



ORCHARD NETWORK

For Commercial Apple Producers

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Orchard Management

Your Report Card on Cropload Management

Leslie Huffman, Apple Specialist, OMAFRA

Much effort and expense has gone into achieving the correct cropload for each block of apples: counting buds → precision pruning → counting buds → chemical thinning → measuring fruitlets → re-applying thinners → counting fruitlets → hand-thinning. Did we get it right? Generally fruit size and fruit finish at harvest is a good indicator, but the amount of return bloom next year will also be affected.

We have two tools to help us measure the correct cropload on young trees – the Equilifruit Disk and the Cornell Young Tree Gauge. Orchard crews have found these useful to determine how many apples to leave. These tools can also be used to track the effect of cropload on return bloom.

Before harvest, take the time to mark some trees, count the cropload and flag them for next year's observations:

- Gather your equipment: flagging tape, notebook, Equilifruit disk or Cornell gauge.
- Choose blocks of Gala, Honeycrisp and/or Ambrosia (5- 10 yr) that are cropping.

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- Choose 10 trees with a typical cropload for each block and flag them. It's a good idea to also flag the endposts of the row.
- For each tree, write down:
 - * Cultivar, Row #, Tree # (eg. Row 5, Tree 3)
 - * Total number of apples on the tree
 - * Trunk diameter (from Equilifruit disk, or a digital caliper)
- Cropload indicated by Equilifruit or Cornell gauge

Next year at bloom time, return to see the level of return bloom and write it down. This should help your cropload management decisions next year.



Using ReTain to Manage Apple Harvest

Leslie Huffman, Apple Specialist, OMAFRA

Harvest is only a short time away, so now is the time to think through your harvest strategy. It is critical to pick apples at their proper maturity, which may be as short as 5-10 days. This will maximize eating quality for both fall sales and long-term storage. Consumers will appreciate this - and your final payments will reflect your success.

As growers increase their acreage of desirable cultivars like Gala, Honeycrisp and Ambrosia, picking each apple at optimum maturity becomes a greater challenge. ReTain is proving to be an effective tool that allows apple maturity to be delayed until the harvest crew arrives.

Tips for using ReTain:

- Apply 4-5 weeks before anticipated harvest. On multi-pick cultivars, time for 4 weeks before the 2nd harvest pick date. Adjust for seasonal weather differences.
- Jonagold and Gala are more sensitive to ReTain than McIntosh, and have responded well to lower rates that still allow proper ripening.
- Sylgard should be added to the tank, but should have minimum agitation due to foaming.
- Treat only healthy trees.
- Use starch iodine test to monitor maturity and pick at the proper stage.
- Store ReTain-treated fruit separate from untreated to prevent ethylene exposure.
- Keep good records to learn more of how to use this tool.

Consider using ReTain when any cultivar:

- Will require more than 5-10 days to harvest with your existing crew
- Has a tendency for pre-harvest drop
- Needs better fruit size or colour
- Tends to crack around the stem
- Develops greasiness
- Develops water core

Read more about ReTain and how to use it in Publication 360, p. 74-75 www.omafra.gov.on.ca/english/crops/pub360/3stopdrop.htm#retain

Primer for Use of ReTain

http://journals1.scholarsportal.info/pdf/22915907/v15i0003/3_pfuori2.xml

Alert! Root Suckers

Leslie Huffman, Apple Specialist, OMAFRA

Root suckers have caused headaches for growers for years. M7a was particularly notorious for proliferating root suckers, despite efforts to mow, cut, spray or otherwise destroy them. High density orchards continue to have problems with root suckers, with recent tree losses due to root suckers highlighting the need to manage them.

Root suckers are adventitious shoots emerging either from the rootstock shank, or from below ground buds. Because rootstocks are propagated from new shoots, suckering in the nursery is considered a good characteristic for ease of propagation. But root suckers in the orchard have long been a concern for several reasons:

- Root suckers provide an entry point for disease eg. fire blight. Susceptible rootstocks like M9 or M26 can die quickly after infection through suckers.
- Root suckers provide an entry point for systemic herbicides like glyphosate or amitrole. Once in the tree, these herbicides may weaken the tree and make them susceptible to disease like cankers and fire blight.
- Root suckers continue growing later in the season, after terminal bud set. They become attractive to sucking insects in the late season, which can increase populations for overwintering. Sucking insects may also transmit fire blight.
- Root suckers steal energy needed to for fruiting area and quality fruit.
- Root suckers interfere with orchard operations like herbicide applications.
- Root suckers are expensive to remove through cutting or spraying.

Growers wonder why some blocks have many suckers, while other plantings with the same rootstock/scion combinations have very few. I suspect the vegetative condition of the rootstock starts in the nursery, and if left unchecked, remains vegetative. Root tips may get planted pointing up instead of down, especially with tree planters, providing a site for new “shoots”. Sometimes nursery trees come with “shoots” emerging from the rootstock, which should be removed.

Should root suckers be removed? Yes, mostly because of the risk of fire blight infection. Invest the time to remove root suckers in new orchards – diligence will reduce them over time. Cut the attachment and side buds to avoid regrowth. Ripping may be better for young, soft suckers.

Choose warm, dry weather, or wait until the dormant season. Contact herbicides like Ignite, Gramoxone or Aim can be effective on soft, young growth, but woody suckers will regrow after treatment.

Some newer rootstocks promise less root suckers, and hopefully will reduce the risk of damage from herbicides and diseases through root suckers.

Is Fall Apple Planting a Good Idea?

Leslie Huffman, Apple Specialist, OMAFRA

In recent years, fall orchard planting has been successful in some areas of Ontario, and has become the norm in some neighbouring Great Lakes regions. There are several advantages to fall planting:

- Available labour after harvest, or between late ripening cultivars
- More time to establish the trellis system (at least part of the basic structure)
- More time to establish roots before soils freeze, and before summer drought
- Avoids planting delays in cold or wet springs
- Stronger growth the first summer compared to spring-planted trees
- Bloom synchrony with established trees, which synchronizes timing of fire blight sprays. Spring-planted trees bloom later than established orchards when temperatures are warmer, and are at higher risk of blossom blight if left unprotected or with fewer streptomycin sprays. This is especially important for replants.

But is fall the best time to plant, or are there any problems or concerns to consider?

Successful fall planting requires a combination of conditions:

1. A well-prepared site with good drainage, weeds under control and minimal rodent and deer populations
2. Mild weather and warm soil temperatures for several weeks after planting to encourage root establishment
3. Nursery trees that begin their dormancy process early, including leaf drop
4. A nursery supplier that is willing to fall dig trees
5. Sufficient labour to plant trees quickly without drying
6. Proper soil conditions to dig and re-close the soil around the roots without leaving air pockets. **The soil should be friable when worked to allow the soil to flow around the roots as the tree planter passes. This last point is probably the most critical.** There are some fall seasons that are just too wet and proper soil conditions are never achieved after Oct 15. It is a costly mistake to “mud” trees in if the soil is too wet. This can lead to tree dessication and death. In those years trees should be left in the nursery or stored until the spring.

Nursery trees need to experience cool temperatures and short daylengths to encourage dormancy. Frost will promote leaf fall, and some nurserymen use copper sprays to encourage leaf abscission. If trees are moved before dormancy, they could begin to grow again, which could predispose them to winter injury.

Once the trees show signs of dormancy, they can be dug and moved. Total leaf removal is necessary only if trees will be in storage for some time, to prevent diseases. It is critical to prevent roots from drying out, especially since they may not be fully dormant. Use covering tarps and wet down any roots that seem dry.

The roots and soil need to be in intimate contact immediately after planting to ensure the trees survive. Where a tree planter is used, the presser wheels need to be adjusted properly. Hand planted trees should be tramped well around the trunk. A follow-up watering is recommended if a soaking rain does not occur within a few days.

There is a risk of winter injury with fall planted apple trees, especially to the lower trunk and scaffold branches, because they are the last to harden off fully. Mounding up soil up to a half-meter around the trunk has an insulating effect against sudden freezes, and can be left to prevent insects from boring into the rootstock. If the mound is not washed down by the third season, it should be removed to prevent rooting of the scion.

If all these precautions are followed, fall planting of apple trees can help your new orchard get off to a quick start next spring.

Timelines for Your Next Apple Orchard

Leslie Huffman, Apple Specialist, OMAFRA and Anne Verhallen, Soil Management Specialist (Hort Crops), OMAFRA

The trees, posts and trellis anchors are ordered. The field has been selected for its topography, air and water drainage and fertility. What else needs to be done to ensure the success of this new planting? It is challenging to manage harvest and prepare for a new orchard, so here are suggested timelines:

August

- If you want to plant this fall, talk to your nursery to ensure they are ready to dig trees as soon as they are dormant.
- Improve drainage where necessary. Trees do not like “wet feet”, so systematic tile drainage, and surface catchments should be installed as soon as possible.
- Soil sample to determine nematode populations and soil fertility. The soil should be moist for nematode sampling (not a problem this year), but soil fertility samples can be taken anytime. Request a complete range of nutrients, including pH and organic matter. Don't forget that nematode samples should be taken

to a depth of 6-8 inches, with the top inch of soil removed due to exposure to temperature extremes.

- Control weeds to prevent weed seeds (annuals) and to reduce patches of perennials. Mow and allow perennials to regrow to a susceptible stage.
- Establish short season cover crops to add organic matter and improve soil structure. Oats, rye, and mustards or radish are a good choices for late summer.

September

- Where soil tests indicate the need, lime, phosphorus and potash can be applied in the fall before planting.
- Sod can be established now, either in row middles only, or across the field (with planting rows killed out before planting). Grass mixes containing no more than 20% perennial ryegrass, with creeping and/or tall fescues work well. Turf-type grasses are available that handle traffic and require less mowing. Use at least 15-25 lb/acre.
- Cover crop establishment and weed management is still timely if not done in August. See the Midwest Cover Crop Council Decision Tool www.mccc.msu.edu/selectorINTRO.html

October

- If soil conditions are not too wet, there is still time to install drainage. Be sure to map this to avoid damaging tile with your support system. Note how surface water flows in the orchard and plan to manage water to prevent ruts in the future ie consider catch basins or French drains in strategic locations to prevent water collecting in areas.
- Mustard cover crops should be shredded and immediately incorporated before frost to achieve nematode suppression. Soil temperatures should be at least 50°F (10° C).
- Perennial weed regrowth can be successful even after a light frost eg. glyphosate on quackgrass, 2,4-D on dandelion, Lontrel on thistles.
- Work closely with your nursery to determine when trees become dormant and shed their leaves. Time will be short to achieve fall planting, so it's important to be ready.

Dealing with Ruts

Anne Verhallen, Soil Management Specialist (Hort Crops), OMAFRA

Ruts are not a new problem in orchards. Odds are the ruts that have developed this summer have been there before. Heavy rains, the need for timely sprays and just the sheer number of trips needed over an orchard tends to lead to ruts developing. So what to do to make harvest easier?

For now:

- Scrape and level where possible.
- Fill in the worst areas with gravel or sand if needed.
- Adjust the drive path ie. drive on the grass.

Fixing for the future

- Grade and level rutted areas.
- Observe drainage patterns – look for where the water is coming from ie. are the ruts across a side slope? Can you intercept the water earlier with a catch basin or French drain?
- Install gravel in the worse areas.



Water collecting in ruts in an apple orchard.

Reducing compaction with flotation tires can help. The challenge with orchards usually is not just the weight of the tractor/wagon but the number of passes particularly during harvest. For extremely high traffic areas, where there is also a lot of turning, it may pay to build a better lane before harvest.

Crop Protection

Look Out for These Pests During Harvest Assessments

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA

Before harvest ramps up, set aside some time to do a harvest assessment in your orchard blocks. This will not only help you assess this year's IPM program, but will also help to prepare you for next season.

Randomly select 200-400 apples from the top, sides and bottoms of 10-20 healthy trees to evaluate for pest damage. Without removing the fruit, look at all sides and make note of what you see. Anything causing 2-5% damage would be of concern.

While walking through the orchard, make note of damage to leaves, branches and graft unions that could be caused by leafcurling midge, mites, powdery mildew, dogwood borer and other pests. This information will also help give you a head start planning your IPM program for next year.

Recently, a number of pests have become quite a concern in many orchards throughout the province. Pay particular attention to the following damage as targeted

control programs are required to manage these pests. Refer also to the article "What are these spots on my apple?" in this issue of Orchard Network for more descriptions of potential causes of fruit injury.

San Jose Scale

Limb injury appears as reddish discoloration when bark is cut away. Heavy infestations reduce tree vigour, growth and productivity. Fruit injury is most abundant around the calyx and stem ends, often resulting in a red inflamed ring surrounding each spot where a scale settles (Fig 1). Severe infestations may result in small, deformed fruit or the apples may not colour properly. In Ontario, the summer generations seem to overlap, which means the risk of fruit injury is present once crawlers begin to emerge after petal fall and continues until harvest.



Fig 1. San Jose scale feeding injury on developing fruit.

If scale has been detected in a block, the best method of control is an annual dormant oil application to target overwintering immature scales before they develop a protective waxy layer. However, complete coverage and timing are essential with the use of oils since they only smother immature nymphs with no impact on adults. This means delaying a dormant oil spray to target mites will reduce the efficacy on scale.

Movento and Closer are both registered for summer control of the crawler stage of scale. While these products do help to protect fruit during the growing season, they should be used to supplement, not substitute a dormant oil spray. For more information on spray timing, see the June 2014 Hort Matters article "[Predicting San Jose scale crawler emergence in apple orchards](#)" and September 2013 Orchard Network article "[Monitoring for San Jose scale](#)".

European Apple Sawfly

This invasive species and direct pest of apples has moved slowly westward across Ontario since monitoring began in the late 1980's. As of this year, European apple sawfly (EAS) damage has been reported as far west as the Georgian Bay region.

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 russeted, ribbon-like scar that spirals out from the calyx end (Fig 2). 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.



Fig 2. Typical European apple sawfly damage at harvest.

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.

Currently, only products from 2 insecticide groups are registered for this pest:

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

Research is ongoing to look at biological control agents and organic products to manage EAS.

For more information on scouting, thresholds and management of this pest, refer to the [EAS module](#) on AppleIPM.

Apple Maggot

Trap catches for apple maggot were exceptionally high this year across the province, likely due to the amount of rain we had. In a typical year, most apple maggot pressure comes into an orchard from adjacent hosts. However, populations can quickly become resident in an orchard if proper control is not implemented.

Damage from this pest can occur in two ways. The adult female creates oviposition stings on the fruit surface by laying her eggs under the skin, leaving a sunken or

dimpled appearance (Fig 3). After hatching, the larvae tunnel within the fruit and cause breakdown and discoloration of the pulp (Fig 4). Invasion by disease fungi, such as *Alternaria* spp. and *Pseudomonas* spp. leads to further decay and heavily infested fruit can become completely rotten.



Fig 3. Apple maggot oviposition sting



Fig 4. Internal breakdown and discoloration of fruit as a result of apple maggot larval feeding.

As there is zero tolerance for fruit damage caused by apple maggot, sprays should be applied 7-10 days after first adult catch on a yellow sticky trap, which is generally near the end of June. Activity of this pest can continue until the first hard frost, which means applications should continue every 14-21 days if trap catches warrant a need. Unfortunately, not all products used during this time for other key apple pests, like codling moth, are effective against apple maggot. See the August 2014 Hort Matters article "[The Year of the Maggot](#)" for more information.

What Are These Spots on My Apple?

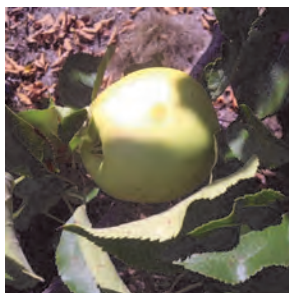
Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA

A number of insects, disease and physiological disorders of apples can cause spots on the fruit, many of which do not appear until harvest time. The following is a summary of just some of the more common causes typically seen in Ontario apple orchards. For more information refer to [Ontario Apple IPM](#).



Bitter Pit

A physiological disorder that often affects Spy, Delicious, Idared, Crispin, Cortland, Empire, Honeycrisp and other varieties. Slight depressions form, concentrated at the calyx end of the fruit. Tissue in the affected area is darkened, dry and spongy with a bitter taste. Calcium nutrition is directly involved in bitter pit development. See [Bitter Pit Control in Apples](#).



Cork Spot

Generally appears as small discolored depressions and may appear anywhere on the fruit flesh. These spots eventually enlarge to corky areas that extend into the flesh of the apple. Similar to bitter pit, cork spot is related to calcium availability in the developing fruit.



Blister Spot

Appear as raised brown blisters (4-5 mm) with a purplish black margin associated with the lenticels on the fruit surface. The first spots are often found near the calyx end of fruit growing towards the outside of the tree facing the sun. Although lesions rarely penetrate the flesh more than 1-2 mm deep and do not develop into fruit decay, several spots can occur on a single fruit reducing the fresh market quality significantly.



Hail Damage

Damage can occur any time during the growing season. Early season damage may appear as very deep depressions or deformation of the fruit. Later season damage could appear more bruise-like. Cracking is not uncommon.



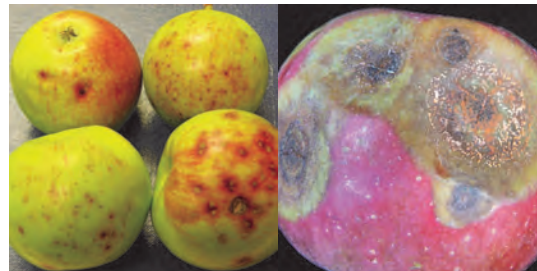
Black Rot

Lesions begin as sunken black spots often located in close proximity to mummified fruit left from chemical thinners. Eventually these lesions enlarge into a firm tan or brown rot with concentric rings and black fruiting bodies, or pycnidia. See [Black Rot in Apples](#).



Bitter Rot

Appear as brown spots that enlarge into sunken lesions, often surrounded by a red halo. Especially during wet or humid conditions, masses of salmon-colored spores are produced on surface of lesion. A diagnostic V-shaped rot progressing towards the core can be observed when infected fruit are cut open. See [Glomerella leaf blotch and bitter rot in Ontario apples](#).



Sooty Blotch

Appear as brown to olive green, cloudy blotches with irregular margins on the surface of the skin, often more obvious on light-coloured fruit. These blotches can be removed with vigorous rubbing. In storage, fruit with sooty blotch infection shrivel more readily than uninfected fruit.



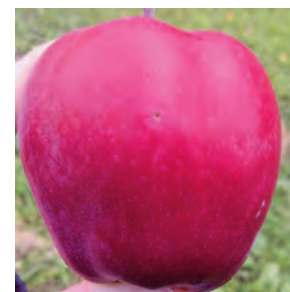
Fly Speck

Appear as groups of few to several small (0.5 mm), shiny black fungal bodies, or thyrrothecia on the fruit surface. Although these fungal bodies appear to exist individually, they are connected by mycelium to form colonies, typically in round or irregular groups 1-3 cm in diameter. Fly speck often appears together with sooty blotch and does not damage the flesh.



Stink Bug

Injury to fruit occurs when adult stink bugs pierce the fruit skin to extract plant juices. The injury consists of slightly indented areas with a light brown corky area just under the surface. Cutting open the fruit shows a feeding tube rarely more than halfway to the core. While many pest species of stink bugs can be found in an orchard, a major pest of concern is the brown marmorated stink bug. See [Avoid the Sting of Stink Bugs](#).



Apple Maggot

Appear as small dimples or depressions where females insert their eggs under the skin of the fruit. When fruit is cut open, larval feeding damage appears as meandering tunnels of brown or discolored flesh. Fruit may become bumpy as they mature, drop prematurely or rot. See [The Year of the Maggot?](#)

Fall Orchard Clean-up for Disease Control

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA and Michael Celetti, Plant Pathologist (Horticulture Crops), OMAFRA

While disease management is not something typically thought about during harvest, the fall is a great opportunity to get a head start on cleaning out the orchard and reducing inoculum for next season.

Fire blight

Many orchards across the province were hit hard with fire blight this year because of ideal conditions during bloom leading to extreme infection periods, and the numerous storm events that occurred after which created wounds for the pathogen to infect. Fire blight bacteria do not overwinter well outside of a host, which means next year's fire blight inoculum will come from overwintering cankers in trees that had active infections this year, within the orchard or in the area nearby. Pruning out infected branches and cankers will lower the risk of infection during bloom.

By the time terminal buds set and the weather has cooled, the fire blight bacteria are no longer spreading through the tree and cleaning pruning tools is unnecessary. As well, after fruit have been harvested, fire blight strikes are easy to recognize against the green of the healthy limbs and canker margins are clearly visible. However, while the edges of the canker may look well-defined, it is still recommended to prune at least 12 inches below. Pruning is best done during the dormant season.

Trees that have had issues with fire blight for several years or with extensive damage should be removed and burned. At this point the bacteria may be systemic and will simply serve as an infection source for healthy trees in years to come.

Summer rots

A primary control strategy for the management of summer rots, such as black rot and bitter rot is to remove sources of inoculum, including dead or diseased tissue or trees, infected branches, cankers, and rotten or mummified fruit.

Overwintering inoculum can be spread by rain, wind, insect vectors or contaminated equipment to new growth as soon as the next season begins and the environmental conditions are favourable. Since it is not possible to control the environment, preventing the spread of pathogens to healthy trees and eliminating inoculum within the orchard from one season to another can help reduce the amount of fungicide required the following year.

Apple scab

Applying 45 kg of agricultural urea per 1,000 L of water/ha to the orchard floor after 95% leaf drop (November) contributes to the reduction of overwintering ascospores

that will infect green tissue the following season. Urea works in a number of ways: 1) it directly inhibits the development of ascospores, 2) it stimulates the growth of naturally occurring organisms that are antagonistic against the scab fungus, and 3) it facilitates the breakdown of the leaves. A fall application of urea at low rates does not have a negative impact on winter hardiness or the fruitfulness for subsequent years.

An alternative timing for urea is in the spring (April) before bud break. However, if snow cover remains until bud break, this may reduce the time for urea to work and reduce the effectiveness of the treatment. In orchards requiring lower rates of nitrogen, a fall application may also be preferred to reduce the impact of the nitrogen.

In addition to a urea application, scab inoculum can be reduced by shredding overwintering leaves. Rake or blow leaves from under trees and shred them using a flail mower. This helps encourage leaf decay and may re-orient the leaves to prevent spores from discharging up into the trees.

Have You Seen This Damage at Harvest?

Margaret Appleby, IPM Systems Specialist, OMAFRA

Have you seen this damage this year at harvest? A spiral russeted scar that goes from the calyx end to the stem end across the body of the fruit. This is typical damage from European apple sawfly that you would see at harvest. The larvae that created this early in the season, has died and left this scar.

This year there are reports of damage in the Georgian Bay area. To find this damage east of Toronto is common but not expected in orchards in western Ontario. 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 in your orchard. It takes a few years for it to build up in an orchard and traps set up at pink will track the adult fly emergence from the soil. If adults are found an insecticide right at petal fall is needed.



Brown Marmorated Stink Bug Update

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA and Hannah Fraser, Entomology Program Lead (Hort Crops), OMAFRA

The Brown Marmorated Stink Bug (BMSB) provincial survey has continued again this year.

It is likely BMSB is established in all areas listed below, although adults and nymphs (or signs of damage) have not yet been found in crops. The presence of adults in traps indicates growers / consultants need to be on the look-out for this pest and its damage. It is very easy to miss BMSB when it is at low levels. This pest is highly mobile, and the adults can move in from adjacent areas at any point in the growing season. See www.ontario.ca/stinkbug for [management recommendations](#). It is likely this will be revised as we learn more about the biology of BMSB in Ontario.

During harvest assessments this year, make sure to look for signs of stink bug injury, especially along crop borders near woodlots, hedgerows, the Escarpment, etc. Early injury in tree fruit ('catfacing') looks like water spots or small areas of bleeding (Fig 1), becoming depressed or sunken as fruit develops (Fig 2). In apples, injury may

take 2-3 weeks before it is obvious. This means fruit could go into storage unblemished, but come out with brown spots. For detailed pictures of BMSB damage to tree fruit, visit www.northeastipm.org/neipm/assets/File/BMSB%20Resources/BMSB-IWG-Jun-2014/BMSB-Injury-to-Tree-Fruit.pdf.

Thresholds and management programs are still being developed in the mid-Atlantic US, where BMSB is abundant. Scouting is always important, on the crop and landscape hosts. Finds of adults in traps are indicative that BMSB are established in the area but they do not always mean insecticide sprays are necessary. However, in tree fruit, the presence of adults or nymphs in the crop itself is enough to trigger an insecticide spray. Keep in mind that sprays will only control those BMSB that are present at the time of application, or shortly thereafter, and nymphs are easier to kill than adults. Residual activity is typically limited. New waves of adults can migrate into crops from adjacent areas through the season, so managing BMSB requires season-long attention.

Remember that there are other stink bugs capable of causing damage to apples. If you think you have found BMSB, please contact us immediately via the Agriculture Information Contact Centre 1-877-4524-1300 or email ag.info.omafra@ontario.ca.

To date, BMSB has been confirmed in the following areas:

Region	Established /breeding population	Adults trapped in orchard site	Homeowner finds
Golden Horseshoe/GTA	Hamilton St. Catharines	Beamsville Niagara-on-the-Lake St. David's Waterdown	Burlington Fort Erie Milton Niagara Falls Stoney Creek Toronto Vaughan
Western Ontario	London Windsor	Cedar Springs Essex	Kincardine Maidstone Paris Tecumseh
Eastern Ontario	Newboro	n/a	Ottawa



Fig 1. Early stink bug feeding injury is often difficult to detect, but may appear discolored. (Peter Jentsch, Cornell University)



Fig 2. As fruit develops, stink bug feeding injury develops into darkened, sunken spots. (Peter Jentsch, Cornell University)

Post-Harvest Perennial Weed Control

Amanda Green, Weed Management Program Lead-Horticulture, OMAFRA

During this busy time of year weeds may be your last priority but once you are done harvesting it will be a good time to control perennial weeds. Perennial weeds are hard to control because they typically have an extensive root system that can propagate new shoots.

To effectively control perennials you will need to kill as much of the root system as possible. During the fall, perennials are allocating carbohydrates produced by the leaves to the roots for over-wintering energy. Therefore if you use a herbicide that is phloem mobile, like glyphosate

(ROUND-UP) it will translocate to the roots where it will have the most impact to the plant.

ALION (indaziflam), since being introduced into the 2012 field season, has now been a part of a many growers' herbicide programs. Since ALION has such a long season residual control and is broad spectrum, growers may be cutting out a clean-up spray after apple harvest out of their spray program. Since growers may not be applying a post-harvest clean up spray when it is the best time of the year to control perennials and ALION may not have good control on some perennials like Canada thistle or perennial sow thistle, perennials are becoming more present in fields.

If you are seeing perennial weeds in your field these are options that you can use for post-harvest weed control:

Herbicide	Perennial Weeds controlled	Precautions
2,4-D	Dandelion, plantains, Canada thistle	- Established plantings only - Do not apply when usable fruit is on the harvest floor - Can be applied until two to three weeks before normal frost time
Clopyralid (LONTREL)	Vetch, perennial sow-thistle*, Canada thistle**	- Use as a spot treatment - Avoid contact with tree limbs - Do not apply when usable fruit is on the orchard floor - Controls vetch best at early flowering stage - Apply before weeds are hardened off for winter
Glyphosate (ROUND-UP, TOUCHDOWN, CREDIT)	Field bindweed, dandelion, wild grape, milkweed, plantains, poison-ivy, quackgrass, perennial sow-thistle, Canada thistle, yellow toadflax, curled dock, Virginia Creeper*	- Established plantings only - After terminal bud set (June) glyphosate can cause permanent damage to apple trees if absorbed. To avoid this from occurring remove root suckers and avoid contacting green tissue and bark with glyphosate. Use a wick wiper or roller or hand held dripper to apply glyphosate. - Mowing weeds prior to application will reduce effectiveness of glyphosate, unless the weeds have been allowed to regrow - Can be applied after a mild frost, as long as the tissue is green and actively growing at the time of application - Do not apply after the first damaging frost

* Top growth only, regrowth can be expected

** Control ratings are not as high as glyphosate



Figure 1: Canada thistle at the rosette stage



Figure 2: Canada thistle in an apple orchard

Postharvest

Maturity and Storage of 'Honeycrisp' Apples

Dr. Jennifer DeEll, Fresh Market Quality Program Lead - Hort Crops, OMAFRA

Determining the optimum harvest maturity for 'Honeycrisp' is difficult. Standard maturity indices, such as internal ethylene concentration, starch index, soluble solids concentration and fruit firmness are not always consistent. Current recommendations suggest that **harvest should occur when the ground color begins to change from green to yellow and the starch index is at least 6** (on the Cornell chart). The best eating quality has been associated with 13.5 lb minimum firmness and at least 13% soluble solids (Watkins et al., 2004). There has been no consistent relationship of internal ethylene to harvest date and differences in maturity do not always exist among 'Honeycrisp' apples with varying levels of red color. For example, brilliant red fruit can exhibit very similar internal ethylene concentrations, starch content, and firmness values as those having poor red coloration.

Immature 'Honeycrisp' may never mature and thus remain of poor eating quality. Fruit harvested too early do not develop varietal flavor and are almost tasteless. This remains true throughout storage as well. If harvested too late, 'Honeycrisp' can develop fermentation products, such as ethanol and acetaldehyde, which cause undesirable flavors. The onset of such off-flavors is difficult to predict, as there are no associated visual symptoms. Harvesting at optimum maturity is the best way to achieve the characteristic flavor of 'Honeycrisp'.

'Honeycrisp' is **extremely susceptible to bitter pit**. Lesions may appear prior to harvest or during storage, and usually develop in the calyx end of the fruit. The cause for bitter pit is a mineral imbalance in the apple flesh, associated with low levels of calcium. 'Honeycrisp' fruit are also **prone to developing soft scald during storage**. Soft scald is a low-temperature disorder of apples that is characterized by sharply defined, irregularly

shaped, smooth, brown lesions of the skin (Plate 1). Peel tissue is initially affected and then hypodermal tissue is damaged as the disorder continues to develop. Skin lesions are often then invaded by secondary pathogens, such as *Alternaria* or *Cladosporium*. 'Honeycrisp' is also **susceptible to soggy breakdown**, which likewise develops during storage and is also chilling related. Soggy breakdown is distinguished by soft, brown, spongy tissue within the fruit cortex (Plate 2).

Prior to cold storage, **conditioning at 10°C for 1 week is recommended** to reduce the incidence of soft scald and soggy breakdown. Conditioning at warmer temperatures has been shown to substantially reduce titratable acidity, which has also been noted within sensory evaluations. Bitter pit can develop more rapidly at warmer temperatures, so conditioning at 10°C is a compromise between bitter pit and soft scald development.

After conditioning at 10°C for 1 week, 'Honeycrisp' is best **stored in ambient air at 3°C**. Controlled atmosphere (CA) storage of 'Honeycrisp' is not currently recommended in Ontario. However, limited success has been observed using 3% O₂ and 1-1.5% CO₂ at 3°C (DeEll, unpublished data; Watkins et al., 2013). CA tends to substantially reduce greasiness, as well as maintain titratable acidity. Severe internal browning can develop when 'Honeycrisp' is held in many of the standard or typical CA regimes used for other apple cultivars. 'Honeycrisp' tends to be very sensitive to CO₂, so CO₂-related disorders can develop easily. Treatment with diphenylamine (DPA) has been shown to reduce CA-related disorders in 'Honeycrisp' apples (Contreras et al., 2014).

Ethylene production, respiration, and **greasiness can be reduced by SmartFresh™** (1-MCP) on 'Honeycrisp'. SmartFresh tends to be slightly more effective when applied at the onset of the conditioning period at 10°C, compared to after that 1 week period. However, always be aware of any CO₂ accumulation during the SmartFresh treatment, as this has potential to cause CO₂ injury. There is little loss of firmness in 'Honeycrisp' during storage, so any improved firmness retention caused by SmartFresh treatment is difficult to discern.



Plate 1: Soft scald in 'Honeycrisp'.



Plate 2: Soggy breakdown in 'Honeycrisp'.

Optimum Maturity for Storage of 'Ambrosia' Apples

Dr. Jennifer DeEll, Fresh Market Quality Program Lead - Hort Crops, OMAFRA

'Ambrosia' produces very little ethylene during maturation on the tree. As starch is degraded and color changes, there continues to be only trace amounts of internal ethylene present (<1 ppm). This makes internal ethylene a difficult indicator of fruit maturity for 'Ambrosia' (but at the same time makes 'Ambrosia' an ideal candidate for SmartFresh (1-MCP) treatment).

Overall, the starch index has been the most consistent indicator of 'Ambrosia' fruit maturity, with **starch values of 2.5 – 4.0 optimal for fruit storage.**

It is **important not to wait until the background color is yellow to start harvest**, as the fruit will be over-mature for storage. Background color has more to do with nitrogen levels in the fruit than maturity and background color usually changes in storage.

Optimum harvest of 'Ambrosia' tends to be around the same time as 'Empire'. At the time of harvest, fruit firmness has averaged ~17-19 lb, starch index ~2 to 4, and ground color yellow 2 to 3 on the BC color chart. **Apples harvested later tend to soften more rapidly and develop more disorders and greasiness during storage.**

'Ambrosia' apples treated with SmartFresh are firmer and have less internal ethylene than those not treated, as well as higher malic acid content and reduced greasiness after an additional 7 days at 21°C. Controlled atmosphere (CA) storage also improves fruit firmness and acidity retention, with no greasiness development.

The current **CA recommendations for 'Ambrosia'** are:

- 1) **2.5% O₂ + 2% CO₂ (standard CA), or**
- 2) **1.7% + 1% CO₂ (low O₂ CA) at 1°C.**

Cleaning and Sanitizing Cider Production Areas

Louise Agius, Risk Management Specialist, OMAFRA

A cleaning and sanitizing program is essential for minimizing food safety risks in the production of apple cider. Cleaning involves the removal of food residues and non-organic debris from food and non-food contact surfaces, while sanitizing reduces the number of pathogenic and/or spoilage-causing organisms to safe levels. It is important to understand this distinction.

The cleaning and sanitizing protocol for all food processing/packing facilities, including those producing apple cider, should follow seven steps.

1. Rough Clean

The rough clean eliminates as much gross soil and debris as possible from surfaces before wet cleaning begins. Brooms, shovels, scrapers, etc. should be used to physically remove debris from equipment, utensils, walls, and floors. Dismantling equipment may be required to remove trapped food debris.

2. Pre-rinse

In this step, equipment and the production area are flushed with potable water until they are visibly clean. Hard-to-reach areas and areas where materials accumulate, such as the apple chopper and press, may require particular care. Stubborn soils can be addressed using mechanical action or increased water pressure. However, caution must be exercised as higher water pressures can generate bacteria-laden aerosols (fine droplets in the air) which can cross-contaminate other surfaces. The use of high-pressure washers is discouraged.

3. Wash/application of cleaning agent

The objective is to remove soils at the microbiological level. Washing requires application of the right cleaner at the right concentration, with water at an appropriate temperature, adequate contact time, and the use of mechanical action when necessary. Always read and follow cleaner label instructions.

- **Organic soils** — Soils associated with apple cider production are mostly organic. Except when cleaning is delayed and soils have dried to surfaces, organic soils are easily removed using a mild to moderately alkaline detergent in warm water.
- **Inorganic minerals** — Inorganic mineral deposits from hard water require acidic cleaners.
- **Biofilms** — When cleaning is inadequate or infrequent, biofilms form on surfaces. Biofilms are difficult to remove, and as such require stronger, more sophisticated cleaners along with extra mechanical action to eliminate.

4. Post-rinse

To remove detergent and any remaining soils, the wash step is followed by a rinse with potable water. The lowest effective water pressure and volume should be used to reduce the risk of aerosols and overspray.

5. Inspection

A visual inspection of all equipment, utensils, walls and floors should follow the post-rinse to verify their cleanliness. Any areas or equipment parts that fail this inspection should be re-washed, rinsed, and re-inspected.

6. Sanitizing

Only when surfaces are clean can sanitizing take place. Sanitizers, especially chlorine, are rendered ineffective by organic matter—hence the importance of clean surfaces! Several types of sanitizers may be used, including chlorine, peroxyacetic acid (PAA) and quaternary ammonium compounds (Quats). Each type has an optimal contact time, temperature, and concentration, and all can be applied by spray or by foam. Always read and follow label directions.

After a sanitizer has been applied, surfaces should be left to air dry. When equipment is not used for four hours or more, the sanitation step should be repeated before production resumes to address remaining microorganisms that may have propagated to dangerous levels. In some instances, a potable water rinse may be necessary.

7. Record

All cleaning and sanitizing activities should be recorded. Deviations from the protocol or expected results should also be recorded along with the corrective actions taken. Records are both a management tool and proof of due diligence.

Additional information regarding cleaning and sanitizing is available at www.omafra.gov.on.ca/english/food/inspection/fruitveg/sanitation_guide/cs-guidebook.htm.

For food safety information on apple cider production, please visit www.omafra.gov.on.ca/english/food/inspection/fs_food_plant.htm#juice.

Announcements

First Call: Ontario Ciders Wanted for Competition

We are planning the 5th Annual Cider Competition for February 2014, and we hope that all Ontario cider producers will enter their delicious beverages. Many cider mills only make cider throughout the fall during harvest, and would need to freeze cider to enter. Here are some suggestions to preserve your cider for the competition:

- Each entry will require two (2) 4 L. jugs of cider. Jugs should be unlabelled.
- Leave some head space before freezing. Full or overfull jugs may split or spill out into the freezer.
- Freeze jugs from several batches, with an additional “tasting” jug. In early February, you can thaw these “tasting” jugs and choose the best tasting cider to enter. This will also allow you to practice how long is required to completely thaw your cider just prior to judging.
- Mixing apple cultivars often produces better flavours than using a single cultivar. The winning ciders often have at least 25% of a tart apple like Idared, Russet, Spy or English cider varieties like Kingston Black, Yarrowton Mills or Michelin (there are many varieties that add to the balance of the mix).

Make some plans now to freeze ciders this fall for the competition, and add to the growing excitement of our Ontario cider industry.

Calendar of Events for Apple Growers

- **Canada's Outdoor Farm Show**, September 9,10,11, Woodstock. www.outdoorfarmshow.com/
- **International Plowing Match and Rural Expo**, September 16-20, Ivy, Simcoe County www.plowingmatch.org/index.php/home-2014
- **South West Hort Expo**, Leamington, Nov. 18,19, 2014. An expanded convention by the Essex County Associated Growers. 519-326-4481
- **Great Lakes Fruit, Vegetable and Farm Market EXPO**, December 9-11, 2014. www.glexpo.com
- **Ontario Fruit and Vegetable Convention**, February 18-19, 2015, Niagara Falls www.ofvc.ca



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