



ORCHARD NETWORK

For Commercial Apple Producers

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Orchard Management

Pruning, Bud Counts and Fruit Size

Leslie Huffman, Apple Specialist, OMAF and MRA

A good pruning job achieves several goals, including shaping the tree to intercept the maximum sunlight, and renewal of the bearing surface. More recently, we've been learning more about the importance of dormant pruning in achieving fruit size – by reducing the number of fruitful buds.

Most apple trees produce many more flowers than are needed to set a crop. Several of our orchard practices encourage this – dwarfing rootstocks, tree support, good fertility and moisture, fruit thinning and sunlight interception. Although this holds true in conventional orchards, the effect is magnified in high density systems like Tall Spindle.

We know that all of the flowers will not set, and that many of the pollinated fruitlets will be removed by chemical and/or hand thinning. But think of the energy used by the tree to produce flowers, pollen and unnecessary fruitlets – this energy is wasted, resulting in reduced fruit size potential on the remaining fruitlets – which are your marketable crop.

Dormant pruning offers an easy and efficient opportunity to control how many flowers will share the tree's energy to set your crop. Maximizing this opportunity

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takes some management time - assessing buds, calculating the target cropload, and adjusting your pruning strategy, perhaps even sending crews through extra times. But it is time well spent to achieve better fruit size.

Dormant pruning as a precision cropload strategy works – because there is a horticultural advantage for trees to produce fewer flowers and fruitlets.

Saving and re-directing the tree's energy before bloom will produce larger fruit – and may make a difference in your markets next winter.

Your challenge: Try this technique this spring on 2 blocks to learn for yourself.

- Calculate your yield goal, and determine how many fruit per tree are needed (see "Pondering Precision Pruning", February Orchard Network www.omafr.gov.on.ca/english/crops/hort/news/orchnews/2014/on-0214a4.htm) This step can be done in the office.
- Choose 2 blocks of smaller trees, one under 5 years old, and a more mature block around 10 years old. Uniform trees are the easiest to count, and small fruited cultivars like Gala may show the greatest effect.
- Count fruit buds on 5 to 10 trees. On larger trees, you can count several of the larger branches and multiply for the total.
- If the bud count is more than 2x what is needed (as an insurance factor), more pruning should be done. The fastest way is remove entire branches to reduce the bud count.
- Flag the trees, and return after thinning, and at harvest to observe the fruit size. Return next year to observe return bloom.

Your Equilifruit disk or Cornell Young Tree Gauge can also help to remind the pruning crew how many buds per branch. Whatever method you try, keep notes, and plan to observe results on these trees this year and next. Let's recapture the horticultural advantage of early cropload management through pruning.

Timing for Success with Apple Plant Growth Regulators

Leslie Huffman, Apple Specialist, OMAF and MRA

Plant growth regulators (PGRs) are important for growing high yields and quality apples. These can be very effective tools, but it is critical to apply them at the correct stage of tree development. This can vary by days or hours, depending on your orchard location and by cultivar.

Here is the optimum timing "schedule" in the orchard:

- **Full bloom:** Promalin or Perlan for fruit elongation
- **Late bloom (shoots @ 2.5-5 cm):** Apogee, first application
- **King bloom petal fall:** Amid-thin (if available)
- **5-6 mm fruit:** thinning with Maxcel or Cilis Plus, NAA or Fruitone-N, Sevin
- **10-13 mm fruit:** thinning with Maxcel or Cilis Plus, NAA or Fruitone-N, Sevin
- **14 days after 1st Apogee spray:** 2nd Apogee application, if needed
- **16-20 mm fruit:** thinning with Maxcel or Cilis Plus, NAA or Fruitone-N, Sevin
- **21 days after bloom:** final timing for Sevin, if needed
- **28-35 days after 1st Apogee:** 3rd Apogee, if needed
- **42-49 days after 1st Apogee:** 4th Apogee, if needed

Performance of PGRs is dependent on many factors, with weather and tree condition being two important ones. Challenging weather conditions can make the application windows short. Daily observations of tree development are needed, especially if during warm temperatures. Be prepared with product on hand, and sprayer ready to go when the best timing arrives.

Read pages 63-77 of Publication 360, Guide to Fruit Production for guidance on how to use PGRs effectively.

I find this is a good refresher every spring, as well as the label instructions.

Planning a New Orchard Planting? Don't forget your soil!

Anne Verhallen, Soil Management Specialist (Horticulture Crops), OMAF and MRA

Just as you have to plan well in advance to order trees and posts for a new orchard planting, take the time to plan your soil management. Whether it is a replant location or a new orchard location now, when the soil is bare is the time to make improvements. Or perhaps it is better to think of it as maintenance – similar to the maintenance that you would do on your tractors or farm trucks.

Time of orchard planting	Maintenance required
Orchards to be planted in fall 2014: full pre-plant preparation year	To do this spring • Soil sample – fertility and pH • Apply fertilizer and lime if needed based upon soil test • Soil sample – nematodes (once soils are 50 F so anytime now) • Review nematode test results – options for suppression if needed include biofumigation with cover crops or chemical fumigation • Opportunity to add organic matter to build soil and enhance soil structure – use manure or compost To do early summer • Plant a cover crop to take advantage of the nitrogen from the manure or compost and to build soil structure with living roots. Eg. Sorghum sudan, pearl millet – something with fast growth
Orchards to be planted in fall 2014: with short season crop this summer (eg. vegetables or soybeans)	To do this spring • Soil sample – fertility and pH • Apply fertilizer and lime if needed based upon soil test • Soil sample – nematodes (once soils are 50 F so anytime now) • Review nematode test results – options for suppression if needed include biofumigation with cover crops or chemical fumigation (allow for time for this between crop harvest and tree planting) • Very short season crop ie zucchini may allow time for a short season cover crop to build soil structure eg buckwheat or cover crop radish/oats • Hope your soil organic matter levels are adequate, manure application really is not an option if you are growing vegetables this summer.
Orchards to be planted in spring 2015	To do this spring • Soil sample – fertility and pH • Apply fertilizer and lime if needed based upon soil test (better to apply a year in advance for P, K and lime) • Soil sample – nematodes (knowing this now allows you the summer and fall to work to reduce populations) • Review nematode test results – options for suppression if needed include biofumigation with cover crops or chemical fumigation • Opportunity to add organic matter to build soil and enhance soil structure – use manure or compost To do early summer • Plant a cover crop to take advantage of the nitrogen from the manure or compost and to build soil structure with living roots. Eg mustard for biofumigation or sorghum sudan or pearl millet for biomass return To do fall 2014 • Plant a fall cover crop like rye to provide ground cover over winter If nematodes were high in spring – re-sample
Orchards to be planted in fall 2015 or later	To do this spring • Soil sample – fertility and pH • Apply fertilizer and lime if needed based upon soil test • Soil sample – nematodes (once soils are 50 F so anytime now) • Review nematode test results – options for suppression if needed include biofumigation with cover crops or chemical fumigation (allow for time for this between crop harvest and tree planting) To do fall 2014 • Opportunity to add organic matter to build soil and enhance soil structure – use manure or compost Plant a fall cover crop like rye to provide ground cover over winter If nematodes were high in spring – re-sample Insert cover crops where possible to build soil organic matter reserves, build soil structure and enhance soil water holding ability and drainage. Enhance drainage where needed and plan for water flow in the orchard.

Pollinators, Pollenizers and Pollination

Leslie Huffman, Apple Specialist, OMAF and MRA

The health and safety of bees has been highlighted in many media lately, and fruit growers are well aware of the importance of our pollinating insects. Most growers invest in beehive rental to achieve better pollination, and work closely with their beekeepers to keep these **pollinators** safe and healthy.

Pollenizers (which are the **source** of the pollen) are another key factor in successful pollination. Adequate pollenizers may get overlooked, especially in intensive orchards with the focus on efficiency. Pollen must be moved from one apple blossom to another blossom on a different (and receptive) cultivar. Traditionally, orchards were planted in 4 row blocks to provide pollenizers, but this close proximity poses other challenges (eg. timing of plant growth regulators, differences in russet susceptibility, PHIs, harvest management). In high density orchards, bees tend to travel down, rather than across rows. Using interplanted crabapples as pollenizers is increasing, and may be also useful where pollination has not been adequate. Read more in the factsheet, "Crabapple Pollenizers for Apples", www.omafr.gov.on.ca/english/crops/facts/00-011.htm.

Native insects also provide pollination, and research is highlighting the importance of protecting these wild pollinators. In a cold and windy spring, when honeybees struggle to fly and collect nectar, these wild pollinators provide an alternative source of pollination. At the IFTA Summer Tour in Pennsylvania last summer, researchers have identified many native insect species in apple orchards that provide pollination. They are working with growers to plant season-long flowering refuges to encourage these insects. Perhaps there are areas near your farms that could provide similar benefits to your orchards.

Fruit growers can do many things to protect their honeybees as well. Read page 269-271 of Publication 360, Guide to Fruit Production for a refresher on preventing bee poisoning. Here are some ways to protect bees:

- Do not apply insecticides while fruit trees are in bloom. This is prohibited by the Bees Act.
- Tell your neighbours that beehives are at your farm and to avoid spraying if possible.
- Give your beekeeper a day's notice if insecticides will be sprayed within 1 km.
- Do not spray insecticides on any crop where bees are foraging.
- Be aware of cover crops in bloom or with blooming weeds— this is the most common site of bee poisonings.
- Provide a source of clean water for bees.

If insecticides must be used nearby:

- Do not spray insecticides during the day. Bees return to their hives in early evening, so spraying after 7 pm is the safest. Early morning sprays should finish by 7 am.
- Choose cooler days. Bees do not forage at temperatures below 13°C.
- Block the hive entrance with wet bags for up to 12 hours after spraying. Leave a space for bees to exit to cool the hive.
- Avoid spray drift by avoiding windy days.

When pollination is complete:

- Remove bees ASAP when bloom is finished before applying petal fall sprays.
- Choose insecticides that are less toxic to bees. Table 11-2 in Publication 360 lists the relative toxicity of pesticides to honeybees. Choose wisely.

Our pollinators, including honeybees and native insects, are critical to our future success in fruit production. Do everything possible to ensure their health and safety.

Crop Protection

Winter Survival of Orchard Pests

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAF and MRA

Following this long winter, there have been many questions on just what sort of impact the cold weather has had on overwintering orchard pests. Unfortunately, at this point, it's still too early to tell just what we can expect this season.

In general, most insect pests that overwinter in Ontario orchards are adapted to the cold temperatures. Many go into what is known as diapause, which is a type of hibernation, while others seek shelter, utilize warming techniques (ie., produce insect "antifreeze"), or a combination of these. For example, codling moth overwinter in diapause in a pre-pupal stage snug within a cocoon, or hibernacula, under the protection of leaf litter or loose bark at the base of the tree. Japanese beetle and apple maggot overwinter as larvae and pupae respectively in the soil, insulated from the extreme temperatures by the snow cover. European red mite and several species of aphids overwinter as eggs by producing specialized proteins that prevent their cells from freezing.

In a typical winter, insect populations often experience winter kill to some degree, depending on many factors within the micro-climate of the orchard, such as air drainage, snow cover and extreme temperature. While an extremely cold winter could reduce pest numbers, favourable weather early in the spring can easily compensate for those that survived. With a warm, dry spring, we could see a quick emergence of European red

mite, rosy apple aphid, tarnished plant bug and mullein bug, whereas a wet, cold and rainy spring could delay emergence of these early season pests.

The same can be said of most overwintering disease inoculum, which typically overwinters protected from cold weather in:

- infected branches or cankers (e.g., fire blight)
- leaves on the orchard floor (e.g., apple scab)
- dead wood or mummified fruit in the tree or on the ground (e.g., black rot, bitter rot),
- alternate hosts to be carried in from other areas on wind currents (e.g., rust).

The exception to this would be powdery mildew, which overwinters as mycelium in dormant fruit and shoot buds that were infected the previous season. Conidia grow out of buds in the spring as infected tissue and spread to other leaves causing secondary infection. Overwintering powdery mildew infected buds and shoots lack winter hardiness. Below temperatures of -24°C, which occurred in many regions this winter, the survival rate is generally less than 5%.

Dormant buds infected with powdery mildew are typically feathered, pointed or shriveled (see figure below) and usually break dormancy 5-8 days later than healthy buds. As well, both buds and infected shoots have a thin layer of fuzzy white fungus that is usually fairly easy to see.



Photo: Chris Duyvelshoff, Perennia

Powdery mildew requires living tissue. So, if the winter has killed the infected bud, the mycelium will not survive. However, if the bud survives, there is a good chance the fungus survived, too. Since infected buds typically open later than healthy ones, susceptible, green tissue may be already present when the first conidia are produced. If conditions are ideal, even a small powdery mildew population can quickly explode if not managed properly. For tips on powdery mildew control and how to incorporate these strategies into an existing apple scab management program, see the previous Orchard Network article, [Managing apple scab and powdery mildew](#).

Clean Up, Clean Out: Orchard Sanitation to Reduce Pest Pressure

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAF and MRA

When pest outbreaks occur, it is often presumed that pest control products are the most important and effective management tools available. However, a good sanitation program can help eliminate or reduce sources of infestation and disease inoculum from the orchard, potentially improving the effectiveness of other management practices.

If your fall clean-up program missed any of the following, consider them this spring to help lower pest pressures for the upcoming season.

- **Remove sources of inoculum, including dead or diseased tissue or trees, infected branches, cankers, and rotten or mummified fruit.** This is a primary control strategy for management of summer rots, such as black rot (Figure 1) or bitter rot, but can also be effective against powdery mildew and fire blight. Overwintering inoculum can be spread by rain, wind, insect vectors or contaminated equipment to new growth as soon as the season begins. Preventing the spread of pathogens to healthy trees and the elimination of inoculum from one season to another can help reduce the amount of fungicide needed in a given year. Remember when taking out fire blight, pruning cuts should be at least 12 inches (30 cm) below the visible symptoms.



Figure 1. Black rot infected branches (right) serve as a source of inoculum for new growth. Frog-eye leaf spot can be seen on leaves (left) as a result of rain splashing spores from the branches, spreading infection.

- **Remove wood piles, fruit bins, stumps and loose bark** that could provide overwintering sites for insects, such as codling moth (Figure 2) and plum curculio. Leaving ideal sites in or adjacent to the orchard will not only promote winter survival in

a sheltered area, but provides a readily available food source when the pests emerge hungry in the spring.



Figure 2. Old wooden bins left next to the orchard provides an excellent overwintering site for apple pests, such as codling moth, which emerge as adults the following season and quickly lay eggs on or near the developing fruit.

- **Shred leaves** with a flail mower (Figure 3) to stimulate leaf decomposition. This may also disorient leaf pieces so they eject ascospores toward the soil, instead of up into the tree canopy, reducing primary scab infection. Rake or blow leaves from under trees into the middle of the row, or off-set the mower to reach them.



Figure 3. Shredding leaves in the fall and/or spring will help reduce overwintering apple scab inoculum.

- **Prune** to increase air flow, promote faster drying time and ensure thorough spray coverage (Figure 4). Rots and scab are more likely to develop in areas where good fungicide coverage is difficult to obtain and drying of leaves or fruit is slower. When pruning, remove excessive branches that reduce air circulation or anything that may impede spray coverage.

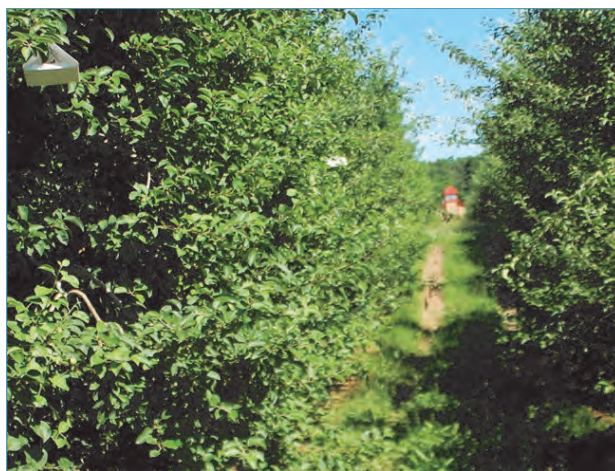


Figure 4. Dense or poorly pruned foliage impedes spray penetration and uniform coverage, and slows drying time, which often promotes disease development.

Fungicide Considerations for Early Season Disease Control

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAF and MRA

Sorting out a season-long disease management program is getting more and more complicated with the incorporation of new products and pre-mixes, dealing with resistance issues and the emergence of new pests. It can be quite difficult to keep it all straight. The following are some suggestions that may be helpful as a starting point to developing strategies for the 2014 season.

Apple scab management can begin before green tissue is even present as a means to reduce the amount of inoculum you're starting out with in the orchard this season. Applying urea fertilizer at 45 kg/ha (mixed with 1,000 L of water/ha) and/or shredding fallen leaves with a flail mower are two practical and inexpensive methods to minimize scab pressure. Ideally, these practices should be done before green tip if possible, but there may still be some benefit if this is delayed shortly after.

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

Dr. David Rosenberger from Cornell University recommends that copper sprays should be applied at ¼ to ½" green only since later sprays can result in severe fruit russetting. As well, in order for copper sprays to work effectively, it is recommended they be

applied to all of the trees in the block. Untreated trees, even non-susceptible varieties, provide a safe haven for the bacteria and insect vectors can move the bacteria around easily.

Copper sprays applied to green tissue may also provide some protection against apple scab when applied before spores are released. However, this should not take the place or delay the application of the first scab protectant fungicides.

Prebloom sprays of protectant fungicides for apple scab, such as EBDCs (mancozeb, metiram) and/or captan have worked well for growers for many years. Since scab infection can occur anytime there is green tissue present, a tight spray interval program is needed beginning at green tip. It is important to keep in mind, however, these are contact fungicides and do not provide effective post-infection or anti-sporulant activity. That means if sprays are applied in less than ideal conditions, ie., windy, alternate rows, or washed off in rain, the risk of scab infection is increased.

It is also important to note EBDC and captan fungicides do not have activity against powdery mildew. For effective mildew control, management needs to begin early season ½" green. Consider including a mildewcide, such as sulphur in early sprays, unless temperatures are greater than 25°C or oil is applied. Rosenberger recommends sulphur at a rate of 3-5 kg/ha, tank mixed with ½ rate mancozeb plus ½ to full rate captan, depending on tree size and disease pressure. The mancozeb/captan will have good activity on scab, while the sulphur will suppress mildew.

Once plenty of new growth is present in the orchard, systemic fungicides, such as sterol inhibitors (SI), succinate dehydrogenase inhibitors (SDHI) or strobilurins, should be incorporated into the management program. This is especially important from tight cluster to petal fall to prevent secondary scab infection and protect against mildew.

Early season, SDHI fungicides (Fontelis, Luna Tranquility and Pristine) are registered for the control of scab, powdery mildew and rust. Placement of these products is best between tight cluster and first cover. However, particularly with Luna Tranquility (which is a pre-mix with Scala), it is best to use these fungicides before petal fall as they have only fair to moderate

activity on rust, if this is a pest of concern. Often rust is most difficult to control on leaves after petal fall because of rapid shoot growth.

Similar to past recommendations to tank mix SI and strobilurins with protectant fungicides, the same should be done for SDHIs for good resistance management. As well, be mindful of any formulations that contain mineral oil, which can result in injury under certain conditions if used in combination with captan.

The strobilurin (Flint, Sovran and Pristine) and SI (Nova and Inspire Super) fungicides are also registered for control of scab, powdery mildew (suppression only for Inspire Super) and rust. However, resistance has been documented in Ontario scab populations to both fungicide groups, and may also be present to a lesser extent in powdery mildew populations, though further testing is needed. For this reason, strobilurins and SIs should only be used in orchards with susceptible scab populations and should always be tank-mixed with a protectant fungicide. Where strobilurins are working, their best fit may be at petal fall and/or first cover to avoid using them when scab pressure is of greatest concern. However, the SI fungicides are not effective on fruit scab and should not be used after bloom.

One key strategy to good resistance management is rotating between products of different chemical groups. This does not just mean rotating from one product to another. Fungicides are grouped based on their mode of action, or how the product actually affects the disease. For example, all products in Group 3 have the same mode of action, so using one product is virtually the same as using all other products within that group. In pre-mix fungicides, both groups need to be considered in all rotation decisions. For example:

- Pristine (Group 7 & 11) cannot be rotated with: Flint or Sovran (Group 11), OR Fontelis or Luna Tranquility (Group 7)
- Luna Tranquility (Group 7 & 9) cannot be rotated with: Fontelis or Pristine (Group 7), OR Scala, Vangard or Inspire Super (Group 9)
- Inspire Super (Group 3 & 9) cannot be rotated with: Nova (Group 3), OR Scala, Vangard or Luna Tranquility (Group 9)

The following figure depicts a program that would have activity on scab, powdery mildew and rust while providing excellent resistance management so long as there is rotation among the higher risk fungicide groups (ie., SI, SDHI, strobilurin).

Green tip	½" green	Tight cluster	Pink	Bloom	Petal fall	First cover	Summer sprays
Group M: Manzate, Dithane, Penncozeb Polyram Maestro, Supra Captan Folpan Granuflo-T, Thiram (plus sulphur for mildew)		Group 3: Nova, Inspire Super* + ½ rate Group M				Group M: Manzate, Dithane, Penncozeb Polyram Maestro, Supra Captan Folpan Granuflo-T, Thiram Group 29: Allegro	
		Group 7: Fontelis, Luna Tranquility*, Pristine* + ½ rate Group M					
		Group 11: Sovran, Flint, Pristine* + ½ rate Group M					

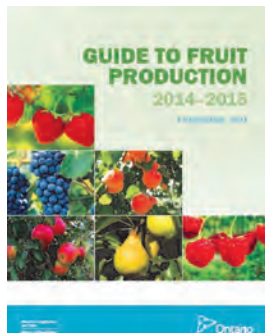
* pre-mix, contains multiple chemical groups

* pre-mix, contains multiple chemical groups

Publication 360 –What's New?

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAF and MRA

The 2014-2015 Publication 360, Guide to Fruit Production is now available with the latest information on pest management, crop nutrition, pesticide safety, resistance management and tree fruit thinning.



What new information can apple growers expect to find?

- **New products and label expansions** for control of apple insects and disease. See the February [2013](#) and [2014](#) Orchard Network Newsletter articles for more information on these products.
- **Additional pests or control timings** in the apple calendar, such as bitter rot, dogwood borer, and brown marmorated stink bug.
- **Updated tables** for PHI/REI periods, product activity against insects, mites and disease, and toxicity of pesticides to beneficial insects.
- A look at the questions that should be asked when **chemical thinning**, including what is needed and when, at what volume, and when results should be assessed.
- Details on the **new regulations** that are in place for **soil fumigant applications**, including the development of a Soil Fumigation Management Plan, restrictions and sign requirements.
- A new chapter on **organic and biopesticide products**, including registered crops, details on product use and important crop-specific information.
- **Updated pesticide resistance** section to include comprehensive resistance management strategies by chemical family for Ontario fruit crops.

The Ontario Apple Growers have purchased copies for all their members again this year. However, additional copies along with many other factsheets, publications and resources can be ordered from Service Ontario:

- Online at www.publications.serviceontario.ca/pubont/servlet/ecom/
 - Use the Product Number #109045, or search "fruit guide"
- By phone through the ServiceOntario Contact Centre, Monday-Friday, 8:30 am-5:00 pm
 - 416-326-5300 / 416-325-3408 (TTY)
 - 1-800-668-9938 (Toll-free) / 1-800-268-7095 (TTY Toll-free)
- In person at ServiceOntario Centres located throughout the province or at any OMAF Resource Centre. Many can also be found online at www.ontario.ca/omaf

Getting Ready for Your Integrated Pest Management (IPM) Program

Margaret Appleby, IPM Systems Specialist, OMAF and MRA

Do you have a monitoring plan in place for your IPM program?

Here is a checklist to help you prepare:

- Take an IPM workshop to refresh your knowledge of identification, biology and monitoring techniques for insects, diseases and weeds in your crops. OMAF offers a series of IPM workshops starting late April and throughout the month of May. You can find a list of workshops on the OMAF website at the horticultural section of the conferences and meetings page. www.omafra.gov.on.ca/english/crops/conferences/index.html#hort
- For a self-directed refresher, check out Ontario Crop IPM www.ontario.ca/cropIPM. Here you will find interactive online training and information modules on pests and pest management in a number of crops: for fruit crops - apples, tender fruit, grapes, and strawberries, and for vegetables - sweet corn, tomatoes, brassica, cucurbits and onions.
- Designate someone on your farm to monitor on a weekly basis so that this job doesn't get forgotten when all sorts of other issues are pushing you in different directions.
- Make up a pest management kit with the right tools for monitoring such as a hand lens, tapping tray, sweep net, containers such as paper bags and vials, traps, flagging tape notebook, markers and copy of the farm map.
- Have your farm map up to date. Outline new plantings, blocks that have been removed and take the detail if possible down to cultivars planting dates. Circle where the problems were in the past such as mite or weed hot spots and diseases such as powdery mildew. Use your map to develop a reporting template for your scout. Using this map, the scout can quickly identify to you where they have monitored and where they have found problems.
- Set up a communication plan with the scout to report findings and to find out what needs to be looked at next. Keep the scout up to date on when and what crop protection materials have been applied and when it safe to re-enter the block.
- In order to have your crop protection information at your fingertips, make sure you have the current 2014-15 issues of Publication 75, Guide to Weed Control, Publication 360, Guide to Fruit Production and Publication 838, Vegetable Crop Protection Guide.

Brown Marmorated Stink Bug may be Widespread in Ontario – Watch for it!

Hannah Fraser, OMAF and MRA, Tara Gariepy, Agriculture and Agri-Food Canada, and Cynthia Scott-Dupree, University of Guelph.

During surveys conducted in 2012/2013*, the invasive brown marmorated stink bug (BMSB) was confirmed as established in the City of Hamilton and in Newboro (Leeds and Grenville County), ON. By “established”, we mean both adults and immature life stages have been identified at these locations, indicating there is a reproducing population. In both cases, finds of adults (Figure 1) and nymphs (Figure 2) came following at least two years of confirmed homeowner reports in the area. In addition, we have also trapped BMSB adults at farms near Cedar Springs and Waterdown. Although BMSB was not identified in the crops at either location, there were multiple adults captured over several weeks, indicating the pest is probably established nearby (likely at low population densities). In the case of Cedar Springs, an adult was found at a homeowner site (indoors) earlier in the year, and of course, Waterdown is very close to known areas of infestation in Hamilton.



Figure 1 - BMSB adult



Figure 2 - BMSB 5th instar nymph

What this means is that homeowner finds, especially multiple finds and at multiple locations in an area, need to be taken seriously. BMSB adults move indoors in the fall to overwinter. While most may go unnoticed in unfinished spaces such as attics, some make their way into living spaces where they are easily detected.

To date, there have been confirmed homeowner finds in Hamilton (2010 – many dozens of homes), Burlington (2012 – dozens of homes), Cedar Springs (2013), Milton, Newboro (2012), Toronto (2012), Vaughan (2013), Windsor (2013) Niagara-on-the Lake (September 2013), London (October 2013), Kincardine (November 2013), Paris (January 2014), Fort Erie (February 2014), Stoney Creek (February 2014), and most recently Ottawa (March 2014). In order to confirm homeowner finds of BMSB in a new area, we require an actual specimen. For example, we received photos of BMSB from Niagara Falls (winter 2014) and in St. Catharines (April 2014) but without an actual specimen, this cannot be added to our list. After we’ve received a few specimens, quality photos can be used to help track local abundance. Following recent media interest in BMSB in mid-April, we’ve had several new homeowner finds in Windsor and London, suggesting this pest is also established in those areas. Early detection is critical in mitigating economic injury to crops, and obviously we will follow up with surveys near these finds in 2014.

We will be updating our BMSB webpages soon, with information on monitoring and management (www.ontario.ca/stinkbug) based on recommendations from other affected areas. We have no direct experience with this pest, as we have not found BMSB in crops in Ontario (although we’ve trapped them on two farms – Cedar Springs / Blenheim and Waterdown - indicating they’re around).

The most important advice is to monitor for BMSB in crops and on preferred wild hosts (examples “tree of heaven”, buckthorn) in adjacent landscapes / woodlots, keeping in mind this insect is highly mobile and can move into apples from adjacent crops or woodlots at any time in the season. There are no good thresholds in tree fruit. The presence of adults in the orchard is a good indication that nymphs are also present, and when nymphs are present, insecticide sprays are almost always necessary. In fact, a single BMSB found in 100 feet of tree fruit row along a wooded edge triggers intervention (see extension.umass.edu/fruitadvisor/brown-marmorated-stink-bug/management). Early in the season, before BMSB builds up, directed border sprays may suffice (when BMSB is found only in the perimeter of the orchard or in adjacent plants). Products do not have much residual activity, and for this reason, alternate row middle (ARM, single side of tree) sprays have been recommended in the US. Later in the season (late July onwards), whole orchard applications are warranted. There are several products registered for control or suppression of BMSB in Canada; this information is posted on our website.

If you think you have found BMSB, please let us know so we can add new areas to the distribution map and to provide assistance. Call the Agriculture Information Contact Centre at 1-877-424-1300 or send an email to ag.info.omafra@ontario.ca. For more information and updates specific to Ontario, visit www.ontario.ca/stinkbug. Details on the biology and management of BMSB, including an excellent video series, can be found at www.stopBMSB.org.

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Effective Sprayer Cleanout Practices – Survey Results From Colorado

Dr. Jason S.T. Deveau, Application Technology Specialist and Thia Walker, Colorado State University Extension Specialist

Cleaning the sprayer is a critical part of every spray day. Pesticide residues clog and corrode equipment and can injure crops. So what is the best process for sprayer cleanout? In 2013, Colorado State University conducted a state-wide survey of sprayer clean-out practices. The results of the survey were very telling and anyone that operates a sprayer can benefit from what they found. The survey was in two parts:

In part one, more than 600 ground sprayer operators responded. They were roughly equal parts commercial (primarily weed control in field crops and turf/ornamental) and private applicators. 84% of the respondents had more than three years' experience.

1. At any time over the last five years, have you observed symptoms to off-target plants? (n=608)



2. How often do you clean your sprayer? Select all that apply. (n=587)

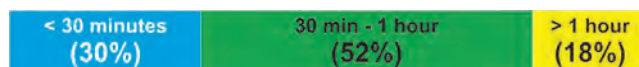
60% When switching types of pesticide (n=352)
31% When switching application sites (n=182)
37% At the end of the season as part of winterizing equipment (n=217)
18% At the end of each day's use (n=106)

Operators should clean out their sprayers every time they switch pesticides, but respondents only did it 60% of the time. Operators should also clean out the sprayer when changing sites (e.g. moving from corn into soybeans) but

only 31% did so. Finally, operators should clean out the sprayer at the end of the day, even if they intend to spray the same product the next day, but only 18% did so. These relatively low figures might partially account for the fact that 16% of operators ADMITTED to seeing off-target damage in recent years. So, why aren't they doing it more frequently?

Respondents indicated that the biggest constraints are not time or cost, but the lack of a suitable place to clean the sprayer, the limited availability of clean water and limited places to put the rinsates

3. How long does your tank cleaning procedure take? (n=591)



4. Where is the equipment cleaned:
 ⇒ At the application site? (n=598)*



⇒ At the facility where sprayer is stored? (n=597)*



**It should be noted that respondents who reported that they never clean at the application site, preferring where the sprayer is stored, were primarily the turf/ornamental applicators that choose not to clean the sprayer at a client's location. This skews the data somewhat.*

5. How do you dispose of rinsates from tank cleaning? Select all that apply. (n=582)

71% Apply to labeled application site (n=413)
23% Pull the plug and let it drain (n=134)
23% Store for future use (n=134)

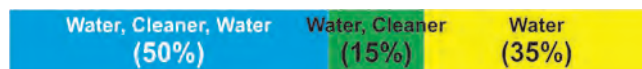
Ideally, the sprayer should be cleaned at the site where product was applied. The location should not contaminate water supplies or nearby sensitive sites and should not be readily accessible to people, pets or livestock. The easiest way to do this is to have rinse water available in the field (e.g. on the sprayer or a support vehicle) so the rinsate can be applied back onto crop. Alternately, the sprayer can be cleaned at the loading area, but there should be a pad impervious to water with a sump to catch wash water and rinsate.

Next, the researchers wanted to determine the most effective cleaning method. For this part of the survey, more than 50 respondents provided samples of their clean water source, their pesticide tank mix, and samples of rinsate from each sprayer rinse in their typical cleaning process.

6. Which [cleaning] procedure do you typically use? (n=599)

- Water, then tank cleaner +water, then rinse with water

- Water, then tank cleaner + water
- Just water



7. How full do you fill the tank [each time]? (n=593)*



**It should be noted that there was an inverse correlation between tank size and fill volumes. Those with smaller tanks filled them more and vice versa.*

8. What additive [if any] do you use? Select all that apply. (n=591)

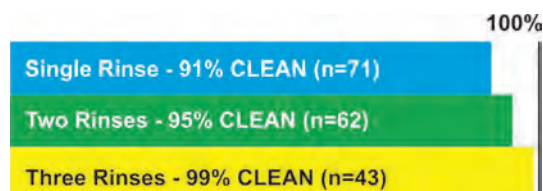
- **48%** Just water (n=284)
- **40%** Commercial tank cleaner (n=236)
- **14%** Ammonia (n=83)
- **9%** Bleach (n=53)

A review of several recommended protocols for tank cleaning reveals four key steps:

- Avoid having excess spray mix left over (except for the unavoidable volume in the ballast)
- Perform a low-volume rinse of the tank
- Use some form of tank cleaner (as indicated on the pesticide label) in a second low-volume rinse, and
- Finish with a third low-volume rinse

Respondents complied with this protocol only 50% of the time. 30% of respondents filled the tank more than 1/2 full. Further, 48% of respondents did not use some form of tank cleaner in their process. Does this mean their sprayer cleanouts were not effective? Not necessarily!

According to the results of the survey, the size of the tank being cleaned was not a factor. Perhaps surprisingly, the impact of cleaning agents was unclear. What was obvious was that the more rinses, the more effective the cleanout. Further, as long as the volume used to rinse cleared any baffles in the tank, and was sufficient to rinse all surfaces, **volumes as low as 10% of the overall tank volume** were able to clean the tank by 99% when triple rinsing.



The average overall cleanout efficiency was 95%. There's no absolute threshold for what is acceptable, but most would agree that 5% pesticide remaining in the tank and lines may not be sufficiently clean.

So, clean your sprayer in an appropriate location, clean it often and be sure to use the low-volume triple rinse method. To learn more, download PowerPoint presentation number 27 from:

sprayers101.ca/additional-information/presentations/

Winter Injury and Apple Cankers

Margaret Appleby, IPM Systems Specialist, OMAF and MRA

In the winter of 2013-14, some Ontario apple growing areas reported temperatures below -30°C. Fortunately this occurred when trees were in full dormancy, so would be very tolerant to these extreme temperatures. Also fortunately, temperatures didn't warm up much, or swing erratically over short periods of time this winter, so winter injury is less likely. However, damage to apple trees depends on many factors, and will vary between species and cultivars. For example, some apple cultivars might be damaged below -28°C, while others can tolerate -35°C. Winter injury can reduce yields, kill the tree immediately, or cause a shorter tree life expectancy by making the tree more susceptible to pests (ie. cankers and borers)

The cankers associated with winter injury are weak pathogens or opportunistic fungi. They rarely attack healthy trees, only trees that have been weakened by winter injury and by pruning cuts. It may take a few years for the cankers to appear after the infections take place. Here are some cankers that are associated with winter injury:

European apple canker (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 fruiting bodies can be seen produced on cankers in the winter. Infected limbs or young trees will become completely girdled over time and die.



Figure 1: Orange sporulation on branch

Black rot cankers (Figure 2): Limb cankers first appear as reddish or pinkish sunken area 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 and becomes black as the bark 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 disease (Figure 3) appears after cold winters. It is an opportunistic fungus entering trees through damaged wood. 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.



Figure 2: Black rot canker on infected apple tree limb



Figure 3: Silver leaf in apple

Although fungicides reduce the spread of cankers, 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 the large cankers, it is best to remove the tree.
- Burn prunings or remove them from the orchard promptly. If this is not possible, chopping prunings hastens their breakdown and reduces the spread of the disease.
- Woodpiles must not be stacked in or near orchards since they can be major source of inoculum.
- Make an attempt to scout surrounding woodlots and identify hardwood trees 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.

Postharvest

Timing of SmartFresh Treatment on 'Honeycrisp'

Dr. Jennifer DeEll, Fresh Market Quality program Lead, OMAF and MRA

'Honeycrisp' apples are typically held at ~10°C for 7 days before subsequent cold storage at ~3°C. Therefore, the following is a common question – is it better to apply SmartFresh before or after the conditioning period?

To help address this query, 'Honeycrisp' apples were harvested on September 10, 2012 from a commercial orchard near Simcoe, Ontario. Apples were transported to the *Apple Research Storage Lab* in Simcoe, within one hour of harvest. Fruit maturity upon arrival at the lab consisted of 3.8 ppm internal ethylene concentration, 13.6 lb firmness, 13.4% soluble solids concentration, 637 mg malic acid per 100 g of juice, 7.5 starch index (Cornell chart), and 46% red blush.

Nine boxes of apples were held for 5 days at room temperature, fluctuating around 18°C during the day to 10°C overnight. This regime occurs often, when a dedicated room at 10°C is not commercially available for 'Honeycrisp' conditioning. Three boxes were treated with SmartFresh (1 ppm, 24 hr) at room temperature 1 day after harvest. After 5 days, all boxes were moved to air storage at 3°C. Three boxes were then treated with SmartFresh at 3°C, representing treatment at 5 days after harvest. Three boxes were left untreated. All apples were subsequently held for 4 and 6 months in ambient air at 3°C.

There were few differences in 'Honeycrisp' treated with SmartFresh on 1 or 5 days after harvest. Lenticel breakdown was significantly less in apples treated with SmartFresh at 1 day after harvest (2%), compared to those treated at 5 days (8%) or not treated (10%), after 4 months in air storage at 3°C. This trend was also apparent after 6 months of storage, although not statistically significant.

Greasiness was reduced consistently with SmartFresh treatment at 1 day after harvest, compared to non-treated fruit. After 6 months of storage, apples treated at 1 day after harvest were also firmer (+ 0.8-0.9 lb) than those not treated. There were no significant differences in greasiness or firmness in apples treated with SmartFresh at 5 days after harvest or not treated.

When bitter pit was present it was exacerbated in severity by SmartFresh treatment at 1 day after harvest (Plate 1). However, there was no significant difference in bitter pit (incidence or severity) in non-SmartFresh 'Honeycrisp' and those treated at 5 days after harvest. Bitter pit incidence ranged from 9 to 13% and 33 to 37% after 4 or 6 months of storage, respectively.

Regardless of treatment time (1 or 5 days after harvest), 'Honeycrisp' treated with SmartFresh had lower internal

ethylene concentration and higher malic acid than fruit not treated. There were no significant effects of SmartFresh on soluble solids concentration, soft scald incidence or storage rots.



Plate 1: Exacerbated bitter pit in 'Honeycrisp' treated with SmartFresh.

Acknowledgements – financial support for this work was provided by Ontario Apple Growers, Apple Marketers' Association of Ontario, Canadian Horticultural Council Apple Working Group, AgroFresh Inc., and Agriculture and Agri-Food Canada.

CA Storage and SmartFresh Treatment of 'Honeycrisp'

Dr. Jennifer DeEll, Fresh Market Quality program Lead, OMAF and MRA

Controlled atmosphere (CA) storage is not currently recommended for 'Honeycrisp' in Ontario, because there tends to be increased risk in CO₂ injury and CA-stress related disorders.

To further evaluate the potential of CA storage for 'Honeycrisp', the following scenario was investigated. Apples were harvested on September 10, 2012 from a commercial orchard near Simcoe, Ontario. Apples were transported to the *Apple Research Storage Lab* in Simcoe, within one hour of harvest. Fruit maturity upon arrival at the lab consisted of 3.8 ppm internal ethylene concentration, 13.6 lb firmness, 13.4% soluble solids concentration, 637 mg malic acid per 100 g of juice, 7.5 starch index (Cornell chart), and 46% red blush.

Following harvest, 12 boxes of 'Honeycrisp' apples were held for 5 days at room temperature, fluctuating around 18°C during the day to 10°C overnight. Six boxes were treated with SmartFresh (1 ppm, 24 hr) at room temperature 1 day after harvest. After the conditioning period of 5 days at room temperature, three boxes treated with SmartFresh and three boxes not treated were moved into air storage and into CA (3.0% O₂ + 1.5% CO₂) at 3°C for 6 months.

'Honeycrisp' stored in CA had lower internal ethylene concentrations, less greasiness, and fewer cracked fruit than those held in air storage. Furthermore, SmartFresh-treated fruit stored in CA were essentially free of greasiness and had the highest malic acid content. There were no significant effects of CA and/or SmartFresh on fruit firmness or soluble solids concentration.

Some internal CO₂ injury (5-9%, Plate 1) was found in CA-stored 'Honeycrisp' and SmartFresh had no effect on its incidence. There was low incidence of soft scald (1-5%, Plate 2), with no consistent effects of CA or SmartFresh on this disorder. There were also no consistent effects of CA and/or SmartFresh on bitter pit incidence (4-11%). High incidence of storage rots (13-31%) were found in all treatments.



Plate 1: Internal CO₂ injury in CA-stored 'Honeycrisp'.



Plate 2: Soft scald in 'Honeycrisp'.

In summary, CA storage can substantially reduce greasiness in 'Honeycrisp' apples, but there is also added risk of internal CO₂ injury development.

Acknowledgements – financial support for this work was provided by Ontario Apple Growers, Apple Marketers' Association of Ontario, Canadian Horticultural Council Apple Working Group, AgroFresh Inc., and Agriculture and Agri-Food Canada.

Announcements

Save the Dates: Summer Orchard Tours 2014

Last year's tours were so popular we've decided to do it again. We are again planning two tours, and looking through different orchards to see what more can be learned about this complicated system of intensive orcharding.

Essex-Kent Orchard Tour, Wednesday June 18, 2014 - Hosted by growers in Cedar Springs and Leamington area

Ontario Apple Growers Tour, Tuesday, July 29, 2014 - Hosted by the Georgian Bay Fruit Growers and the Ontario Apple Growers.

Mark your calendars – details will follow about tour stops and featured presentations. I always learn something when I visit orchards and listen to what the orchard managers have learned from their experiences.

Apple IPM Scout Training, May 6, Simcoe

The OMAFRA Apple team is getting ready for this annual workshop focusing on what you need to know to scout for apple pests. This year's workshop is a day-long program at the Simcoe OMAF office. The workshop starts at 9 am, and is packed full of information and reference materials on apple pests.

Most of the participants are hired as orchard scouts, but we do welcome growers, and especially growers and family members who are interested in doing their own scouting. The workshop is free, but you need to preregister by calling our Contact Centre at 1-877-424-1300. As preparation, take some time to review Ontario AppleIPM online at www.ontario.ca/cropipm.

A certificate is provided to all those who complete this training, and it is a good credential for your food safety audits and for due diligence. 2014 may be the year to update your education in Integrated Pest Management.

New health and safety training requirements for farm workers

Ministry of Labour

A new regulation will require health and safety awareness training for every worker and supervisor under Ontario's Occupational Health and Safety Act(OHSA) (www.labour.gov.on.ca/english/hs/pdf/farming_ohsa.pdf) . The regulation comes into force July 1, 2014. This includes all farms with paid employees.

One way to complete the new health and safety awareness training will be for workers and supervisors to take part in a one-hour tutorial either individually or in groups using free, online e-learning tools or hard copy workbooks. The training is designed to help prevent workplace incidents and injuries by making workers and supervisors aware of their roles, rights and responsibilities in the workplace.

Workplaces that have provided similar training to employees will not need to participate, as long as the previous training met the minimum requirements of the new regulation.

New and young workers are three times more likely to be injured in the first month of their employment than more experienced workers.

Training materials are available at:

www.labour.gov.on.ca/english/hs/training/index.php

- Once the e-learning training module is complete, an employee will receive a certificate that is valid for the remainder of his or her career.
- The printed training materials are available in nine languages.
- You do not have to report the training to the Ministry, but you must maintain a record of completion for all of your workers and supervisors and be able to present it should a ministry inspector visit your farm or workplace. A record of completion can be as simple as your employee signing and dating their workbook.



Agricultural Information Contact Centre: 1-877-424-1300

E-mail: ag.info.omafra@ontario.ca

Northern Ontario Regional Office: 1-800-461-6132

www.ontario.ca/omafra

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