affected. For instance, in one orchard approximately 10-15% of Gala/M9 were dying while the McIntosh/ M9 immediately adjacent were showing no symptoms at all. If the issue was site-specific, one may expect to see more consistent problems in a block among varieties/rootstock of similar disease susceptibility and likely restricted to one region of the province.

  The interesting pattern of affected trees being mainly Gala/M9 suggests that there may be a variety/ rootstock combination issue. However, other regions in the northeast have seen issues with different varieties and/or rootstocks.

Unfortunately, there is no clear-cut answer to this problem at the present time. With the growing trend towards higher density plantings and pushing trees into productivity in the 2nd or 3rd year, there is bound to be an increased number of stressors placed on young apple trees. In all likelihood, RAD/SAD is a complex of issues caused by any number of stresses: Drought? Cold injury? Herbicide? Replant disease? All of the above? At this point, more research is needed to answer these types of questions.

What can be done?

This is a difficult question to answer without knowing the cause for tree collapse. The best thing to do is minimize tree stress and remove potential sources of inoculum where possible.

- Consider irrigation, especially on M9 rootstock.
- Maintain a proper nutrient program throughout the year based on soil and leaf analysis.
- Paint trunks of young trees white or use tree guards to prevent southwest injury.
- If re-planting on an old orchard, stagger planting rows to avoid planting directly in old tree sites and be sure to test soil for nematodes and nutrient levels prior to planting.
- Prune out fire blight infected shoots as soon as possible to prevent spread to rootstock.
- Orchards planted near woodlots may be more vulnerable to canker-causing diseases. Protect trees during times of disease development to prevent infection.

- Remove dead or dying trees during the dormant season to reduce the inoculum sources within the orchard. Burn trees or chop prunings with a flail mower.
- Remove mummified fruit left in trees which can harbor the black rot pathogen.

Stay tuned – we will be hearing a lot more on this as the northeast works together to find some answers.

Coming Soon to an Area Near You - European Apple Sawfly

Kristy Grigg-McGuffin, Horticulture IPM Specialist

Did you see this damage at harvest? A spiral russetted scar that goes from the calyx to the stem end across the body of the fruit. This is typical damage that was created early in the season from European apple sawfly (EAS).

Figure 1. Spiral russetted scar that extends from the calyx is typical damage from European apple sawfly.

This invasive insect has moved slowly westward across Ontario since monitoring began in the late 1980's. While it is not uncommon to find EAS damage in orchards east of Toronto, it is not expected in the western part of the province. In 2014, damage was reported as far west as the Georgian Bay region. However, while doing harvest assessments in the Niagara region this year, I came across a young orchard block with this:

Figure 2. European apple sawfly damage found in the Niagara region in 2016.

Why is it important to make note of this damage? It is an indication that European apple sawfly has become established in a new area and/or in your orchard. While it takes a few years for the population to build up in an orchard, commercially available traps set up at pink will track the adult emergence and help determine if petal fall control is needed.

From full pink to petal fall, EAS is present as an adult and lays its eggs into the base of the blossoms. After hatching, larvae feed beneath the skin of developing fruitlets, creating a russetted, ribbon-like scar that spirals out from the calyx end.

- If larvae cease feeding early for whatever reason, the damage will likely be seen on mature fruit at harvest. However, the tunneling scars may be short and indistinguishable from damage caused by tarnished plant bug.
- If larvae continue feeding during development, they will tunnel into the fruit towards the seed cavity and reddish-brown frass is often seen protruding from an exit hole. This sort of damage will often cause fruit to abort during June drop.

Delegate (Group 5) was just recently registered for control of EAS. This is the third insecticide group registered for this pest, which also includes:

- Group 4 (neonicotinoids): Assail, Calypso
- Group 28 (diamides): Altacor (petal fall only), Exirel

Research is continuing to look at the potential use of the biopesticide, Quassia for control of EAS and other potential petal fall pests.

For more information on scouting, thresholds and management of this insect, refer to the EAS module on Ontario AppleIPM.

Status of Ambrosia Beetle in Southwestern Ontario High-Density Apple Orchards

Hannah Fraser, Entomologist – Horticulture, Kristy Grigg-McGuffin, Horticulture IPM Specialist, OMAFRA, Ellen Richard, University of Guelph USEL Student

Ambrosia beetles are a group of wood-boring insects that can attack and kill young fruit trees and broadleaved nursery stock. Although these beetles typically attack trees under physiological stress as a result of flooding, drought, winter injury or those weakened by pathogenic fungi, they can attack apparently healthy trees. Three species - *Xylosandrus germanus*, *Xylosandrus crassiusculus*, and *Xyleborinus saxesenii*, have recently been attacking high density apple orchards in New York, New Jersey and Michigan, causing substantial damage and cause for concern among growers. The species of greatest concern in the United States are the black stem

borer - *X. germanus* (Figure 1) and the granulate ambrosia beetle - *X. crassiusculus*, both of which have previously been identified in Ontario. Granulate ambrosia beetle is a new introduction and its distribution has not been documented.

Figure 1. Black stem borer, *Xylosandrus germanus (Photo: Pennsylvania Dept. of Conservation & Natural Resources)*

Biology & Damage

The adult beetles are very small, about 2 to 3 mm in length. In the springtime, mated females leave their overwintering sites in search of new trees to colonize. Females bore into the trunk or branches to create tunnels and branched chambers called galleries where her developing brood will grow.

This group of beetles do not digest the woody tissue of host plants. Instead, the beetles have an obligate mutualistic relationship with a group of ectosymbiotic fungi called ambrosia (hence their name). Ambrosia fungi are carried into the gallery on the beetle's body when she colonizes the tree and become the food source for the adult female and the developing brood. The presence of the fungi disrupts the nutrient and water flow in the tree, causing sap to collect at the gallery surface. The ambrosia fungi alone do not kill a tree. However, the combination of high beetle density and fungal activity can cause wilting and eventual tree death. The secondary introduction of other plant pathogens into these beetle galleries can also cause tree decline.

Ambrosia beetles have a wide host range that includes many woody plants. Trees near the perimeter of orchards, especially near woodlots, are at greatest risk of attack. Signs of infestation include 1 mm diameter entry holes, often with oozing sap, discoloured or blistering bark, and sawdust "toothpicks" from tunnel excavations that protrude from the holes (Figure 2). Some growers have reported that heavily infested trees appear to spontaneously collapse.

2016 Ontario Survey

This year, we monitored high-density apple orchards to gain a better understanding of the range, abundance and diversity of ambrosia beetles in southwestern Ontario. Ethanol-baited traps were installed in 13 commercial orchards across the province to track female flight and to identify the ambrosia beetle species present. Signs of new injury were assessed periodically in trees surrounding the traps. All five apple districts were represented (Figure 3).

Figure 2. Signs of ambrosia beetle infestation can include 1 mm diameter entry holes (left) that often ooze with sap, and sawdust "toothpicks" protruding from holes (right, *Photo: K. Douce, University of Georgia*)

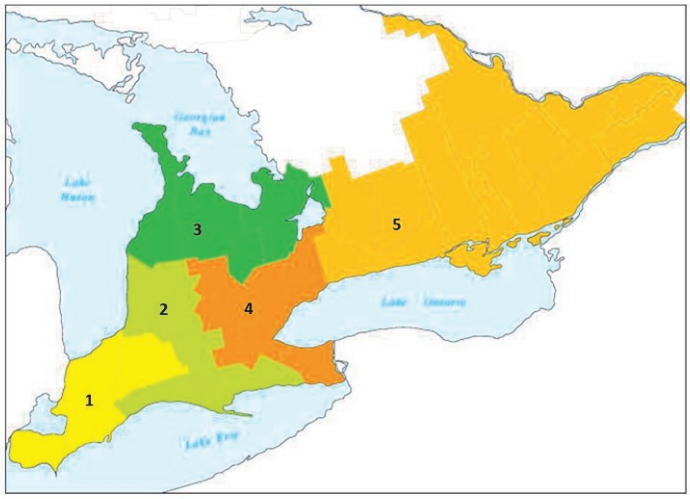


Figure 3. Ontario apple growing districts (*Ontario Apple Growers*)

Results of this survey concluded:

- Six species of ambrosia beetle were identified in the 5 growing regions (Figures 4-8), including
  - *Anisandrus dispar* (European shot-hole borer or pear blight beetle)
  - *A. sayi* (no common name)
  - *Xylosandrus germanus* (black stem borer)
  - *Xyleborus obesus* (no common name)

- *Monarthrum mali* (apple wood stainer)
- *Xyleborinus saxesenii* (fruit tree pin-hole borer)

- Most activity declined by late June with the exception of *M. mali* and *X.* obesus which flew later in the season (mid-June to early August).
- The most abundant species were *X. germanus, X. saxesenii* and *X.* say*i* (Table 1).
- Although *X. crassiusculus* is one of the main pests found in the northeastern US, very few were found in the Ontario survey and only in District 4. These beetles were collected in a peach orchard, not apple.
- It is possible that not all of these beetles are attacking apples, as the ethanol baits may attract beetles from nearby woodlots or adjacent hedgerows. However, *X. germanus* is a confirmed pest in commercial apple orchards in other areas.

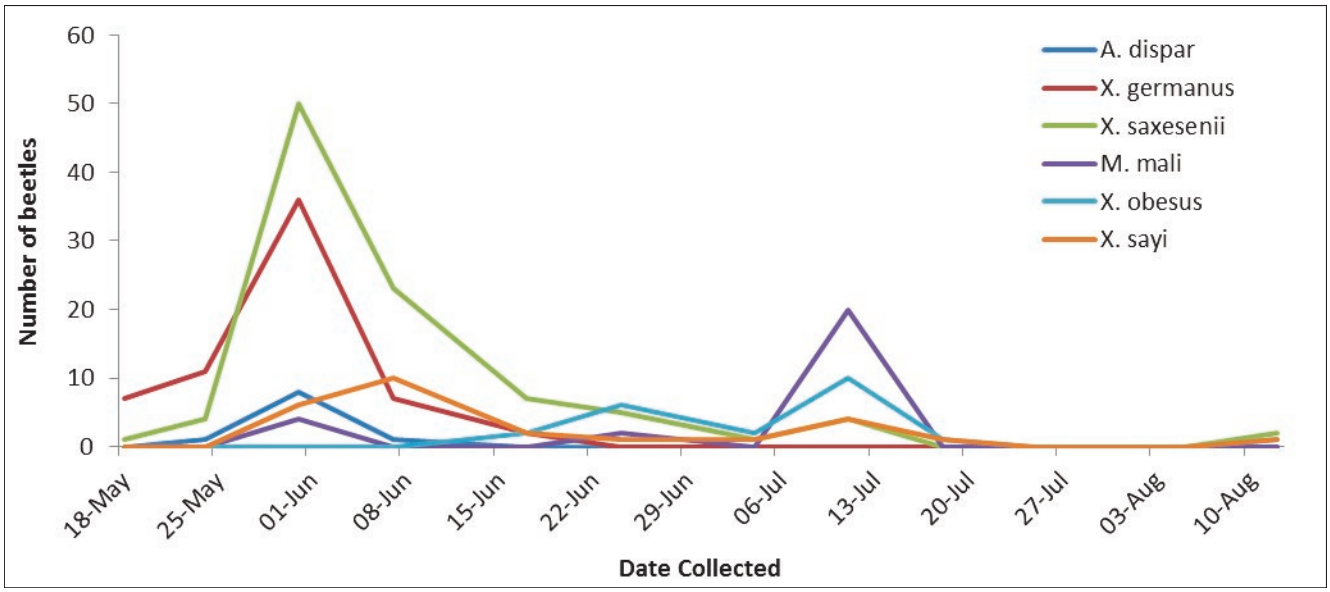


Figure 4: District 1 - Ambrosia beetle samples collected from three orchards with two traps at each orchard (n=6) for 10 weeks

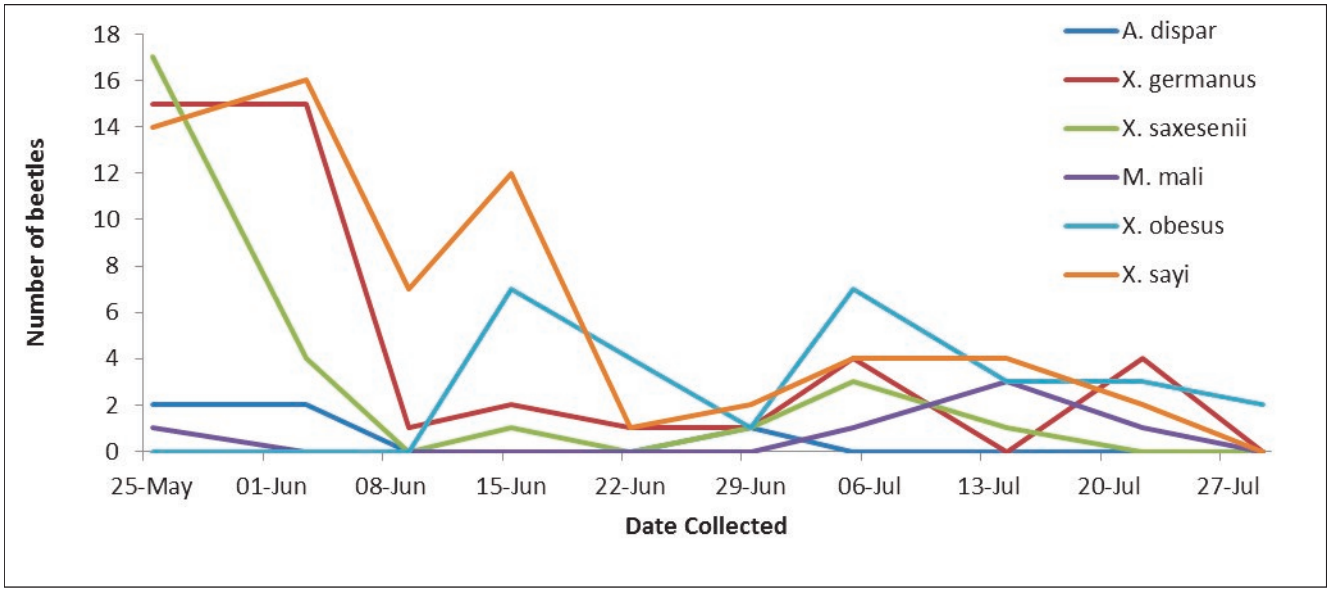


Figure 5: District 2 – Ambrosia beetle samples collected from two orchards with two traps at each orchard (n=4) for 8 weeks.

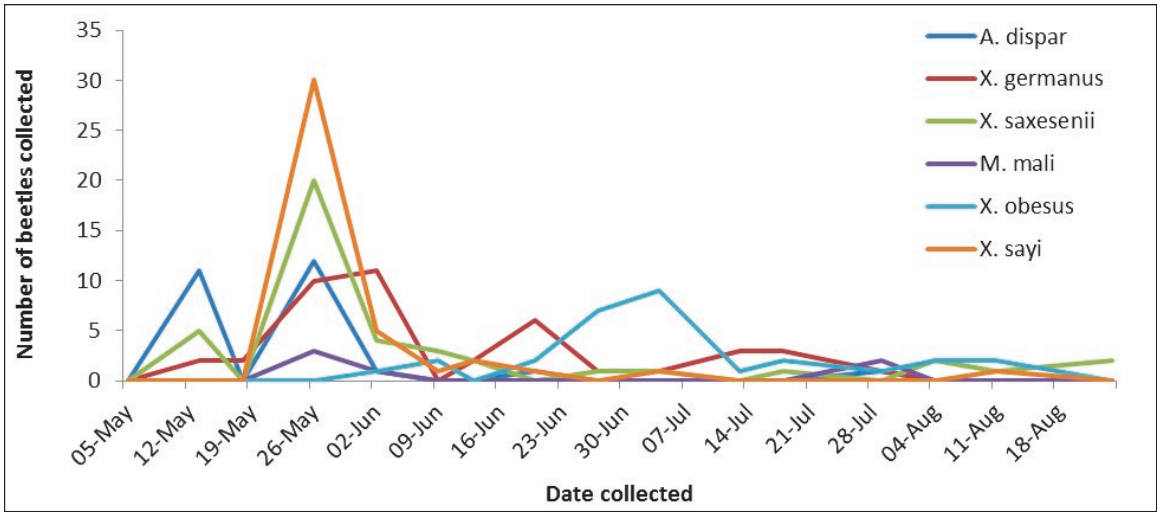


Figure 6: District 3 – Ambrosia beetle samples collected from 3 orchards with two traps at each orchard (n=6) for 12 weeks.

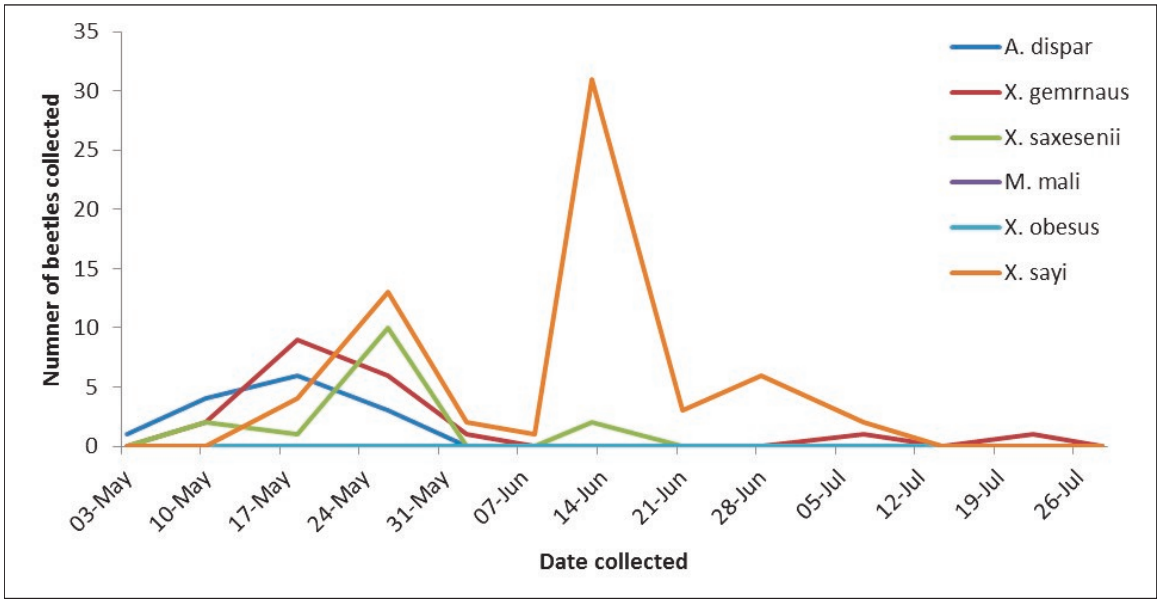


Figure 7: District 4 – Ambrosia beetle samples collected from 2 orchards with two traps at each orchard (n= 4) for 13 weeks.

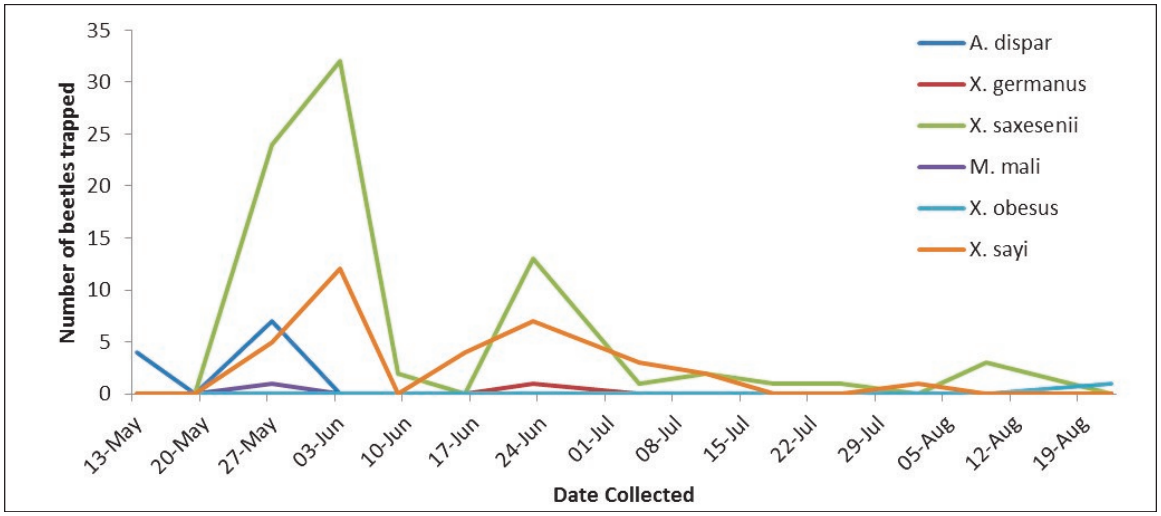


Figure 8: District 5 – Ambrosia beetle samples collected from two orchards with two traps at each orchard (n=4) over 13 weeks.

- The locations where specimens were collected had obvious damage from previous years with holes that were dried and inactive. However, no new damage was observed this year. This could be due to the mild winter causing less stress on the trees which therefore had better defences against beetle attacks.
- The numbers of beetles caught were relatively low (not surpassing 50 from a single trap), while a similar trapping survey conducted in New York detected over 100 beetles during the same time interval. This indicates that perhaps 2016 was a year of low abundance.
- More research is needed in Ontario on the distribution of this beetle complex and the extent of damage that can occur in high-density orchards, including what fungal pathogens are found in beetle galleries.

Management

Insecticides, in the form of trunk sprays, have limited effectiveness since beetles spend the majority of their lifecycle inside the host tree, where they are protected from topical sprays. Preventative application of repellents (e.g., pyrethroids) may deter or kill females as they attempt to find a host and excavate new galleries. Regular monitoring of beetles is required to determine early and peak activity periods. Timing is challenging, particularly if several species are present.

In the absence of registered insecticides to target colonizing females, the only management strategy we have available in Ontario is the removal of dead branches and dying trees. Since beetles will complete their life cycle inside the wood of the tree, all infested tissue should be burned. Maintaining tree health will help prevent beetle colonization and will help trees with low levels of infestation to recover.

We gratefully acknowledge all growers who participated in this study. This project was funded through the OMAFRA-University of Guelph Undergraduate Student Experience Learning program. We would like to thank project mentor Dr. Cynthia Scott-Dupree, School of Environmental Sciences – University of Guelph and Michael Celetti, OMAFRA for technical assistance.

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New Products for Ontario Apple Growers in 2017

Kristy Grigg-McGuffin, Horticulture IPM Specialist, OMAFRA

The 2017 supplement of Publication 360, Guide to Fruit Production is expected to be available in February 2017. This is an update to the full 2016-2017 Publication 360 edition, published earlier this year and includes information on new product registrations and changes from December 2015 to November 2016.

Here is a list of new product additions Ontario apple growers can look forward to seeing in for the upcoming season. For a full list of other registered products, refer to the full edition of Publication 360.

Table 1: Abundance of ambrosia beetles by apple growing district, May 3- August 24, 2016.

	# weeks	# traps	*A. dispar*	*X. germanus*	*X. saxesenii*	*M. mali*	*X. obesus*	*X. sayi*	Total
District 1	10	6	10	63	97	26	22	26	244
District 2	10	4	5	43	27	6	27	62	170
District 3	16	6	26	42	42	6	29	41	186
District 4	13	4	14	20	15	0	0	62	111
District 5	14	4	11	1	79	1	1	34	127
Total	**16**	**24**	**66**	**169**	**260**	**39**	**79**	**225**	**838**

The following products are new product registrations or uses for 2017:

Buran *(garlic powder)* is a biopesticide registered for suppression of powdery mildew at 1.8% v/v (ie. 9 L in 500 L water/ha). Begin applications preventatively when conditions are conducive to disease development. Re-apply every 7-10 days if needed. Do not apply if rain is expected within 48 hours. *Preharvest interval (PHI):* 0 days; *Re-entry period (REI):* when dry; *Maximum # of applications per year (on label):* n/a.

Delegate *(spinetoram)* is a Group 5 insecticide registered for control of European apple sawfly at 420 g/ha. This pest has now been detected as far west as Georgian Bay, Barrie and Niagara regions and continues to move 30-40 km westward each year. Apply pre-bloom and/or post-bloom when thresholds have been reached. Re-apply at 14-21 day intervals, if monitoring indicates a need. *Preharvest interval (PHI):* 7 days; *Re-entry period (REI):* 12 hours; *Maximum # of applications per year (on label):* 3.

Semios CM Plus *(pheromone)* is a mating disruption pheromone registered for reduction in mating of codling moth in pome fruit. Delivery of this product is unique to Ontario using aerosol technology and wireless mesh network. Install 2.5 dispensers/ha in orchard prior to the flight of the first codling moth generation. Use a higher density (up to double the standard density) at the orchard edge toward the prevailing winds. Canisters contain 7675 puffs. Typical dispensing rate is 1 puff every 15 minutes over a maximum 12 hours per day (5PM to 5AM), so canisters should last for approximately 160 days. For more information regarding installation or application, contact Semios (info@semios.com) at least 6-8 months prior to the planned use. *Preharvest interval (PHI):* not specified on label; *Re-entry period (REI):* not specified on label; *Maximum # of applications per year (on label):* not specified on label.

Senator 50 SC *(thiophanate-methyl)* is a Group 1 fungicide registered for control of scab and powdery mildew at 250 mL/1,000 L water. For resistance management, tank-mix with one of the following compatible protectant scab fungicides: Maestro 80 DF or Supra Captan 80 WDG at 0.625 kg/1,000 L water (note: do not use within 14 days of oil) or Granuflo-T at 1.5-2.25 kg/1,000 L water. Historically, Benlate-resistant forms of apple scab have been present in Ontario. Senator belongs to the same chemical family as Benlate. Use caution if Benlate was used in your orchard in the past. Begin applications preventatively when conditions are conducive to disease development. Reduce spray intervals under conditions of severe disease pressure. *Preharvest interval (PHI): 1* day; *Re-entry period (REI):* 12 hours; *Maximum # of applications per year (on label):* max. 1.75 L/ha (Supra Captan/Maestro tank-mix) / max. 0.875 L/ha (Granuflo tank-mix).

Sivanto Prime *(flupyradifurone)* is a Group 4D insecticide registered for the control of rosy apple aphid, green apple aphid, white apple leafhopper and potato leafhopper at 500-750 mL/ha, and scale (San Jose and oystershell) at 750-1,000 mL/ha + 0.25% v/v oil. If using with oil, may cause bark injury on some varieties such as Red Delicious, Empire and Mutsu/Crispin. Do not use oil within 14 days of using Supra Captan, Maestro, Folpan or any other product containing sulphur. Do not apply within 48 hours of freezing temperatures, when temperatures exceed 25°C, to crops under moisture stress or just prior to rain. Sivanto Prime is toxic to certain beneficial insects. Where possible, rotate with products from different groups. Re-apply after 10-14 days, if needed. *Preharvest interval (PHI):* 14 days; *Re-entry period (REI):* 12 hours; *Maximum # of applications per year (on label):* max. 2 L/ha.

The following are important notices regarding changes to existing labels or use patterns:

- **Vivando** *(penthiopyrad)* is no longer registered for use on apples for powdery mildew.
- Due to the decision by the Pest Management Regulatory Agency (PMRA) to phase-out diazinon insecticides, **Diazinon 500 E** (PCP #11889) and **Diazinon 50 WSP** (PCP #29976) will **no longer be permitted for use on apple** after December 31, 2016.
- Due to post-application risk to workers, the PMRA has re-evaluated the use of **Sevin XLR** (PCP #27876). As of September 20, 2016, Sevin is **no longer registered for insecticide use on apples**. For thinning, the following changes have been made:
  - Maximum **one** application per year.
  - Wearing chemical resistant gloves is recommended for hand-thinning following application.
  - For high density trellised orchards – Maximum application rate per growing season is 1.5 kg a.i./ha. Minimum re-entry period is 14 days for hand-thinning and managing hand-line irrigation, and 4 days for pruning, scouting, pinching, tying and training.
  - For low density, traditional, non-trellised orchards – Maximum application rate per growing season is 1.0 kg a.i./ha. Minimum re-entry period is 10 days for hand-thinning and managing hand-line irrigation, and 6 hours for pruning, scouting, pinching, tying and training.

The supplement can be downloaded from the OMAFRA website at ontario.ca/crops. Printed copies along with many other factsheets, publications and resources can be ordered from ServiceOntario:

- Online at ServiceOntario Publications
- By phone through the ServiceOntario Contact Centre, Monday to Friday 8:30 am – 5:00 pm
  416-326-5300 (416-325-3408 TTY)
  1-800-668-9938 (Toll-free across Canada) (1-800-268-7095 TTY toll-free across Canada)
- In person at ServiceOntario Centres located throughout the province or at any OMAFRA Resource Centre.

Low Risk of Chilling Disorders in Apples for 2016-17 Storage Season

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

CIPRA is a computer-based program developed by the research team of Dr. Gaétan Bourgeois (AAFC-QC) that uses weather data to predict the risk susceptibility of apples to specific storage disorders (Bourgeois, DeEll, and Plouffe). According to the CIPRA model, there is **little risk (< 2%) of chilling-related disorders developing this storage season** based on weather data from Simcoe-Delhi (Norfolk County), Ontario (Figure 1).

To reduce the risk of developing chilling-related disorders, pay close attention and use the recommended temperatures and storage regimes for specific apple cultivars. 'Empire', 'McIntosh', and 'Honeycrisp' are especially susceptible to chilling-related disorders (i.e. flesh browning, low temperature breakdown, core browning, soft scald, soggy breakdown) and **symptoms can usually be induced by using storage temperatures lower than optimum**. Late harvested apples are also more prone to developing chilling-related disorders, such as flesh browning in 'Empire' or soft scald and soggy breakdown in 'Honeycrisp'. Therefore, manage your storage periods and marketing accordingly.

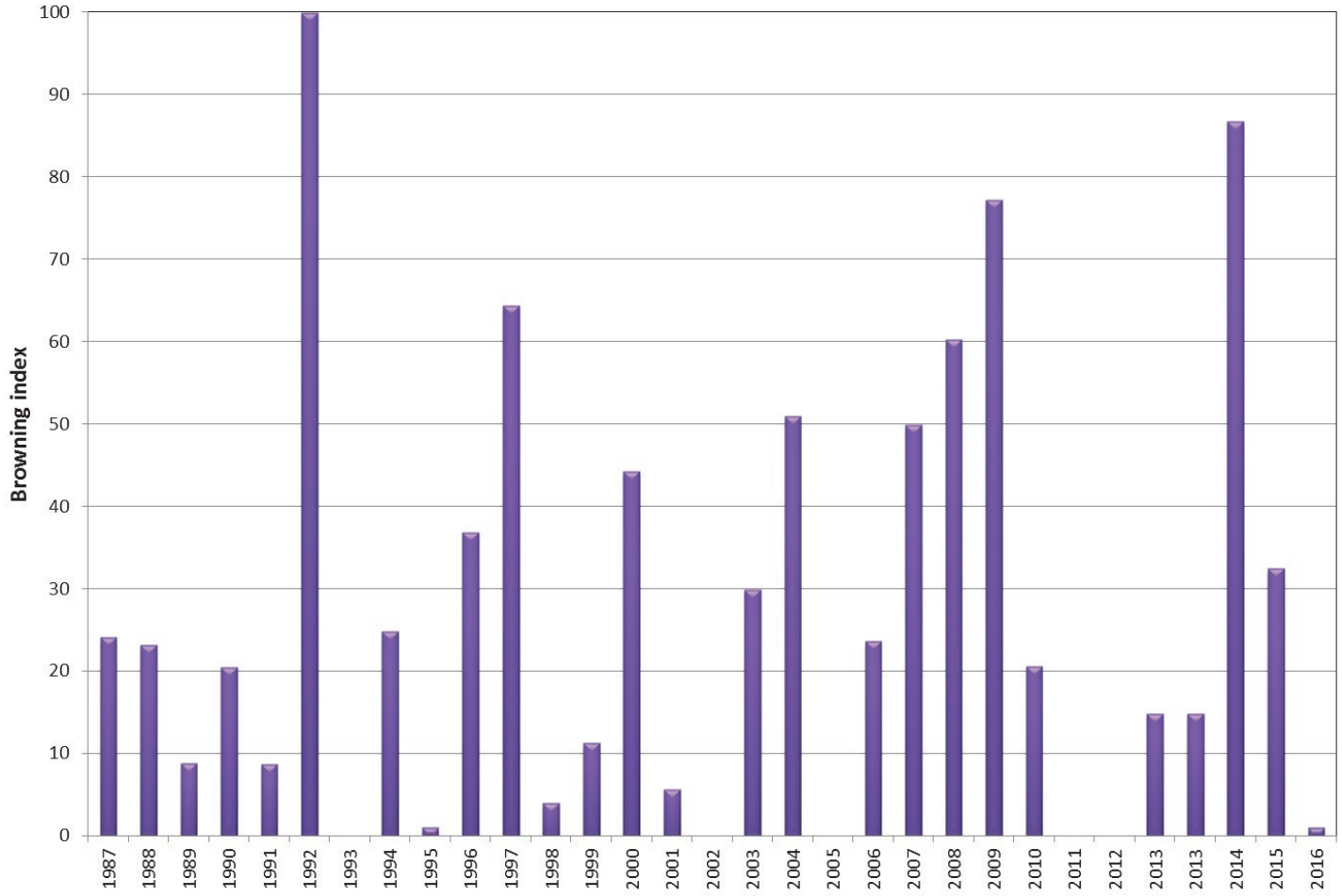


Figure 1. Risk of developing chilling-related disorders during 1986 to 2016, for the region of Simcoe-Delhi (Norfolk County), Ontario.

** Graph supplied by D. Plouffe, AAFC-QC*

Announcements

Have You Subscribed to the Ontario Fruit Blog: ONfruit?

Stay informed with current production and pest management information for apples, berries, grapes and tender fruit by visiting the ONfruit blog. At ONfruit, you can access timely updates on commercial fruit production in Ontario, brought to you by the OMAFRA fruit team.

Some of the topics on the blog include:

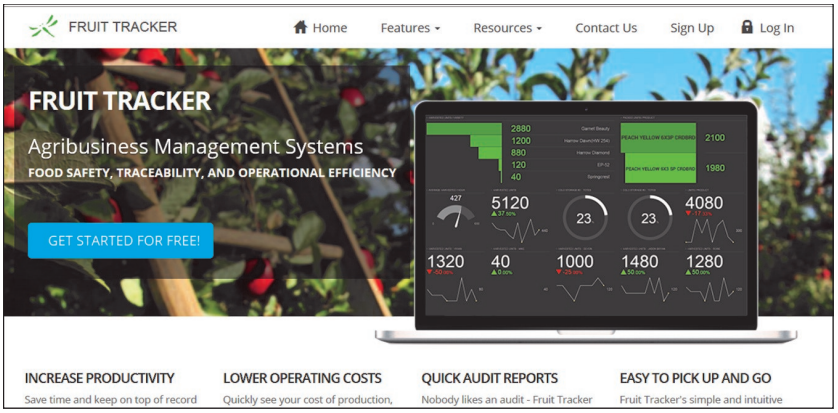
- Fruit crop production
- Pest identification, monitoring and management
- Changes to product registrations
- Weather related issues
- Soil and crop nutrition
- Industry events and resources

Only grow apples? Get crop specific information by going to the “Apples” tab.

To stay up to date on new postings and get notification of new content, go to ONfruit and enter your email under “Subscribe by email” on the right hand side.

Get to Know What Fruit Tracker Can Do For You

With harvest done and the snow starting to fly, now is the chance to take another (or first) look at FruitTracker.com to see how it can help you keep better records. This system provides growers with an innovative, extensive management tool for record keeping and analysis of production events, including tree/block information, food safety and traceability, pest management, crop protection, as well as harvest, storage and shipping event tracking. Now that's being organized!



There have been many changes and updates to the system since it first began operation a few years ago. If you haven’t looked at Fruit Tracker recently, you will be pleased with how efficient it has become. Like any other program, it takes a little time to get used to, but once you do, it is simple to use. If you need to make corrections, there are lots of opportunities to edit. Have questions about the system? Not sure where to start? There are a series of YouTube videos available that will walk you through the program and give a great visual on the capabilities.

The system is free for all Ontario Apple Grower (OAG) members and each member has their own personal login. Don't have your login information? Email Matt Deir at matthew.deir@dragonflyit.ca. Dragonfly IT staff will also have a booth at the Ontario Fruit & Vegetable Convention in Niagara Falls, ON on February 22-23, 2017. Stop by to chat with them or if you have any questions.

Agricultural Information Contact Centre: 1-877-424-1300
E-mail: ag.info.omafra@ontario.ca
Northern Ontario Regional Office: 1-800-461-6132

www.ontario.ca/omafra