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ORCHARD NETWORK

For Commercial Apple Producers

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In this issue...

Orchard Management

Metamitron – A New Compound for Chemically Thinning Apples

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

In the March issue of the Orchard Network Newsletter, I reviewed some of the basis for chemically thinning apples. By now, you've had some time to evaluate and reflect on your thinning outcomes this past season and how effective your programme was. Overall, my view is that it was indeed challenging, with the inclement and cool weather preceding bloom in spring, to apply fruitlet thinners or predict their response.

In this article, I'd like to share our preliminary results using Brevis®, a new unregistered compound manufactured by Adama Canada. We are actively working with the registrant to provide data to support the registration of metamitron in Canada and are encouraged by the thinning response we've seen.

What is Metamitron?

Metamitron is a herbicide first used on sugar beets that is now registered in Europe and Chile for thinning apples. Marketed under the name Brevis®,

This Newsletter is brought to you by the Ontario Apple Team:

Amanda Green, Simcoe
ONNL Editor
Tree Fruit Specialist
(519) 426-1102
amanda.green@ontario.ca

Dr. Jennifer DeEll, Simcoe
Fresh Market Quality Specialist
(519) 426-1408
jennifer.deell@ontario.ca

Dr. John Cline
University of Guelph, Simcoe
(519) 426-7127, ext. 331
jcline@uoguelph.ca

Kristy Grigg-McGuffin, Simcoe
Horticulture IPM Specialist
(519) 426-4322
Kristy.Grigg-McGuffin@ontario.ca

Hannah Fraser, Guelph
Entomologist-Horticulture
519-824-4120,ext 52671
hannah.fraser@ontario.ca

Anne Verhallen, Ridgetown,
Soil Management Specialist-Horticulture
(519) 674-1614
anne.verhallen@ontario.ca

Dr. Jason Deveau, Simcoe,
Application Technology Specialist
(519) 426-8934
jason.deveau@ontario.ca

John Zandstra
University of Guelph, Ridgetown
(519) 674-1500 ext 63627
jzandstra@ridgetownc.uoguelph.ca

Katie Goldenhar, Guelph
Pathologist—Horticulture
(519) 824-4120 ext 58910
katie.goldenhar@ontario.ca

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metamitron is a photosynthetic inhibitor that temporarily reduces carbohydrate supply to developing fruitlets, triggering earlier and enhanced fruit abscission. The objectives of our research were to measure the response of two cultivars to metamitron applications at various concentrations.

What was done:

In 2018, a mature block of Gala/Bud.9 and Honeycrisp/M.26 located at the University of Guelph Simcoe Research were treated with various rates of metamitron ranging from 165 mg/L (1.1 L/ha) to 480 mg/L (3.2 L/ha) metamitron (Brevis 46701) and compared with an untreated control, a hand-thinned control, and various carbaryl (Sevin XLR Plus), 6-benzyladenine (6-BA) (MaxCel) and NAA control treatments - depending on the cultivar. Sprays were applied when the king fruitlet size corresponded to 10-12 mm diameter.

Treatments were applied using a commercial air blast sprayer at 1379 kPa, ~1000 L/ha, which equated to tree row volume (TRV) pesticide dilute (Sutton and Unrath, 1988). The sprayer was equipped with 5 nozzles per boom (side) and a large axial fan to move the spray into the canopy. To minimize treatment interference caused by spray drift, experimental units were separated by at least two guard trees. Regulaid (Kalo, Oveland Park, KS) surfactant at 0.05% (v/v) was included in each of the spray treatments. Gala and Honeycrisp trees were hand thinned by singling clusters to one fruit and spacing fruit ~15 cm apart on 21 June 2018 and 18 June 2018, respectively.

What was measured:

- Fruit set
- Tree trunk circumference 30 cm above the graft union was measured in the spring and fall to calculate trunk cross-sectional area.
- Fifty king and fifty lateral fruitlet cross-sectional diameters were measured repeatedly during the fruit set period.
- Gala and Honeycrisp trees were hand thinned by singling clusters to one fruit and spacing fruit ~15 cm apart on 21 June 2018 and 18 June 2018, respectively.
- Leaf phytotoxicity
- Total number and weight of marketable and unmarketable fruit was recorded at harvest.
- Fruit were graded over a commercial sorting line to determine size distribution.

What did we observe?

- There was no marked leaf or fruit phytotoxicity or leaf drop detected from any of the metamitron spray treatments on either Gala or Honeycrisp.
- Metamitron reduced fruit set compared with the unthinned control treatment for both cultivars.
- For Gala, trees that were left un-thinned or treated with 1.1 and 1.65 L/ha metamitron, fruit set was similar to the untreated controls. Trees treated with 2.2 L/ha metramitron or greater, had fruit set values similar to the hand thinned controls (Figure 1).
- For Honeycrisp, fruit set was reduced for all chemical thinning treatments, including the lowest rate of metamitron (1.1 mg/L), when compared with fruit set on untreated trees. When metamitron was applied at 1.1 to 2.75 L/ha, fruit set was similar to the hand thinned control. Fruit set decreased with increasing rates of metamitron between 1.1 and 2.2 L/ha, but not above that rate. The combination of 100 mg/L Carbaryl and 10 mg/L NAA reduced fruit set excessively, however when these products were applied separately, they provided similar (Carbaryl) or better thinning (NAA) than the hand-thinned control (Figure 2).

Summary

- Thinning response with metramitron was concentration-dependent and increased in a linear fashion within the rates used in this experiment. However, Honeycrisp was less responsive than Gala since rates higher than 2.2 L/ha did not improve thinning.
- Metamitron reduced fruit set similar to the hand-thinned control treatments, providing an alternative to Sevin XLR should it be not available in the future
- Thinning treatments improved mean fruit weight when compared with untreated control treatments for both cultivars**.**
- Further efficacy and rate studies with metamitron involving other cultivars grown in Ontario are required. Additionally, determination of annual variation in thinning response to metamitron over time is required.

Acknowledgements

I am grateful to the Ontario Apple Growers, Ontario Agri-Food Innovation Alliance Research Programs, and the University of Guelph for providing funding for this research. Disclosure: funding from Adama Canada was provided to help fund this research.

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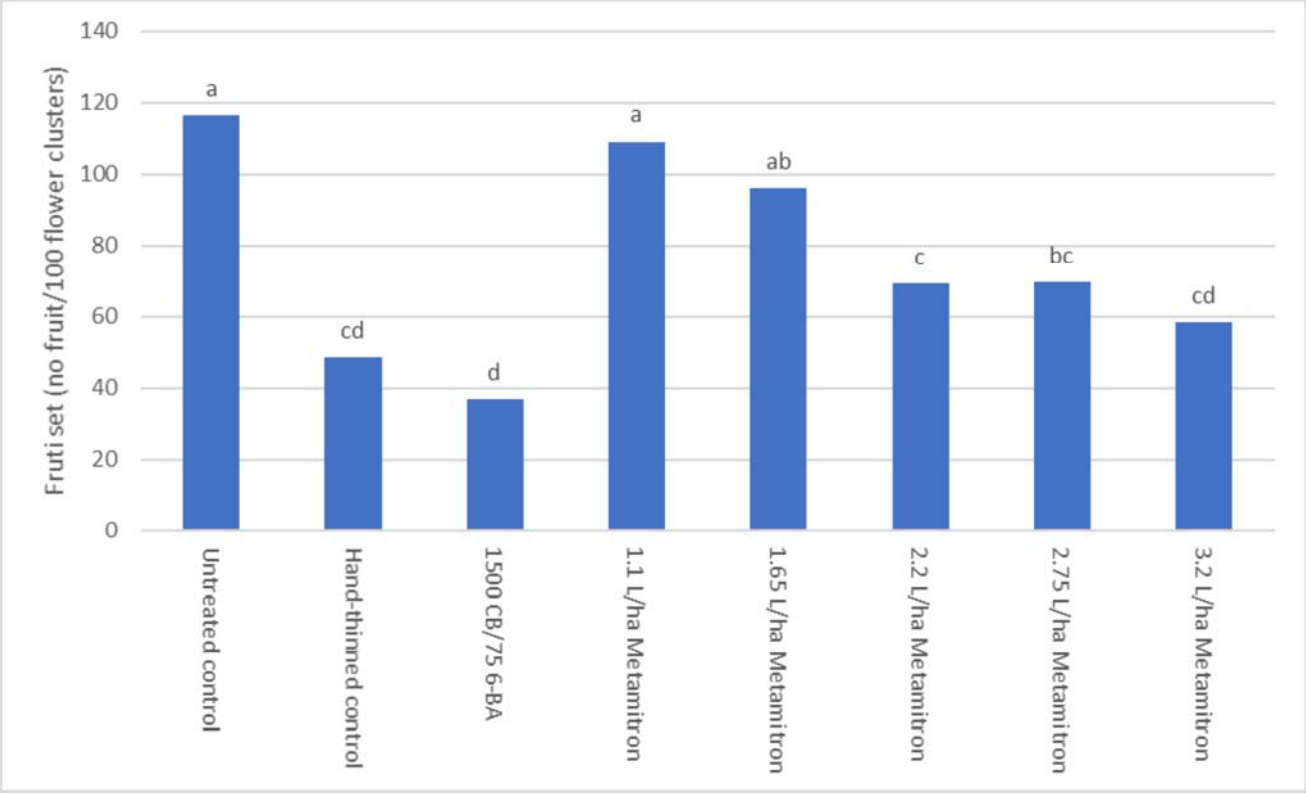


Figure 1. Fruit set of Gala trees in response to an untreated control, hand thinned control, and the fruitlet thinners 1500 mg/L Carbaryl tank mixed with 75 mg/L 6-BA, and 1.1-3.2 L/ha metamitron all applied at ~10-12 mm fruitlet diameter. in 2018, HES Simcoe. Letters that differ above bars indicate significant differences in treatment means (Tukey HSD, P=0.05).

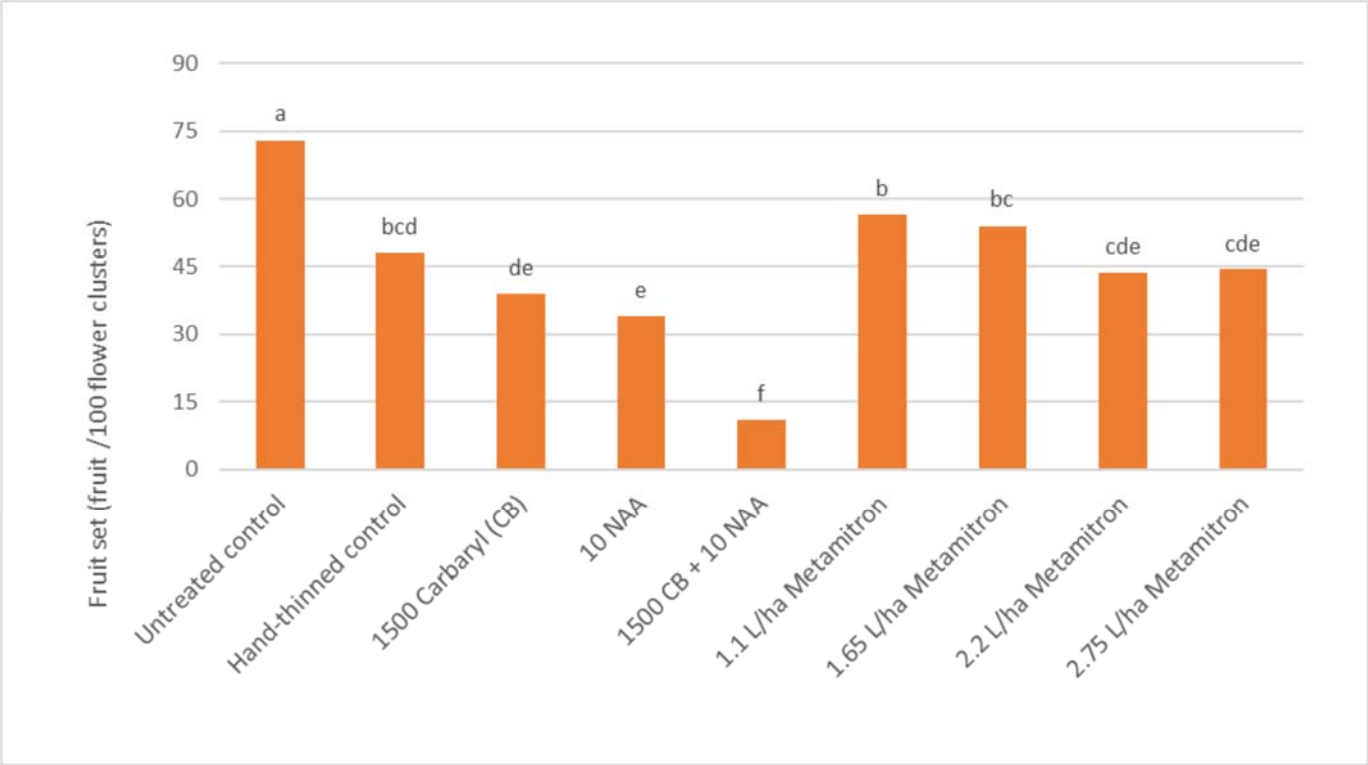


Figure 2. Fruit set of Honeycrisp trees in response to an untreated control, hand thinned control, and the fruitlet thinners 1500 mg/L, 10 mg/L NAA, 1500 mg/L Carbaryl tank mixed with 10 mg/L 6-BA, and 1.1-2.75 L/ha metamitron all applied at ~10-12 mm fruitlet diameter in 2018, HES Simcoe. Letters that differ above bars indicate significant differences in treatment means (Tukey HSD, P=0.05).

Achieving High Yields of High-Quality Apples

Amanda Green, Tree Fruit Specialist, OMAFRA

Often on orchard tours, yields of apple orchards are discussed along with how to achieve high quality apples in the attributes of size and colour. When visiting orchards in Washington State, our eyebrows are raised when we hear 100 bins/acre tossed out along with high pack-out percentages; however, Washington state has the advantage of having more sunlight/ less cloud cover to be able to push yields. Do we have the conditions to push yields further without comprising on quality or next year's crop? Are there practices growers can adopt to achieve higher yields of high-quality apples? At the 2020 Ontario Fruit and Vegetable Convention, three talks will be dedicated to covering some aspects of achieving high yields.

Our first speaker on this subject will be Dr. Poliana Francescatto with Valent BioSciences. Dr. Francescatto is an expert on general crop load management, flower formation and early thinning. She will be speaking on fruitlet thinning, timing, and precision crop load management. She will also be addressing achieving optimal size and yield as well as managing biennial bearing.

Our second speaker on this subject will be Dr. Robert Crassweller from Penn State University. Dr. Crassweller will be speaking on orchard nutrition for achieving optimum yields through soil and foliar fertilization. Dr. Crassweller has expertise in tree fruit production and nutrition. He will also be speaking on how to produce apples in a changing climate as a separate talk in the apple session.

We will then have a panel of growers give their perspective and share their experience and practices in achieving high yields while maintaining high quality. On this panel we will have Doug Balsillie, The Fruit Wagon, Essex County; Gerbe Botden, Blue Mountain Fruit Company, Grey County; and Art Moyer, Moyer Orchards and Vineyards, Niagara Region. These growers come from different ends of the province and incorporate many different and similar practices in their orchard management to achieve their production goals.

Are you Planning to Apply for a New Permit to Take Water? Do you Need to Renew any Existing Permits to Take Water?

Rebecca Shortt, Engineer, Water Quantity, OMAFRA

The Ministry of Environment Conservation and Parks (MECP) will be offering a workshop on how to navigate the new Permit to Take Water (PTTW) electronic application process. This workshop is included with your OFVC registration and will be in room 205 on Thursday 20 Feb, 2pm.

If you're irrigating more than 3-4 acres of orchard, you're likely taking more than 50,000 L of water on an irrigation day. This is the trigger for needing a PTTW from MECP. A PTTW is required for any irrigation water supply, for example a well, lake, stream, river or even a pond on your own property. If you already have Permits for all your irrigation water sources, that's great! Remember that they need to be renewed, usually every 5 to 10 years. Check your Permits to see when they are expiring and renew them up to 6 months in advance.

Plan on attending the ELECTRONIC-PTTW APPLICATION PROCESS workshop at the 2020 Ontario Fruit and Vegetable Convention.

Vineland Research and Innovation Centre Apple Breeding Program Update 2019

Rachael LeBlanc, Apple Breeder, Vineland Research and Innovation Centre

I'd like to introduce myself as Vineland's new apple breeder, Rachael LeBlanc. I am excited to meet all the Ontario apple growers. I encourage you to visit the research centre to meet me and see all the test trees. Producing apples with a high consumer appeal continues to be the focus of the breeding program.

Rachael LeBlanc, Apple Breeder, Vineland Research and Innovation Centre

The apple breeding program added 3800 test 1 trees to the orchard this year. There are now about 28,000 unique Test 1 trees from over 60 different crosses. Of these, 39 have been advanced to Test 2 (8 replicates per selection). An extremely large variety of fruit in every possible characteristic (size, colour, shape, texture, flavour, harvest date, etc.) has been observed. Fruit from about 7000 trees has been evaluated in field for appearance and taste profile. A subset of this group is currently undergoing evaluation by a group of trained staff at Vineland to ensure they have the right flavour and texture to advance. Approximately 15 selections are expected to be advanced to the Test 2 orchard this year.

In addition, Vineland's Biochemistry and Consumer Insights groups are using their knowledge about consumer preferences of apple varieties and are developing instrumental methods that can be used to select for apples that will appeal to consumers for flavour and texture. We are currently correlating the sensory attributes that drive consumer liking, and the aroma volatiles responsible for these attributes in hopes of creating an analytical screening protocol that enables selection of desirable fruit without the need to taste every variety coming out of the orchard. We plan to develop DNA markers for the key aroma volatiles so that our population can be enriched with apples with desirable aroma attributes. We are also working to identify instrumental methods that can identify apples with the right texture characteristics, since correlations between the eating experience and penetrometers are not reliable. The ultimate goal is to have a variety of tools that can be used to evaluate apples from the breeding program to ensure they will have high consumer appeal.

Research is supported by Ontario Apple Growers (OAG) through the Agriculture and Agri-Food Canada (AAFC) AgriScience Program and through the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)-University of Guelph Partnership Program.

Airblast Budget and Work Rate Calculator

Jason Deveau, Application Tech Specialist, OMAFRA; Dr. David Manktelow

There are many factors that affect the work rate of an airblast application. If an operator can improve their work rate, without compromising spray efficacy or safety, they improve operational efficiency and save money.

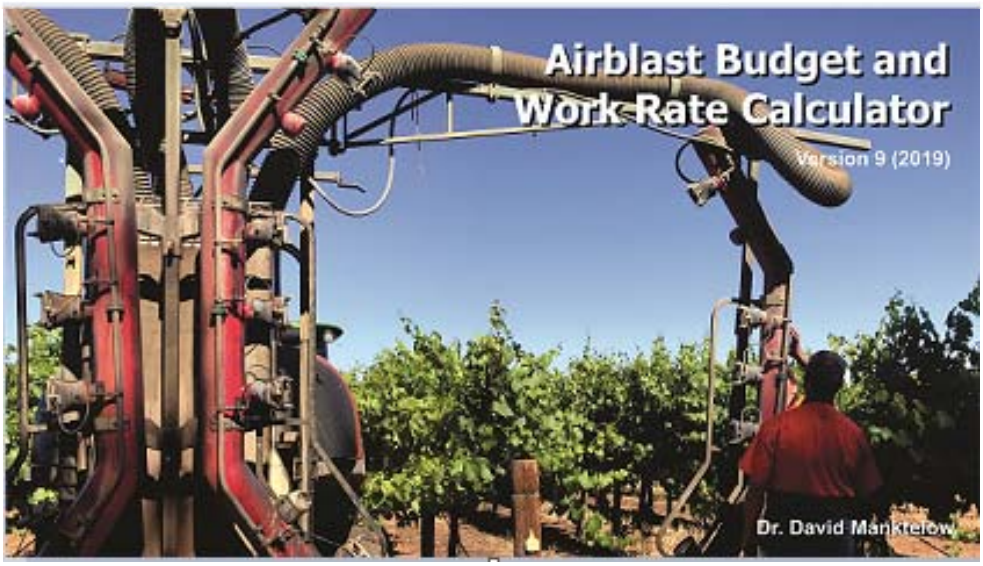
But how does each variable factor in? Is it worth the cost of a tender truck and operator to fill more efficiently? Should you upgrade to a multi-row sprayer? Should your next planting have longer rows?

Download a copy of the Airblast Budget and Work Rate Calculator here https://sprayers101.com/airblast-workrate/ and find out. You must have Excel to run the spreadsheet, and you must permit the use of macros (you'll be prompted to accept).

Build and compare multiple scenarios to explore the relative impact of small changes to your typical spray program. We recommend making only one change for each scenario so you can better understand the results. Print the comparison page for your records.

Whether you're a sprayer operator, or a manager of sprayer operators, this exercise will help you see your spray program in a whole new light.

Spoiler: It's amazing how changes to travel speed have only a marginal impact on work rate. Often less than 60% of the total spray job is spent actually spraying!



Crop Protection

Research Activities Working Towards Identifying Causes of Tree Fruit Decline

Jonathan Griffiths, Plant Virologist and Walid Ellouze, Plant Pathologist, Agriculture Agri-Food Canada

Rapid/Sudden Apple Decline

Fruit trees in Ontario and across the country are facing a serious threat which is killing many of them and research teams from Agriculture and Agri-Food Canada (AAFC) are working towards identifying the cause(s) of this devastating problem. New symptoms were first reported in 2014 in Pennsylvania apple orchards where the condition was named Rapid Apple Decline (RAD). Over the ensuing years RAD symptoms have been reported in the US and Canada. Certain growing regions have reported tree mortality of up to 40 per cent. Even more alarming was the appearance of similar symptoms in stone fruit orchards. This fruit tree condition has perplexed growers and scientists attempting to understand and identify the cause(s) and origin of this apple and stone fruit tree decline. Dramatic increases in tree mortality have continued in Ontario in the 2019 growing season. AAFC is funding a national research program to study RAD and identify the cause(s).

Apple decline has been reported across Canada in British Columbia, Ontario, Quebec, Nova Scotia, New Brunswick and Prince Edward Island. RAD, also known as Sudden Apple Decline (SAD), symptoms include loss of vigor, appearance of yellow-red leaves, rapid development of cankers extending upwards from the graft union, and sudden collapse of entire tree(s) within two weeks. Tree death was seemingly sporadic or random throughout the orchards. In the summer of 2018 and 2019, a total of 21 apple orchards where sampled in Canada; this included nine in British Columbia, seven in Ontario, two in Prince Edward Island and one in Nova Scotia. Tree samples were used to isolate potential fungal, bacterial and viral pathogens. Samples were taken from healthy and symptomatic trees. Fifteen fungal species were isolated

belonging to *Cylindrocarpon* complex, *Botryosphaearia*, *Dothidia*, *Diaporthe*, *Fusarium*, *Alternaria*, and *Trichoderma* species. Molecular techniques were being used to confirm final species identification. Apple luteovirus 1, a newly discovered virus first reported in 2018 in the US, was detected in more than 50 per cent of the collected samples in Ontario. In the US, the virus was detected in SAD affected and healthy orchards. Thus, its association with the disease is unclear although it may be one of the contributing factors. Ethanol-baited traps for monitoring damaging Ambrosia beetles were installed last summer in apple orchards affected by SAD across Ontario. Species identification of trapped species of Ambrosia beetles has started. In spring 2020, the AAFC team in Vineland is planning to artificially expose apple trees, in a contained environment, to one or a combination of the collected pathogens to evaluate if the pathogens can cause SAD disease symptoms.

Stone Fruit Decline

The AAFC researchers in Vineland first became aware of a new and serious disease in apricots at the beginning of the summer of 2018. An apricot orchard in the Niagara region was brought to their attention that had up to half of newly planted trees dying. The AAFC team in Vineland began sampling from that site and quickly expanded to 13 different sites in the Niagara region. Since then, rapid and unexplained tree death has been recorded in apricots, peaches, plums, pears, and nectarines. The disease progression appears similar to SAD in that symptoms are primarily observed in young two- to eight-year-old trees with a rapid decline and sudden death within weeks. Frequently observed symptoms include individual branches dying off, increased suckering and rootstock overgrowth, increased gummosis and cankers on the tree, necrosis that begins at the graft union and progresses up the tree, and tree die back with a full load of mature fruit. This summer the team has intensively monitored and sampled from a plot of nectarines (Fantasia on Bailey rootstock) where at the end of the summer of 2018, there were 11 dead trees out of 170 total (7 per cent). By September 2019, they observed 42 dead trees (25 per cent), with another 118 showing symptoms of decline (69 per cent), and only 9 remaining healthy trees (5 per cent).

The AAFC Vineland team is continuing to process all tree fruit samples in an attempt to identify all potential pathogens present. In addition, abiotic factors such as herbicide/pesticide damage, drought or winter injury, and graft incompatibility are also being studied. The decline of tree fruits appears to be a complex and multi-factorial problem. Careful and thorough scientific investigations are being conducted at AAFC research centres in British Columbia, Ontario, Quebec and Nova Scotia; in a coordinated effort to identify the decline cause(s) and work towards solutions.

Contact information:

For more information, please contact:
Dr. Walid Ellouze (oualid.ellouz@canada.ca) or

Dr. Jonathan Griffiths (jonathan.griffiths@canada.ca)
Agriculture and Agri-Food Canada
4902 Victoria Avenue North,
Vineland Station, ON L0R 2E0

New Pathologist for Horticulture Crops in Ontario

My name is Katie Goldenhar, I have recently joined the Ontario Ministry of Agriculture, Food and Rural Affairs as the Pathologist for horticulture crops in Ontario. I have a background in applied plant pathology from Michigan State University and have been working in the Ontario horticulture industry for the past few years. I am excited to work with the horticulture industry on the many diseases growers are faced with. As part of my position with OMAFRA, I plan to focus on bringing new solutions for disease management to the industry and ensuring Ontario growers are informed and aware of the key diseases that impact horticulture crops in the Great Lakes area.

Alert! Marssonina Leaf Blotch Detected in Northeastern United States

Kristy Grigg-McGuffin, Horticulture IPM Specialist, OMAFRA

Reports coming out of Pennsylvania and New York this summer identified a new apple disease, Marssonina leaf blotch. This pathogen was initially found in both regions in the fall of 2017. It is possible that this could be the culprit for some of the unusual leaf spotting that has been found in a number of Ontario orchards as well. Unfortunately, this pathogen can be quite difficult to positively identify using the typical detection methods. I plan to do a more thorough investigation next year -- stay tuned.

Marssonina leaf blotch, also nicknamed “late season apple scab” is caused by the fungus, *Marssonina caronaria*. Leaf spots develop on the upper surface of mature leaves mid-summer and continue into the fall (Figure 1). These spots are brown with a purple border. Small black fruiting bodies can occasionally be visible on the surface of the lesion. The lesions can coalesce and the surrounding tissue turns yellow before defoliation occurs. Fruit infection can occur as well; however, it is not as common as leaf infection and has not been found in either Pennsylvania or New York.
Management starts with sanitation similar to apple scab

management as the pathogen overwinters in infected fallen leaves. A standard summer disease program with captan and strobilurin (e.g., Pristine) fungicides should effectively manage Marssonina in a typical year. However, symptoms are likely to develop in a year like the one we just had when frequent and/or heavy rains wash off fungicide residue.

For more information on Marssonina leaf blotch and other summer disease issues, come to the Apple session at the Ontario Fruit & Vegetable Convention in Niagara Falls, ON on Feb 20, 2020 to hear from Srdjan Acimovic, Plant Pathologist with the Cornell University Hudson Valley Lab.

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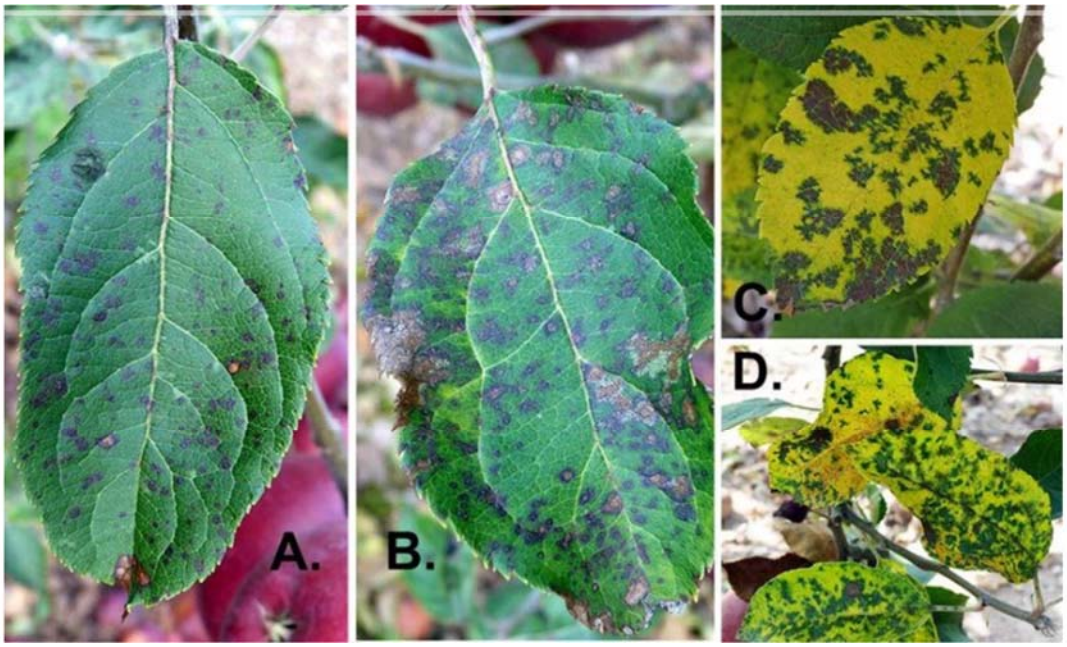

Figure 1. Marssonina leaf blotch: A) Begins as small lesions on the upper surface of the apple leaf. B) Lesions can coalesce into large blotches, C) Infected leaves will turn yellow, D) Infection will cause premature defoliation which can be severe. (Photos: K. Peter, Penn State University)

Managing Rodent Damage in Orchards

Kristy Grigg-McGuffin, Horticulture IPM Specialist, OMAFRA

With the snow this time of year, comes the return of rodents back into the orchard when the cool weather reduces their summer food supply. Every year, voles (mice) and rabbits can cause significant economic injury. They typically establish a system of surface runways and underground tunnels, in the case of voles. Look for indications of rodents in the orchard, such as girdling of bark, burrowing, droppings, or chewed apples. Though often kept in check by their many natural predators, populations can increase quickly, making controls important to reduce damage. The early cold snap in November may have reduced food supply earlier than other years that saw a moderate fall. Some growers this year also minimized their year-end orchard maintenance, opting to leave fruit in the orchard or cut back on late season mowing of long grasses and cover. These can provide the food source and protection from predators these pests need.

In fall and winter, rodents feed on the bark, particularly on young trees (Figure 1). The feeding injury is often more extensive in winters with continuous, prolonged snow cover. Complete girdling of the trunk will kill the tree.

Depending on snow depth, rabbit damage can occur higher on the trunk or lower scaffolds (Figure 2). Voles, such as pine voles which burrow underground, feed mainly on rootlets and strip the bark off larger roots. It's possible damage to roots can be worse than the visible damage above the ground.

Rodents need shelter, food and protection from predators to survive. Manage populations by eliminating one or more of these requirements. There are a number of cultural or physical management options to consider:

- Mow grass to 8–15 cm. Avoid using a sickle-bar mower, which may produce a thatch layer that provides cover for voles.
- Remove all mulch, prunings, apples and other debris around the base of trees, in tree rows or adjacent to the orchard.
- Use tree guards to protect the bark of newly planted trees. Extend the guards at least 45 cm above the soil level and minimum 5 cm below. Keep in mind, when snow is deep, guards generally don't give protection against rabbits.
    - Maintenance of guards is important if left on the tree in subsequent years. Litter and debris can build up inside loose guards providing good shelter and habitat for voles and insect pests such as dogwood borer. Repair or replace loose guards. Clean out debris in the spring and fall.
- While trapping is not effective for controlling high populations, it can be used to monitor or control small populations.
- Shooting rabbits can help keep numbers low, but first consult with local authorities regarding firearm bylaws and regulations.
- Paint trunks and lower scaffolds with white exterior latex paint combined with a repellent such as the thiram-based mixture, Skoot. This has an unpleasant taste and discourages feeding. Do not use oil-based paints because they are toxic to trees. Other repellents available can have an undesirable odour. Repellents in general can have reduced efficacy long-term. Latex paint alone does not prevent rodent damage (Figure 3).

Where other practices are insufficient, toxic baits are available for use against voles in orchards. Always speak to your local Ontario Ministry of Natural Resources office and check the label to ensure the product can be legally used. Growers and landowners are responsible for ensuring all relevant legislation is followed. Contact the Ontario Ministry of Natural Resources for more information.

- Use mouse baits (rodenticides) where voles have caused damage in the past or are likely to be found in the winter (e.g., near brush piles, woodlots, hedgerows or fences). Begin baiting before there is significant snow cover.
- Alternate between a zinc phosphide bait and an anticoagulant bait to prevent voles from becoming bait shy and avoiding bait for a period of months.
- Use bait stations to extend the life of the bait and create a safe haven for rodents to feed. Bait stations will also keep poisonous bait out of reach of pets and other non-target animals.
    - An inverted T bait station (Figure 4) made of 3.8 cm (1.5-inch) ABS pipe is the most common type of bait station available. In this station, place several spoonfuls of bait in the neck, which is capped to protect the bait from the elements. Longer necks can be used in areas where there is substantial snowfall. Set about 25 stations/ha (10/acre).
    - Check stations regularly to monitor the disappearance of bait.
- Some baits can be broadcast below the grass cover around the base of trees. However, use this method with caution to prevent exposure to non-target animals. Refer to specific directions on the label for more information.

It is important to handle poison baits safely. Consider the following points when carrying out a vole management program:

- Use only baits registered for use on targeted rodent and in apple orchards.
- Mark all poison bait storage containers POISON.
- Store poison baits away from children, pets and livestock.
- Do not inhale zinc phosphide dust or fumes.
- Do not keep bait containing zinc phosphide in a building used by people or animals.
- Do not use bait mixing equipment or bait application equipment for any other purpose.
- Wear rubber gloves or other protective gloves when handling bait, as you would when handling hazardous insecticides.
- Wash your hands after handling poison baits.
- Keep dogs and cats that are enthusiastic mousers away from the nursery or orchard for at least 2–3 days to prevent them from catching dying mice.
- Do not handle dead mice or voles with your bare hands.
- Dispose of dead mice and voles away from human and animal contact.

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Figure 1. Rodent damage around base of tree can result in girdling, reduced vigour and eventual tree death.

Figure 2. Rabbit damage can occur higher on the trunk during winters with deep snow.

Figure 3. Rodent damage can occur on young trees painted with white latex paint only.

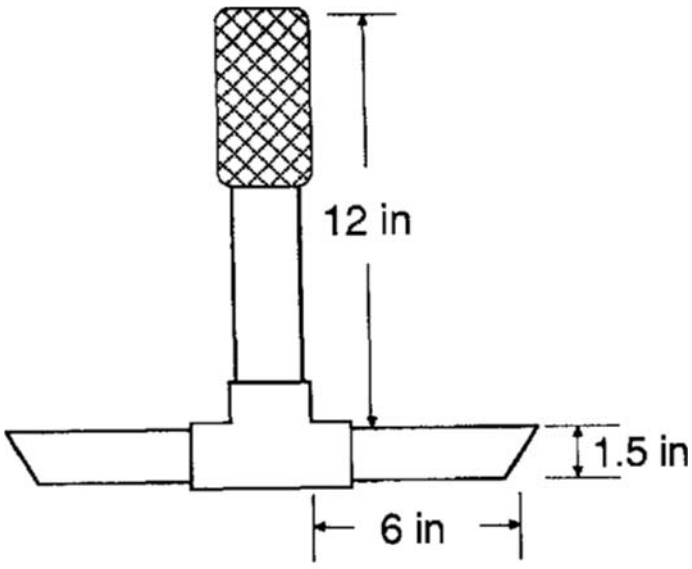

Figure 4. Standard design for an inverted T bait station. (Tobin & Richmond, 1987)

Early Start to Winter Could Lead to Pest-Related Issues

Kristy Grigg-McGuffin, Horticulture IPM Specialist, OMAFRA

The cold snap and snowfall at the beginning of November 2019 caught many growers across the province off guard. Most trees hadn't started losing their leaves and, in some cases, harvest was still wrapping up.

In a typical year, the gradual shift to cooler temperatures triggers plant tissue to start actively exporting water from inside their cells into the intracellular space. But what happens during a sudden drop in temperature before there has been an increase in hardiness? If water remains in the cells, the crystals that form on freezing can destroy cell membranes, causing cell death (also known as winter injury). The graft union, trunk and limb crotches are the last tissues to harden off in the fall, so may be vulnerable to fluctuations in air temperature. Infections from powdery mildew also make shoots more vulnerable to cold injury. Hardiness depends on many factors and will vary between species and cultivars. However, winter injury can reduce yields, kill the tree immediately or cause a shorter life expectancy by making the tree more susceptible to pests (i.e., cankers, borers).

It's possible some orchards may see pest-related issues arise as a result of cold injury from this fall. The cankers associated with winter injury are weak pathogens or opportunistic fungi. They rarely attack healthy trees. It often takes one or two years after a cold injury event for visible canker symptoms to appear. Here are some cankers that are associated with winter injury that growers should be on the lookout for in coming seasons:

- **European canker (or Nectria twig blight)** (Figure 1): These cankers appear as sunken lesions on twigs, branches, crowns, stems or trunks, surrounded by living tissue. A rough collar forms around a wound site and this collar grows larger each year. Bright orange spore cushions develop in the canker in the spring and fall. Infected limbs or young trees will become completely girdled over time and die. Infected limbs can resemble symptoms of fire blight shoot infection; however, this pathogen tends to remain confined to weakened branches which can be pruned out and burned.

- **Black rot** (Figure 2): Limb cankers first appear as reddish or pinkish sunken areas in the bark. Cankers may remain small, but some enlarge around the limb, weakening or killing it completely. As the canker ages, the wood shrinks, darkens in colour and peels away from the infected area. This fungus may also appear as black rot on the fruit and frog-eye leaf spot on the leaves.

- **Silver leaf** (Figure 3): This opportunistic fungus entering trees through damaged wood following particularly cold winters. Symptoms appear after petal fall, with leaves appearing silver in colour as the name suggests. Initially one or two branches have silver leaves, but these symptoms can get progressively worse over time, with the trees declining and eventually dying. In other cases, infected limbs recover completely and exhibit no symptoms. The heartwood is usually stained brown, and in autumn, fruiting bodies from the fungus appear on the surface of dead or severely infected limbs or the trunk.

Although fungicides reduce the spread of cankers during conditions conducive to disease development, they are not effective for curing existing cankers. These management techniques are helpful in reducing loss to cankers:

- Remove cankers promptly by pruning the branch several centimetres below the canker to a natural spot. Don't leave a stub that allow fungi to enter the tree.
- If it is not possible to cut out large cankers on the trunk, it is best to remove the tree.
- Burn prunings or remove them from the orchard promptly. If this is not possible, chopping prunings promotes their breakdown and reduces the spread of the disease.
- Do not stack woodpiles in or near orchards since they can be a major source of inoculum.
- Identify hardwood trees in surrounding woodlots infected with the disease. If possible, remove and burn these trees to decrease potential disease pressure.
- Inspect nursery stock carefully before planting and discard any trees that have cankers.
- Do not prune, fertilize or cultivate in the fall or early winter.
- Paint tree trunks with white latex paint to prevent southwest injury. Re-apply annually, if possible.

In addition to potential canker development, clearwing moth species including dogwood borer tend to tunnel under bark on the trees where tissue has been previously damaged and have been associated with winter injury. Infestations cause a slow decline in tree health and reduced yields due to the girdling caused by larvae feeding in the cambium layer. Look for the presence of reddish-brown frass and pupal cases around the graft union, burr knots or cankers above the graft union (Figure 4). Time insecticidal trunk sprays according to peak adult flight using pheromone traps placed in the orchard mid-June. Refer to Publication 360, Fruit Crop Protection Guide for registered products. Mating disruption can also be very effective for dogwood borer.

Other wood-boring species such as the Ambrosia beetle family are attracted to the ethanol released by injured or stressed trees. Preliminary surveys in Ontario orchards have identified the presence of a number of species from this family including black stem borer and granulate ambrosia beetle. Unfortunately, few management options are available besides removal of infested trees if borer holes are identified. For more information on how to identify ambrosia beetle damage, see the previous

Orchard Network article, titled Status of ambrosia beetle in southwestern Ontario high-density apple orchards.

Full link: http://www.omafra.gov.on.ca/english/crops/hort/news/orchnews/2016/on-1216a8.htm

Figure 1. European canker on apple tree.

Figure 2. Black rot canker on apple tree.

Figure 3. Silver leaf disease of apple.

Figure 4. Reddish brown frass around the graft union is common with dogwood borer.

Out with The Old? Keeping Track of Recent Pesticide Re-Evaluation Decisions in Apples

Kristy Grigg-McGuffin, OMAFRA Horticulture IPM Specialist

Under the *Pest Control Products Act*, the Pest Management Regulatory Agency (PMRA) is required to re-evaluate all registered pesticides every 15 years. As new science, methodology or technology becomes available, a registration status or use pattern on a crop can change often as a result of dietary, environmental or worker exposure concerns. Special reviews can also be initiated at any time for a particular pesticide when there is reason to believe human health or environmental risks are unacceptable, e.g., neonicotinoid insecticides and pollinator health.

All information on past and present re-evaluations can be found in the Pesticide Product Information Database on the PMRA website. The PMRA's Re-evaluation and Special Review Work Plan 2019-2024 is also available on the PMRA website and lists anticipated dates for public consultation or final decisions for pest control products. Tables 1 and 2 summarize some of the important dates of cancellation and final decisions for products registered specifically on apples.

Captan
The final decision for the active ingredient, captan will have growers seeing a change in use pattern and formulation for registered products. This decision was based on worker exposure issues. As a result, the currently registered products, Maestro 80 DF and Supra Captan 80 WDG are being phased out and are to be replaced by formulations with water soluble packaging.

The last date of sale by retailers for these products will be Spring 2020. Growers will have an additional year after last date of sale to use up their supply, following the existing container label for rates, restricted entry interval (REI) and preharvest interval (PHI). As of May 2021, these old formulations and labels can no longer be used.

The new WSP formulation for Maestro 80 is already available. This label can be found on the PMRA label search. All required use pattern amendments are reflected on this label and must be followed when using this formulation. The use pattern changes are as follows:

- New rate: 3 kg/ha
    - Important side note, the high rate is required for effective control of fruit rot, fly speck and sooty blotch. Do not use a reduced rate if these diseases are of concern.
- REI:
    - High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley) – 2 days, 6 days and 15 days are the re-entry intervals for general re-entry, pruning/training and hand thinning/harvest, respectively
    - Non-high density or standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley) – 2 days, 4 days, 19 days and 24 days are the re-entry intervals for general re-entry, pruning/training, hand harvest and hand thinning, respectively
- PHI: 7 days
    - Where REI exceeds PHI, use the longer interval.

Ethylene bisdithiocarbamate (EBDC)
The group of fungicides commonly referred to as EBDCs include the active ingredients, metiram (Polyram) and mancozeb (Penncozeb, Manzate, Dithane). An earlier review determined the cancellation of metiram due to worker exposure with a last date of use being June 2021. However, at that time, the PMRA retracted the final decision for mancozeb and are currently in the process of re-evaluating this registration. Presently, it is proposed for cancellation on apples. While there may be a chance some uses could be maintained, the final decision will not be released until Summer 2020. Typically, active ingredients are given a 2–3 year phase out period from the time a final decision is released until the products can no longer be used.

Neonicotinoids
A number of active ingredients belonging to the neonicotinoid insecticide group, including thiamethoxam (Actara), imidacloprid (Admire/Alias) and clothianidin (Clutch) have undergone special review for environmental concerns. The final decision for impacts to pollinator health has been released while the aquatic invertebrate special review final decision isn't anticipated until early 2020. Regardless of the upcoming decision, all 3 active ingredients are being cancelled on apples based on risk of pollinator exposure.

During the re-evaluation for Actara and Clutch, lack of alternatives for the management of brown marmorated stink bug (BMSB) were identified. As a result, a 1-year extension was granted to allow growers to use these products for control of BMSB until 2022. The Clutch label that has now been posted on the PMRA website reflects this change, listing only BMSB for apples. The PMRA, however, has confirmed that growers can still continue to use the container label until April 2021 for all currently registered pests.

Looking to keep informed about re-evaluation decisions?
Keep up to date with re-evaluation decisions, public consultation periods and management strategies for key apple pests by subscribing to the ONfruit blog at onfruit.ca. Select which crops you would like to receive email notifications for when a new blog has been posted. If you are interested in all of the information ONfruit has to offer, select "Everything". Current ONfruit subscribers can update their email preferences at any time.

Table 1. Pest control product cancellations (final decision) on apples

Pesticide Type	Product	Active Ingredient	Last Date of Sale	Last Date of Use
Fungicide	Maestro 80 DF[1]	captan	May 10, 2020	May 10, 2021
	Supra Captan 80 WDG[1]	captan	May 10, 2020	May 10, 2021
	Polyram DF	metiram	Jun 21, 2020	Jun 21, 2021
	Granuflo T	thiram	Dec 14, 2020	Dec 14, 2021
	Ferbam 76 WDG	ferbam	Dec 14, 2020	Dec 14, 2021
Insecticide	Actara 25 WG[2]	thiamethox-am	Apr 11, 2020	Apr 11, 2021[3]
	Admire 240 F[2]	imidacloprid	Apr 11, 2020	Apr 11, 2021
	Alias 240 SC[2]	imidacloprid	Apr 11, 2020	Apr 11, 2021
	Clutch 50 WDG[2]	clothianidin	Apr 11, 2020	Apr 11, 2021[3]

[1] These formulation of the active ingredient captan are currently being phased out. A new formulation of Maestro is now available.
[2] Final decision for pollinator health special review.
[3] A 1-year extension was granted for control of brown marmorated stink bug. Last date of use for this pest is Apr 11, 2022.

Table 2. Anticipated date of final decision for pest control products registered on apples

Pesticide Type	Product	Active Ingredient	Proposed Action	Final Decision Expected
Fungicide	Dithane Rainshield	mancozeb	cancellation	Jun 2020
	Manzate Pro-Stick	mancozeb	cancellation	Jun 2020
	Penncozeb 75 DF	mancozeb	cancellation	Jun 2020
Insecticide	Actara 25 WG[1]	thiamethoxam	cancellation	Jan 2020
	Admire 240 F[2]	imidacloprid	cancellation	Jan 2020
	Alias 240 SC[2]	imidacloprid	cancellation	Jan 2020
	Clutch 50 WDG[1]	clothianidin	cancellation	Jan 2020
	Madator 120 EC	lambda-cyhalothrin	cancellation	Mar 2020
	Silencer 120 EC	lambda-cyhalothrin	cancellation	Mar 2020
	Imidan	phosmet	cancellation	Jul 2020

[1] Final decision for aquatic invertebrates special review.
[2] Final decision for general re-evaluation.

Pest Susceptibility of Common Apple Cultivars and Rootstocks

Kristy Grigg-McGuffin, Horticulture IPM Specialist, OMAFRA

Pest susceptibility varies among apple cultivars and rootstocks. Understanding, selecting and managing for particular characteristics is an important component to a successful integrated pest management (IPM) program. This information can be used when buying new trees, selecting appropriate planting sites or developing a block design, considering a pest control program including resistance management strategies, as well as for scouting or monitoring.

Table 1 summarizes some of the more common apple cultivars grown in Ontario. It is by no means an extensive list. For more information on other cultivars, see the reference list at the end of this article.

While some cultivars have resistance to a number of the major diseases Ontario growers deal with, those growers who sell to retailers will be largely influenced by market acceptability. For example, organic growers or those who have on-farm markets can have a consumer base for scab-resistant cultivars such as Enterprise, Freedom, Liberty, Prima or Pristine, whereas large-scale retailers would not.

As with every management strategy in an IPM program, use of resistant cultivars is not a stand-alone control. Under high disease pressure, even resistant cultivars can show symptoms. However, incorporating cultural (e.g., orchard sanitation, urea, removal of wild hosts), physical (e.g., pruning) and chemical (e.g., organic, biological or conventional pesticides) controls in disease-resistant plantings will help reduce overall inoculum pressure from these pathogens long-term.

Continue to also monitor and manage other diseases common in Ontario orchards, such as fruit rots, sooty blotch and fly speck. These pests may become an issue if fungicides that normally control them are reduced (e.g., after primary scab infection period or late summer). While there are cultivars that are known to be more susceptible to these diseases, there are no resistant cultivars available.

Table 2 summarizes pest susceptibility characteristics of some apple rootstocks. Similar to Table 1, this list is not extensive nor does it represent what rootstocks are currently available in your area. Speak with your nursery to determine your options. For fire blight and, to an extent, woolly apple aphid, rootstock resistance can be conferred to the scion. Again, similar to what was mentioned earlier, this would be under ideal conditions only. If pest pressure is high, relying on rootstock resistance alone will not provide effective control, especially if the cultivar is susceptible to the pest.

Replant disease complex consists of several pathogens (*Cylindrocarpon*, *Pythium* spp., *Fusarium*, and *Rhizoctonia*), bacteria and parasitic nematodes as well as abiotic factors such as soil pH, moisture stress, soil compaction, toxins, soil structure and nutrient availability. Rootstocks are considered tolerant to replant disease when they show a level of resistance to one or more pathogens. This doesn't account for all factors that come into play with the replant disease complex and may not improve tree vigour depending on the planting site.

The ability of a rootstock to tolerate insect pressure can be considered with woolly apple aphid and borers that prefer burr knots such as dogwood borer. In sites that have a history of pest pressure, rootstock selection may be beneficial. It is important to note however, there are root and aerial populations of woolly apple aphid. If control is limited with the aerial population, tree vigour will still be reduced, particularly on young trees. As well, dogwood borer infests a tree at a weakened site which also includes near cankers, pruning cuts, mechanical damage or winter injury. Management of the population will still be important even if burr knots are minimal.

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See Tables 1 & 2 on following pages.

Table 1. Disease susceptibility ratings of common apple cultivars

Cultivar	Scab	Fire Blight	Powdery Mildew	Rusts[1]
Ambrosia	VS	S	R	S
Belmac	R	–	T	R
Braeburn	S	VS	S	S
Cameo	S	S	R	S
Cortland	VS	S	S	S
Crimson Crisp	VR	T	T	S
Delicious (Red)	S	R	T	VR
Delicious (Golden)	S	S	VS	S
Dayton	VR	R	T	T
Early McIntosh	S	R	T	R
Empire	VS	R	S	R
Enterprise	VR	R	S	R
Freedom	VR	VR	R	R
Fuji	S	VS	R	varied
Gala	VS	VS	S	varied
Ginger Gold	VS	VS	S	VS
GoldRush	VR	T	S	S
Gravenstein	S	S	VS	varied
Honeycrisp	T	R	S	S
Idared	S	VS	S	VS
Jerseymac	VS	S	S	VR
Jonagold	S	VS	S	R
Jonamac	S	S	S	R
Jonathan	S	VS	VS	S
Liberty	VR	R	R	VR
Lodi	S	VS	R	S
Macoun	VS	S	T	R
McIntosh	VS	S	T	VR
Mutsu (Crispin)	VS	VS	S	S
Northern Spy	S	S	S	S
Novamac	VR	VR	VR	VR
Nova Spy	R	–	S	MR
Paulared	R	VS	T	R
Pink Lady	VS	VS	R	R
Pristine	VR	R	R	S
Silken	VS	–	S	VS
Stayman	VS	S	VS	S
Wealthy	S	S	S	VS
Zestar!	S	S	R	S

VS = very susceptible **S** = susceptible **T** = tolerant (moderately resistant under ideal conditions) **R** = resistant **VR** = very resistant

[1] Rusts include cedar-apple rust and quince rust. Resistance in a cultivar may vary depending on type of rust.

Table 2. Pest susceptibility ratings of common apple rootstocks

Rootstock	Fire Blight	Phytophthora	Replant Disease Complex[1]	Woolly Apple Aphid[2]	Burr Knot Formation[3]
Budagovsky series					
B.9	S	T	–	S	medium
B.118	T	S	–	–	–
Malling series					
M.7		S	–	–	–
M.9	S	T	–	S	high
M.26	S	S[4]	–	–	high
M.27	T	–	–	–	low
Malling-Merton series					
MM.106	–	S	–	T	–
MM.111	–	T	–	R	–
Geneva series					
G.11	R	T	T (partial)	S	low
G.16	R	T	T (partial)	S	–
G.30	VR	T	T	S	low
G.41	VR	T	T	R	low
G.202	VR	T	T	R	low
G.210	VR	T	T	R	low
G.213	VR	T	T	R	low
G.214	VR	T	T	R	–
G.222	VR	T	S	R	medium
G.814	VR	T	T	S	medium
G.890	VR	T	T	R	low
G.935	VR	T	T	S	–
G.969	VR	T	T	R	low
Other					
Ottawa 3	S	T	–	S	low
Vineland series	R	–	–	–	–

S = susceptible **T** = tolerant (moderately resistant under ideal conditions)
R = resistant **VR** = very resistant

[1] Replant disease complex consists of several pathogens (*Cylindrocarpon*, *Pythium* spp., *Fusarium* and *Rhizoctonia*), bacteria and parasitic nematodes

[2] Does not effectively control high pressure from aerial colonies of woolly apple aphid.

[3] Burr knots are common entry points for insect pests such as dogwood borer.

[4] Though moderately resistant to *Phytophthora*, M.26 will not perform well on poorly-drained sites.

Announcements

Ontario Fruit and Vegetable Convention Session Highlights

OFVC is on Wednesday, February 19th and Thursday, February 20th. The entire Ontario Fruit and Vegetable Convention program can be found at http://ofvc.ca . The following sessions may be of special interest to apple growers.

Wednesday Morning

Craft Cider
Room 204

9:30 Traditional and Modern Practices in Cider Fermentation
Claude Jolicoeur (The New Cider Maker's Handbook)

10:00 Making Winning Cider at Hounds of Erie Winery
Mat Vaughan (Hounds of Erie Winery)

10:30 Development of Original *Pommages* for Eastern Canada
Claude Jolicoeur (The New Cider Maker's Handbook)

11:00 Challenges and Opportunities for the Ontario Craft Cider Association
Richard Liu and Derek Cartlidge (OCCA)

Soil Precision Planting and Mapping
Room 206

9:30 Improved Approaches for Soil Mapping
Dr. Asim Biswas (U of Guelph)

10:00 Soil Suitability Considerations for Planting the Best Crop
Daniel Saurette (OMAFRA)

10:30 Case Study: Soil Mapping and Changes to Fruit Planting *Tony Balkwill (NithField Advanced Agronomy)*

11:00 Panel: Robotic Transplanters in Ontario
Rob deNijs (Agriplanter), Kenny Forth (Plant Tape), John Beardsley (Ferrari)

Farming Basics for New Fruit and Vegetable Growers
Room 221

9:30 Introduction to Farming and Finding Markets
Dr. Sean Westerveld and Robb Wagner (OMAFRA)

10:00 The Business of Farming: Setting Up
Robb Wagner, Erich Weber, John Molenhuis and Mark Ferguson (OMAFRA)

10:30 The Business of Farming: Day to Day
Robb Wagner, Erich Weber, John Molenhuis and Mark Ferguson (OMAFRA)

11:00 It All Begins with Your Soil
Anne Verhallen (OMAFRA)

11:30 Waterlogged or Dry as a Bone? Manage Water before You Plant
Rebecca Shortt (OMAFRA)

AAFC-Fruit and Veg Sector Priorities and Partnerships
Room 203

9:30 Identifying Ambrosia Beetles in Apple and Tender Fruit Orchards in Ontario
Justin Renkema (AAFC)

10:00 Managing Fire Blight in Young Ontario Apple Orchards
Darlene Nesbitt and Antonet Svircev (AAFC)

11:00 Performance of the Horticulture Sector + Current Collaborative and Strategic Initiatives
Nathalie Durand (MISB - Crops and Hort. Division)

Wednesday Afternoon

Farming Basics for New Fruit and Vegetable Growers
Room 221

2:00 Pest Management and Weed Control 101
Dr. Melanie Filotas and Kristen Obeid (OMAFRA)

2:30 Cropping Systems Introduction: Fruit Production
Kathryn Carter (OMAFRA)

2:50 Cropping Systems Introduction: Vegetable Production
Dennis Van Dyk (OMAFRA)

3:10 Cropping Systems Introduction: Specialty Crop Production
Evan Elford (OMAFRA)

3:30 Grower Experience: Starting a Farm in Ontario
Hayden Dooney (Norfolk Fruit Grower's Assoc.)

4:00 Q&A Session

Ensuring Food Safety Along the Supply Chain
Room 203

2:00 What Is Enough When Managing Food Safety Risks
Dr. Michelle D. Danyluk (U of Florida)

2:30 Walmart Canada Requirements from Farm to Fork
Katherine Di Tommaso (Wal-Mart Canada Corp.)

3:00 Food Safety-from A Farmer's Perspective
Chalmers R. Carr III (Titan Farms)

3:30 Panel Discussion: How to Meet Food Safety Expectations of your Buyers and Consumers
Dr. Michelle D. Danyluk (U of Florida), Katherine Di Tommaso (Wal-Mart Canada Corp.), Chalmers R. Carr III (Titan Farms)

Thursday Morning

Apple
Ballroom A

9:30 Fire Blight Biology, Management Options and Research
Dr. Srdjan Acimovic (Cornell U)

10:00 Crop Load Management - Right Timing, Right Number
Dr. Poliana Francescatto (Valent BioSciences, USA)

10:30 Emerging Fungal Diseases of Apples in New York - Fruit Bitter Rot, Marssonina Leaf & Fruit Rot
Dr. Srdjan Acimovic (Cornell U)

11:00 Managing Storage Disorders in Gala and Honeycrisp Apples
Dr. Jennifer DeEll (OMAFRA)

General Labour
Room 204
9:30 Tools to Manage the HR part of your Farm - Best Practices and How to Comply with Legal Requirements
Portia MacDonald-Dewhirst (AHRC)

10:00 Protecting Potential: How to Build your Safety Program and Reduce Premiums under the new WSIB Rate Framework
Kristina Dragun (WSIB)

10:30 SAWP/TFW Ag Stream -2020 Update
Ken Forth & Carrie Raymond-Gardner, (FARMS)

11:00 Programs and Resources to Help with your HR Management and Labour Productivity
Peter Coughler (OMAFRA)

Transition to Organic Production
Room 205

9:30 Managing the Transition to Organic
Hugh Martin (Martin Ag. Consulting)

10:00 Certifying Bodies 101
Dave Lockman (Pro-Cert Organic Systems Ltd.)

10:30 Fertility and Weed Management Strategies for Organic Growers
Andy Hammermeister (Dalhousie U)

11:00 Transitioning to Organic - A Grower's Perspective
Manus Boonzaier (Algoma Orchards)

Thursday Afternoon

Apple
Ballroom A

2:00 Future Trends in Fruit Crop Spray Application and Why You Still Need to Get the Simple Things Right
Dr. David Manktellow (App. Research & Tech. Ltd. New Zealand)

2:30 Orchard Nutrition for Achieving Optimum Yields
Dr. Robert Crassweller (Penn State U)

3:00 Panel: Grower Insights on Achieving High Yields of High-Quality Apples
Art Moyer (Moyer Orchards and Vineyards), Gerbe Botden (Blue Mountain Fruit Company), Doug Balsillie (The Fruit Wagon)

3:30 How to Produce Apples in a Changing Climate
Dr. Robert Crassweller (Penn State U)

Workshop: Electronic-PTTW Application Process
Room 205

2:00 Session-Long Workshop
Brittany Keene (MECP)

Margaret and Angus Hamilton Scholarship

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

In 2016, I was contacted by Elizabeth Hamilton of New Brunswick to discuss the possibility of establishing a scholarship in her parents' names, Margaret and Angus Hamilton. Margaret's background was in home economics and education. She developed one of the first commercial U-pick orchards in New Brunswick, taking over an established orchard just outside Fredericton, New Brunswick, in 1971. With political savvy derived from her years on school boards and as association executives in Ottawa, she helped guide the growth of the industry through participation and service in the New Brunswick Fruit Growers Association, N.B. Farm Markets Association, Canadian Home Economics Assn., the International Dwarf Fruit Tree Assn., and the N.B. Federation of Agriculture. In 1981, Margaret began to operate and manage Happy Apple Acres Bed & Breakfast while her husband Angus took on the orchard management. Angus was just finishing up a career in Surveying Engineering but his family connection to apple growing was well-embedded through a relative, James Hamilton, who was a researcher in pomology at Geneva, New York.

Very sadly, Margaret passed away Jan 23, 2019. We are pleased that the *Margaret and Angus Hamilton Scholarship* came to fruition in 2017 when the first bursary was awarded. In the future, a scholarship of $10,000 will be awarded to one student each year pursuing graduate studies in Pomology at the University of Guelph.

Inspired by Margaret's long-standing passion for education and for her desire to build excellence in research supporting the Canadian apple growing and marketing industry, this will be a legacy to train and enrich the lives of graduate students in their pursuit of pomology research at the Ontario Agricultural College, University of Guelph. The scholarship also recognizes the historical connection of the family of Angus Hamilton with the University of Guelph and the OAC. We are grateful to the Hamilton family for their incredibly generous legacy that will keep on giving for generations to come.

I gratefully acknowledge Ms. Elizabeth Hamilton, daughter of Angus and Margaret Hamilton, for providing details for this article, and for assisting OAC in establishing this scholarship.

Orchard Network Newsletter Survey

Thank you for subscribing to the Orchard Network Newsletter. Help us to improve our service to you by providing feedback which will be used to direct our focus for the upcoming year. This should take about one minute of your time. All answers are anonymous. You can find the survey at this link: https://www.surveymonkey.com/r/2019orchardnetwork