



ORCHARD NETWORK

For Commercial Apple Producers

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In this issue...

Orchard Management

- Weather Risks: Strategies to Mitigate the Risk of Frost
- Pruning is a Priority in 2013
- High Density: Apple Orchard Workshop

Crop Protection

- Apple Tracker: Take Another Look
- Powdery Mildew Resistance Testing
- Early Season Oil Sprays for Scale and Mites
- Blossom Protect: A New Biopesticide for Fire Blight Control
- New Products Registered for the 2013 Apple Season
- Efficacy Ratings for Pesticides

Postharvest

- Repeated SmartFresh Treatments for Apples
- Controlled Atmosphere Storage for 'Honeycrisp' Apples?

Announcements

- Apple Information at Your Fingertips
- Ontario Fruit and Vegetable Convention
 - Apple Program
 - Apple Cider Workshop
 - Sweet Cider Competition
- Airblast 101 Workshops 2013

Food Safety

- Maintaining Proper Water Quality
- Proper Sewage Disposal

Orchard Management

Weather Risks: Strategies to Mitigate the Risk of Frost

Leslie Huffman, Apple Specialist, OMAFRA, Harrow
Kathryn Carter, Tender Fruit and Grape Specialist, OMAFRA, Vineland

Apple and tender fruit growers in Ontario face many weather risks that can damage their trees and crops. It is important for growers to recognize the weather risks for their own location, and develop a strategy to reduce or eliminate the impact on their business operation. Frost is one of the main weather risks for tree fruit growers.

What it is: Frost damage occurs to the **reproductive parts of flowers**, when temperatures drop to or below 0°C. When the female parts (style or ovaries) are frozen, (appearing water-soaked and then dark), pollination and seed set cannot occur. If the male parts (stamen and pollen) are frozen, pollination and seed set might still occur if

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

Leslie Huffman, Harrow
ONNL Editor
Apple Production
(519) 738-1256
leslie.huffman@ontario.ca

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

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

Paul Bailey, Guelph
Risk Identification and Management
paul.bailey1@ontario.ca
(519) 526-4380

Kristy Grigg-McGuffin, Simcoe
Pome Fruit IPM
(519) 426-4322
kristy.grigg-mcguffin@ontario.ca

Margaret Appleby, Brighton
IPM Systems
(613) 475-5850
margaret.appleby@ontario.ca

Hannah Fraser, Vineland
Entomology, Horticultural Crops
(905) 562-1674
hannah.fraser@ontario.ca

Michael Celetti, Guelph
Plant Pathologist, Horticultural Crops
(519) 824-4120 ext. 58910
michael.celetti@ontario.ca

Christoph Kessel, Guelph
Horticulture Crop Nutrition
(519) 824-4120 ext. 52480
christoph.kessel@ontario.ca

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

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

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

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Service Representative, Carolyn
Prieur, OMAFRA, Vineland Station

pollen from other flowers survives the cold event. Frost damage can also occur to the **skin of the fruit** when the outer tissues of the flower are frozen. This often appears as russetting, and if severe, may cause the disfiguration of the fruit. Early **spur leaves** can also be damaged by frost, which may affect early season crop nutrition, reaction to plant growth regulators like chemical thinners, and foliar nutrition and pesticide sprays.

When it occurs: Frost damage occurs mainly in two scenarios:

- when fruit bud development is pushed ahead of normal schedule by mild winter and/or early spring warming trends, OR
- when below freezing temperatures occur in late spring after blossoms have opened in a normal sequence. Some crops may be more vulnerable to frost before the blossoms are fully open (e.g. cherries).

Frost damage should not be confused with winter injury, which happens from extreme cold or fluctuating winter temperatures during the dormant season.

Where it occurs: Frost injury can occur in any orchard that is at or near bloom. However, it tends to be worse on locations with level topography, or in low-lying areas of orchards. Buildings, windbreaks, woodlots and farm equipment (e.g. bins) can also block airflow and create frost pockets. Frost damage tends to be worse in orchards that are distant from moderating bodies of water (e.g. the Great Lakes).

What can you do: There are several strategies that may help avoid frost damage, or lessen the injury. None of these have proven 100% effective, and some have failed to protect from frost in some situations. Each should be assessed for its suitability to your individual site and business. In some cases, it would be wise to implement several strategies to protect your crop from more of the risk.

Mitigation strategies to consider:

- **Production insurance (PI):** Production insurance can be purchased well before bloom, and can give you peace of mind that at least some of your input costs will be covered. Your premiums will depend on the coverage you choose, your claim history, and the yield potentials of your orchards. Over time, your premiums can be reduced if you are lucky enough not to have claims. However, some growers struggle with the premium costs (especially in their start-up years or if they have claims) and the fact that PI is not intended to fully cover your loss, either in yield or price. There is also the problem of reduced coverage levels in the years after your crop is reduced, due to the effect of the loss on your long-term average yields. Also, spot loss insurance for frost is not available, so growers with multiple orchard sites may be penalized when good yields occur on the non-frosted sites.
- **Selecting sites less susceptible to frost:** Avoiding low-lying areas, analyzing the effect of buildings and windbreaks, and seeking sites with good air drainage or located near large bodies of water can help avoid frost. These are not available to all growers, but should be considered when choosing your orchard site.

- **Thinning hedgerows or clearing forested areas:** This may reduce the area of a frost pocket, or promote better air drainage. However, the benefit from wind protection through the season may be lost, making spraying more challenging and allowing soil movement and sand blasting. Generally thinning/clearing needs to be done in advance of the season. Remember that bin piles may affect air movement.
- **Selecting cultivars that bloom later:** Generally early blooming cultivars are more susceptible to frost damage, simply because most frost events happening earlier in the season. In 2012, we noticed that Honeycrisp, Golden Delicious and Ambrosia tended to bloom later, and produce some crop even on frosted sites. This is not always feasible due to your climatic location, market demand, or length of growing season, but needs to be considered.
- **Frost fans:** Tower fans raise temperature of the blossoms by drawing down warm air from an inversion, and mixing it with cold air at ground level. Generally, the temperature at ground level can be raised by about 50% of the difference when warm air is trapped high above the orchard. Frost fans are installed in advance of the expected frost, and only protect about 10 acres. They are expensive to install and require a fuel source (propane, diesel, natural gas, gasoline) that must be replenish frequently (possibly daily) when in use. They only prevent frost if and when an inversion is present and there is enough temperature difference to raise temperatures above freezing. They cannot be operated in a wind (even a breeze). Neighbours do not like the oscillating noise, especially on clear, cold mornings, and the motors may be difficult to start in the cold. There are smaller, tractor-PTO mounted versions for much smaller areas, but these require continuous driving while temperatures remain below freezing.
- **Cold air drains:** These machines try to avoid frost by blowing cold air upwards, to keep air moving around blooms and prevent crystal formation. They require a barrier to direct cold air towards them (which may in itself create a frost pocket). Generally, at most they can only provide a few degrees of protection on about 10 acres. The current models are tractor PTO- or engine-driven, and can be moved between orchards. They are less expensive

than tower fans. Again, they work best when an inversion is present.

- **Frost protection with sprinklers:** Applying low rates of water will cause ice formation around the blooms, because water releases small amounts of heat as it freezes, enough to protect the blooms. This technique has proven effectiveness in strawberries for many years. There is a cost for a solid-set irrigation system, including low-flow frost sprinklers. A large source of water is needed, because once started, the irrigation must continue until the sun comes up and melts the ice. If you run out of water, everything will freeze. The weight of the ice build-up on trees may break some branches. The structure in trellised orchards may be a good candidate to install this system, especially if it can be used for irrigation or other uses.
- **Burning hay or smudge pots:** This technique covers the orchard in smoke, which may prevent frost formation at ground level. It is less expensive than frost fans, but requires a source of hay or fuel, and can be implemented the day of anticipated frost. At most, it may offer a few degrees of protection. Local burning regulations must be followed, and the smoke may irritate neighbours, workers and cause environmental issues and traffic concerns. This requires labour to ensure the fires burn as intended and do not escape.
- **Orchard heaters:** These could be placed through the orchard, but generally only a small amount of heat can be produced, and it would only protect a small area. In some situations, a heater may actually draw cold air down as air currents are affected.
- **Products with frost protection claims:** Scientists have tested numerous products over the years to protect against frost, including foliar zinc sprays, Pristine fungicide, and Promalin plant growth regulator. If ice-nucleating bacteria is present in the blossom (which makes ice form at higher temperatures), and if some products replace this bacteria, there may be some frost protection. But this is not always the case. Promalin may promote the formation of parthenocarpic fruit (without seeds), but a full crop is not likely to be set, and fruit would have limited shelf life with no seeds. The cost-potential benefit of these products needs to be closely analyzed.

Summary:

Frost injury is not uncommon, and each year there are orchards in Ontario that have reduced yields due to frost. In some years only blossoms on lower branches are affected, while in other years, as in 2012, a large portion of the crop is lost. There are a variety of options available to mitigate frost injury in orchards. The effectiveness of each mitigation strategy varies depending on weather conditions, site conditions and economics. Often the use of multiple strategies (ie. site selection and frost fans) provides the best protection. Choose the strategies that work best for your situation.

Pruning is a Priority in 2013

Dr. Jason S.T. Deveau, Application Technology Specialist, OMAFRA, Simcoe

Were you able to prune and train your trees last year? I hope so, because the density of a tree canopy can greatly affect spray coverage. Terence Robinson (Cornell University) points out that the benefits of proper pruning include improved light penetration into the canopy, containment of tree size, renewal of bearing surface and **improved spray penetration into the canopy**.

Even a sprayer that's perfectly calibrated can fail to achieve acceptable coverage when faced with tight alleys and overgrown canopies. In Figure 1, the sprayer is more-or-less buried in the lower canopy. Branches are brushing against the tractor and the sprayer. Nozzles need a minimal distance of about half a meter (preferably more) for the spray to become fine droplets. If the branches block the



Figure 1- A very tight alley.

spray before it becomes droplets, the canopy may have areas with no coverage.

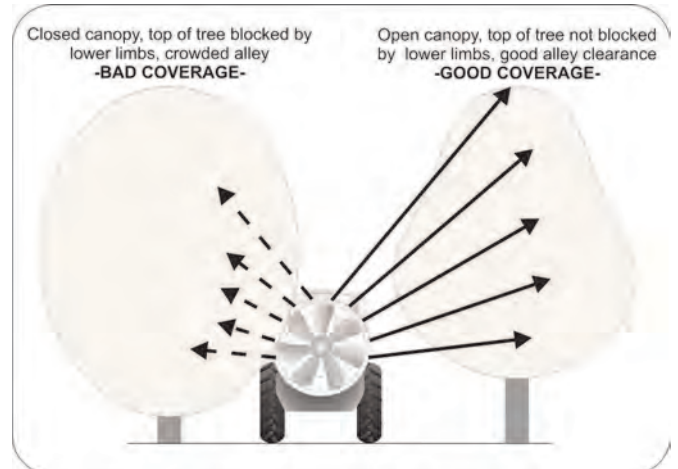


Figure 2- Dense canopies and tight alleys make it very difficult to achieve even spray coverage.

If the sprayer is forced to spray upwards through a dense canopy, such as in Figure 2, no spray will reach the top of the tree. This situation cannot be overcome by slowing tractor speed, increasing spray volume, switching to venturi-style nozzles or increasing air speed. I have tried it all.



Figure 3- The larger tree is easier to spray. It's not the size of the box so much as what's in the box.

Figure 3 shows two trees - one tree is a massive 18 feet in width while the other is a smaller 10 feet. Which do you think is easier to spray? It is the wider tree, because while the canopy is taller and wider, there is very little density to prevent spray from penetrating.

Stand in your alley and imagine your eyes are the sprayer nozzles. Can you easily see the trunk of your tree? Can you see past the branches to the top of your tree? If you can't "see" the target, then your nozzles can't spray it. Another good trick is to look at the shadow of your tree. Figure 4 looks like a large tree, but when you see its shadow created in Figure 5, you can see how open the canopy really is.



Figure 4 – This large tree seems like a difficult spray target.



Figure 5 – The shadow cast by the tree shows how open the canopy truly is.

So pruning is a must for many reasons. Spray coverage should be counted among them. A tight, overgrown canopy that obscures the top of the tree and brushes against the tractor will make effective spray coverage difficult or even impossible. Towers might help a bit, but pruning will help far more.

Describing how to train and prune your apple orchard is far too much to include here. Leslie Huffman, OMAFRA's Apple Specialist and Terrence Robinson of Cornell University have already provided great information for you to consult.

To learn more, follow this link and read about training orchards:

<http://www.omafra.gov.on.ca/neworchard/english/apples/index.html>

and then follow this link

www.youtube.com/watch?v=ZqZPQV9I9jA to learn four rules for pruning Tall Spindle trees.

High Density Apple Orchard Workshop: Adoption of New Horticultural Techniques and Cultivars Simcoe, December 2012

This workshop, organized by John Cline, University of Guelph, Simcoe, focussed on all the new technology involved with planting successful high density apple orchards. Most of the presentations can be accessed on the University of Guelph pomology website:

<http://www.plant.uoguelph.ca/treefruit/workshop/>

The presentations are available as individual pdf's, and video links of most of presentations will be posted shortly. Topics included Tall Spindle and Super spindle performance, new planting economics (including downloadable spreadsheets), crop load management, rootstocks, cultivars, mechanization, plant growth regulators, harvest analysis and grower experiences with high density. In short, everything needed to decide about planting high density orchards.

Thanks to the workshop sponsors, Agricultural Management Institute, University of Guelph, and OMAFRA; and to the University of Guelph staff who assisted with this event: Judy Kelly, Rob Grohs, and Mike Peppard.

Crop Protection

Apple Tracker: Take Another Look – You will Like It!

*Margaret Appleby, IPM Systems Specialist,
OMAFRA, Brighton*

Take another look at Apple Tracker to see how it can help you keep better records! Apple Tracker is a record keeping, and orchard management system that helps growers keep accurate records for food & worker safety, pest management and production. By entering spray, fertilizer, harvest and other event data into the system, growers can track chemical usage, pre-harvest intervals, re-entry intervals, and generate reports on their orchards by the block.

This on-line tool has its roots in the Fruit Tracker project developed by East Central Ontario Fruit & Vegetable Growers' Association in the early 2000's. Apple Tracker has evolved from the desktop version (called Fruit Tracker) to an on-line program that

tracks all orchard management events year round, in one place, ready at your fingertips when you need them. That's being organized!

All members of the Ontario Apple Growers (OAG) have their own personal, private site for Apple Tracker accessed with login and passcode. Call Kelly Ciceran at 905-688-0990 ext. 241 to obtain your login information. Your orchard maps are already in place from the GPS ADaMS mapping done by Agricorp, and updated daily. If your orchards are not mapped, give Larissa Osborne ext. 235 at the Ontario Apple Growers a call to see about having this mapping done.

When logging on to your site, a "dashboard" will display a series of tabs - Growing, Harvest, Packing, Storage, Shipping, GAP/Audits and Reports. The "All Events" tab gives a quick look of all the events that you have recorded from spray application, employee training, harvest, storage to building assessments. This information is used complete the CanadaGap required reports.

Haven't looked at Apple Tracker yet? Gather up your records from 2012, go on-line and try it out. Like any other program, it takes a little time to get used to it but once you do, it is simple to use. If you need to make corrections there are lots of opportunities to edit your inputs.

For pesticide applications (under Growing), there are lots of cool features. Each chemical listed is linked to the label. You can add new chemicals to the list. A drop-down list will show existing treatments from Publication 360, showing the name, formulation, rates and target pest. You add - When, Why, Where and What of your spray event - and Apple Tracker will record it and ask you to confirm. If you want, Apple Tracker can send you alerts by email when re-entry intervals have passed or when it is safe to harvest. A new feature is the chemical inventory - you input your current inventory, record purchases and the program keeps track of what is in your spray shed. In fact, right now, you can start by inputting your inventory as of today.

More features are being developed. For this season, you will be able to produce cost of production reports by block, production practices modules and use a new app for iPhone/Android to input your events including harvest, shipping and sprays. We are excited to see the iPad scouting app being developed too!

Visit Booth #710 at the Ontario Fruit and Vegetable Convention (February 20 & 21) for a demonstration of the web site by the developer. Also, webinars will be available from the OAG in March to walk you through the program. Start today to see what Apple Tracker can do for you!

APPLE TRACKER
AGRI-BUSINESS SYSTEMS

Dragonfly Test Orchard
123 Street

Dashboard :: Dragonfly Test Orchard

Dashboard You are here

All Events Growing Harvest Packing Storage Shipping GAP/Audit Reports

New Spray New Harvest New Storage New Shipment Switch Accounts

Recent Events

Date	Organisation	Event Type	Event Summary	Actions
21-Jan-2013	Dragonfly Test Orchard	Harvest	- East Hill / Gala 11-1050 / Gala 11-1150 / Gala 11-1160 / Gala 11-1220 / Gala 11-1230 / Gala 11-1240 / Gala	View
16-Jan-2013	Dragonfly Test Orchard	Spray	11-1190 / Empire 11-1190 / McIntosh	View
11-Jan-2013	Dragonfly Test Orchard	Storage		View
10-Jan-2013	Dragonfly Test Orchard	Harvest	11-1190 / Empire 11-1190 / McIntosh	View
09-Jan-2013	Dragonfly Test Orchard	Spray	11-1190 / Empire 11-1190 / McIntosh	View
05-Jan-2013	Dragonfly Test Orchard	Building Pest Control		View

Powdery Mildew Resistance Testing

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA, Simcoe

Margaret Appleby, IPM Systems Specialist, OMAFRA, Brighton

Leslie Huffman, Apple Specialist, OMAFRA, Harrow

Collections last spring launched the start of a 2-year National Powdery Mildew Fungicide Resistance Testing, which is part of a project administered by the Ontario Apple Growers (OAG). Funding for this project is provided by Agriculture and Agri-Food Canada through the Canadian Agricultural Adaptation Program (CAAP) and the Pest Management Centre, Risk Reduction Program. All apple-producing provinces (Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia) participated, with 16 Ontario sites randomly selected by the OAG from the five growing districts. In total, 45 sites across Canada were tested for powdery mildew fungicide resistance, including 17 in British Columbia, 6 in Quebec and 6 in Nova Scotia.

Similar to the apple scab resistance survey, cooperating growers agreed to leave 6-8 trees unsprayed for disease until “white tips” of powdery mildew infected shoots appeared (Figure 1). Samples were collected and sent to the Okanagan Tree Fruit Cooperative (OTFC), north of Kelowna, BC for resistance testing to both sterol inhibitor (SI) (Group 3) and strobilurin (Group 11) fungicides.



Figure 1. Powdery mildew symptoms on the leaves appear as white, felt-like patches of fungal growth with a pinkish-red discoloration or hue on the leaf margins.

DNA screening using a standard method was successful for all 2012 orchards tested. The method detected the presence of the G143A mutation, which

indicates a high level of resistance to strobilurins (Flint, Sovran and Pristine). With guidance from Dr. Danielle Hirkala from the OTFC, results were interpreted using baseline mutant genotype thresholds set to determine the sensitivity levels of powdery mildew to strobilurins:

- If the mutant genotype (MG) is **below the baseline susceptible average MG of 10%**, then the population sample is considered susceptible to the fungicide.
- If the MG is **between the baseline susceptible average MG of 10% and the resistance threshold average MG of 50%**, then the population has shifted toward resistance.
- If the MG is **above the resistance threshold average MG of 50%**, then the population is considered resistant to the fungicide.

An alternative resistance test using spore germination bioassays had difficulty with contamination and low spore viability. OMAFRA specialists are working with the OTFC to develop a better sampling protocol. In 2013, we will be adjusting our collection method to improve spore viability in order to re-test the 2012 orchards as well as the 2013 samples. At that time, plated media treated with a SI (Nova, Nustar or Inspire), a strobilurin (Flint, Sovran or Pristine) or an untreated control will be inoculated with powdery mildew isolates from each orchard and the amount of sporulation will be determined.

Based on the project results (Figure 2):

- **Caution should be used with strobilurin (Flint, Sovran, and Pristine) fungicides;** preliminary results indicate powdery mildew populations may be shifting or resistant in some orchards.
- Presence of the G143A mutation indicates a high level of resistance to strobilurins; 6 out of 16 orchards tested in Ontario had levels of this mutation greater than 10%.
- Powdery mildew management should:
 - * start early season when buds are opening,
 - * use fungicides as protectants only,
 - * include broad-spectrum mildewcides (e.g., sulphur),
 - * continue from green tip to terminal bud set,
 - * always include a targeted program for susceptible varieties (e.g., Gala, Honeycrisp, Cortland, Idared, Paulared, Crimson Crisp, Goldrush, Fuji, Russet)

Remember that resistance is dependent on how the fungicide was used. Though some orchards in your area may show resistance to a product, don't

assume it's in yours! Each orchard needs to be individually tested for resistance and each product needs to be evaluated. Also, although an orchard may be resistant in laboratory tests, it does not mean control failure is occurring in the field. It will eventually fail, however, if use of the product is continued. Testing for powdery mildew fungicide resistance can be challenging, expensive and, at times, inconclusive. However, it can be a very useful tool to make appropriate control strategy decisions.

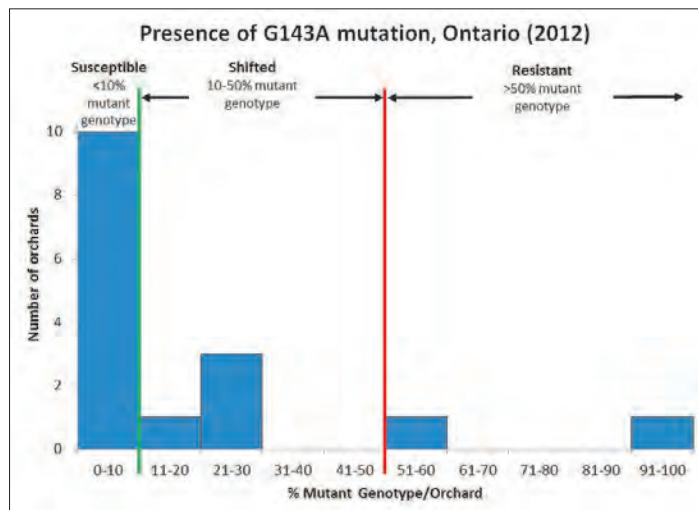


Figure 2. Presence of the G143A mutation associated with strobilurin (Flint, Sovran, Pristine) resistance in 16 Ontario powdery mildew populations, 2012

This work was in partnership with Ontario Apple Growers, Apple Growers of New Brunswick, Nova Scotia Fruit Growers' Association, Fédération des producteurs de pommes du Québec, British Columbia Fruit Growers' Association and the Apple Working Group of the Canadian Horticulture Council. We gratefully acknowledge Danielle Hirkala at the Okanagan Tree Fruit Cooperative. Funding has been provided by Dow AgroSciences Canada, Syngenta Crop Protection E.I. DuPont Canada, BASF Canada Inc and Bayer CropScience Inc. Technical assistance by Ken Wilson, Lindsay Pink, Brian Sutton, Frankie Cooper, Michelle Linington, Rebecca Vandertoorn, Carly Decker and Tyler Jenner.

Early Season Oil Sprays for Scale and Mites

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA, Simcoe

Though many would like to put 2012 behind them, it's hard not to wonder whether we're in for another early spring again this season. Now is the time to begin thinking about whether you will apply a dormant or delayed dormant oil spray to target apple

pests, such as scale, mites and several species of aphids that overwinter on the bark, under bud scales, or in other protected places on the tree. After all, spring will be here before you know it!

Oil sprays are excellent tools for managing scale and European red mites, but timing is important to achieve good control. Understanding how oil sprays work, as well as the biology of the pests will help to optimize control applications and avoid tissue damage.

Oil sprays can work by suffocation, interfering with egg development, and/or prevent settling of scale crawlers. If applied properly, the use of dormant or delayed dormant oil can sufficiently reduce the amount of miticides or insecticides that may be used for scale or mites later in the season. Early season oil sprays also fit well into IPM programs because the product is applied before predatory mites and other beneficial insects are present.

There are several species of scale insects affecting apples; San Jose scale is the most common in Ontario orchards. This insect overwinters as an immature scale under bark and emerges just prior to bud break (Figure 1). As the immature scales feed, they exude a waxy substance that forms a protective layer. Dormant oil sprays are the **best** timing for this pest before they develop a protective waxy layer. Post-bloom sprays of Movento or the use of summer oil have shown to have effective, long-lasting control over scale in some Ontario orchards, but are often difficult to time and may not be as reliable as a dormant spray. As growers experienced this year, while it may be hard to find time and good weather early season, an oil application is well worth it.



Figure 1. Overwintering San Jose scale on apple twig.

Once scale has become established, it can be very difficult to eradicate.

European red mites overwinter as eggs (Figure 2) on roughened bark around the bases of buds and

spurs, or in the inner parts of the tree close to the main trunk and branches. Oil sprays should be applied before egg hatch, between half-inch green and tight cluster. **Some growers in Ontario, who have used dormant oil with good water volumes and good coverage, have achieved excellent mite control with few summer escapes and no need for summer miticides.**



Figure 2. Overwintering European red mite eggs on spur.

Unfortunately, optimal timing for scale is not necessarily the same for mites. If monitoring indicates scale is a bigger issue in the orchard, oils need to be applied before bud break. **This efficacy against scale is significantly reduced with later oil applications for European red mite—if you have scale, dormant oils should be applied.** However, if European red mite populations are the problem, sprays can be delayed to half-inch green to tight cluster. Delayed dormant oils may also kill overwintering aphid eggs, if the timing coincides with hatching.

Petroleum-based horticultural oils are not created equal in terms of their level of refinement, and this has implications for their use in IPM programs. In Canada, newly registered Purespray Green Spray Oil 13E has been refined to remove sulphur impurities that may cause phytotoxic effects with some of the older “heavy” horticultural oils, and can be used safely in both dormancy or during the summer. However, even highly refined “summer” oils can cause crop injury when:

- they are applied with or too close to products containing sulphur (e.g. Captan/Maestro)
 - * do not apply oil within 14 days before or after these products
- they are applied above label rate
 - * 2% solution (20L/1,000L) for dormant sprays
 - * 1% solution (10L/1,000L) for summer sprays
 - * High water volumes are essential for good

coverage

- plants are under moisture stress
- temperatures are very high (above 25°C)
- within 48 hours of freezing weather

Horticultural oils may cause bark damage on Red Delicious, Empire and Mutsu/Crispin. Check product labels for additional instructions and precautions.

Blossom Protect: A New Biopesticide for Fire Blight Control

Michael Celetti, Plant Pathologist Horticulture Crop Program Lead, OMAFRA, Guelph

A new biopesticide, Blossom Protect was recently registered for apple and pear growers for fire blight control. Other biopesticides are registered for fire blight **suppression**, but Blossom Protect is registered for **control**. There is little experience with this product in Canada, but it may have some merit.

Blossom Protect contains two live strains of the yeasts *Aureobasidium pullulans* in one container and a citric acid buffer in another container which are mixed together prior to application. The yeast strains colonize the same areas of the blossoms and utilize the same nutrients as the fire blight bacteria.

Blossom Protect can be applied up to 5 times per season. Cougar Blight and MaryBlyt should be used to target the sprays 1-2 days before infections. Otherwise, apply at 10%, 40%, 70% and 90% open blossoms. Remember the yeast need to colonize open blossoms before fire blight bacteria are introduced. Studies have shown that applying Blossom Protect early can result in good fire blight control, but later applications may only result in suppression.

Be aware of a few precautions when using Blossom Protect:

- Blossom Protect may increase fruit russetting on sensitive varieties.
- Do not tank mix or apply Supra Captan, Maestro, Equal, Syllit, or strobilurins (Sovran, Flint, Pristine) the same day or within 2 days of Blossom Protect, as they are toxic to these yeasts.
- Scala and Vangard are not toxic, but are not recommended as a tank mix.
- Use Blossom Protect in rotation with streptomycin to reduce the risk of resistance.

(con't)

Blossom Protect can be stored for up to 10 months at room temperature (20°C) and up to 24 months in cool storage (8°C). This allows flexibility to keep unused product around for next year, which is not possible with other biopesticides.

New Products Registered for the 2013 Apple Season

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA, Simcoe

The new 2013 Publication 360 Supplement will be available shortly online or from your local OMAFRA Resource Centre. In the meantime, here are the new products for apples that will be included in this publication:

- **Altacor** (chlorantraniliprole) is a Group 28, anthranilic diamide that is already registered for numerous apple pests. The PMRA recently approved the label expansion to include **control of European apple sawfly** at 215 g/ha, **spring feeding caterpillars** (green fruitworm, eye spotted bud moth, variegated leafroller) at 145-285 g/ha, and **dogwood borer** as a trunk drench at 285 g/ha, as well as for **suppression of apple maggot, white apple leafhopper, and Japanese beetle** at 285 g/ha. Re-apply, if necessary, every 10-14 days. **Pre-harvest interval (PHI):** 5 days, **Re-entry period (REI):** 12 hours, **Maximum # applications:** 3.
- **Blossom Protect** (*Aureobasidium pullulans*) is a biological product registered for **fire blight control**. Rate is dependent on tree height. For every 1 m of tree height, dilute 5.25 kg Component A in 500 L/ha of water and add dilution to 0.75 kg Component B. If a forecast system (e.g. Maryblyt, Cougar Blight) is available, apply 1-2 days before an infection date. Repeat after 2 days and up to 5 times if infection continues. If no forecast system is available, apply at 10, 40, 70 and 90% open blossoms. This product is sensitive to fungicides and may have reduced efficacy if tank mixed. Enhanced russetting of fruit from sensitive varieties is possible. This is a biopesticide and may not provide the same level of control as conventional products. There is limited to no experience with this product in Ontario. **PHI:** n/a, **REI:** when dry, **Maximum # applications:** 5.
- **Fontelis** (penthiopyrad) is a Group 7 fungicide registered for the **control of apple scab, powdery mildew and cedar apple rust** at 1.0-1.5 L/ha. Begin applications at green tip and continue as needed on a 7-10 day interval for scab and 7-14 day interval for powdery mildew or rust. Use the higher rate and shorter interval when disease pressure is high. Avoid repeated use of this product or other products from Group 7. **PHI:** 28 days, **REI:** 12 hours, **Maximum # applications:** 4.
- **Isomate DWB** (pheromone) is registered to **disrupt mating of dogwood borer**. Apply 250-375 dispensers/ha before adult borer emergence (end of May). Use high rate for high population areas or initial year of treatment. **PHI:** n/a, **REI:** n/a, **Maximum # application:** 1.
- **Lannate Toss-N-Go** (methomyl) is a Group 1A, carbamate insecticide registered for the **control of brown marmorated stink bug** at 2.1 kg/ha. When used with regular scouting, apply when insects first appear. This product is very toxic to workers and non-target organisms. **PHI:** 8 days, **REI:** 5 days, **Maximum # applications:** 1.
- **Luna Tranquility** (fluopyram + pyrimethanil) is a Group 7+9 fungicide registered for **control of apple scab** at 800 mL/ha and **powdery mildew** at 600 mL/ha. Begin application at green tip and continue as needed on a 7-14 day interval. Though this product may provide up to 72 hours of post-infection control of apple scab, Luna Tranquility should only be used as a preventative treatment for resistance management. This product is weak on fruit scab and should be tank-mixed with a protectant fungicide for powdery mildew control after pink. Avoid repeated use of this product or other products from Groups 7 or 9. **PHI:** 14 days, **REI:** 12 hours (24 hours for hand thinning), **Maximum # applications:** 4.
- **Rimon 10 EC** (novaluron) is a Group 15, insect growth regulator registered for the **control of apple clearwing moth and dogwood borer** at 1.4 L/1,000 L water. Begin applications when economic thresholds are reached. Make 1-2 applications at a 14 day interval, targeting 25-75% egg laying. Applications should target the tree trunk. **PHI:** 14 days, **REI:** 12 hours, **Maximum # applications:** 2.
- **Syllit 400 FL** (dodine) is a Group U12 fungicide (same active as old products, Equal and Cyprax formerly of Group M) registered for **apple scab control** at 1.75 L/ha, plus 2.8 kg/ha Supra Captan 80 WDG or Maestro 80 DF, OR at 1.75

L/ha, plus 3.36 kg/ha Dithane 75 DG, Manzate Pro-stick or Penncozeb 75 DF. Begin application at green tip and repeat 7 days later. Do not use after tight cluster. Resistance to U12 fungicides is present in some Ontario orchards. Check the status of resistance to U12 fungicides in your orchard before using it. **PHI:** 7 days, **REI:** 48 hours, **Maximum # applications:** 2.

The following is a list of apple product registrations which have expired as of 2012.

1. Guthion 50 WSB, Sniper (azinphosmethyl) –also on apricots, cherries, grapes, peaches, plums, pears, raspberries
2. Thiodan 4E, Thionex 50 WP (endosulfan) –also on grape, pear; December 31, 2016 on apricot, cherry, peach, plum, strawberry
3. Zolone Flo (phosalone) –also on cherries
4. Dikar (mancozeb + dinocap) –also on pears, grapes

Efficacy Ratings for Pesticides

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA, Simcoe

There are many recent pesticide registrations in apples. However, growers should take note of some important phrases used to describe the efficacy of these products: control, suppression, and partial suppression/reduction in damage. What exactly does this mean?

All insecticides/miticides and fungicides are evaluated by the Pest Management Regulatory Agency (PMRA) for efficacy. The definitions for "control" and "suppression" for insecticides have a somewhat different meaning than the same terms applied to fungicides.

Traditionally, growers could expect control of labelled pests when products were used at the correct rate and optimum timing. The definitions for "control" can be found in the PMRA directive 2003-04, "Efficacy Guidelines for Plant Protection Products", and have been summarized in the table below. More recently, pesticides which do not provide this level of control have been registered for use, including:

- Serenade Max (*Bacillus subtilis*) –suppression of scab, powdery mildew, fire blight

- Inspire (difenoconazole) –suppression of powdery mildew
- Bloomtime Biological FD (*Pantoea agglomerans*) –suppression of fire blight
- Bio-Save 10 LP (*Pseudomonas syringae*) – suppression of storage rots
- Purespray Green Spray Oil 13E (mineral oil) – suppression of powdery mildew, European red mite
- Altacor (chlorantraniliprole) –suppression of apple maggot, white apple leafhopper, Japanese beetle
- Clutch 50 WDG (clothianidin) –suppression of oriental fruit moth, codling moth
- Allegro 500F (fluazinam) –suppression of spider mites
- GF-120 NF (spinosad bait) –suppression of apple maggot
- Surround WP (kaolin clay) –reduction in damage of oriental fruit moth, oblique banded leafroller, tarnished plant bug, Japanese beetle

For direct pests which cause damage to the fruit (eg. codling moth, apple scab), it is important to choose products which provide control rather than suppression. However, if the pest is an indirect pest, and does not affect fruit directly (eg. leafhopper, mites), products labelled for suppression may be useful. Together with natural enemies or biological control, products used for suppression might be enough to prevent significant crop damage. Products labelled for suppression may also play a role in resistance management. Under low to medium pest pressure, by alternating with products from different families, the risk of pest resistance to important products can be reduced. For example, by rotating streptomycin with biological controls, such as Serenade Max, Blossom Protect or Bloomtime, the risk of fire blight developing resistance to streptomycin may be reduced. However, when using a new product for pest suppression, try to leave an untreated check and evaluate the benefits of using these products compared to the cost of application.

The terms "control", "suppression" and "partial suppression/reduction in damage" are stated on the product label. Be sure to make note of these terms when you are choosing a product for pest management.

The following table defines the efficacy rating for insecticides, miticides and fungicides as used by the PMRA:

(con't)

Pesticide	Efficacy Rating	Defined As
Insecticide, Miticide	Control	The product, when applied in accordance with the label directions, consistently reduces pest numbers or damage to a commercially acceptable level.
	Suppression	The product, when applied in accordance with the label directions, does not consistently reduce pest numbers or damage to a commercially acceptable level. Under such situations, the level of performance offered by the product must still have value in a pest management program. Partial suppression/reduction in damage claims are most likely to be used for non-conventional pesticides. This degree of control would be more of an incidental activity against pests other than the target pest(s) on the label.
	Partial suppression/Reduction	
Fungicide	Control	The product, when applied in accordance with the label directions, consistently reduces disease incidence and severity to a commercially acceptable level and protects yield potential.
	Suppression	Consistent control at a level which is not optimal but is still of commercial benefit. Suppression is not used for products which show highly variable performance.

Postharvest

Repeated SmartFresh Treatments for Apples

Dr. Jennifer DeEll, Fresh Market Quality Program Lead, OMAFRA, Simcoe

The SmartFresh™ label in Canada was expanded in 2011 to allow up to four applications (1 ppm 1-MCP) within 240 days of harvest. As a result, many storage operations are treating rooms with SmartFresh more than once during filling. This has provoked interest in the possibility that more than one application of SmartFresh could enhance fruit quality benefits, but also potentially increase the development of disorders that are aggravated by SmartFresh.

There have been no scientific reports on the effects of rapid consecutive SmartFresh treatments on apples at harvest, simulating daily SmartFresh applications as storage rooms are loaded with fruit. Therefore, the objective of this study was to investigate the effects of rapid consecutive postharvest SmartFresh treatments (1 and 2 d after harvest) on fruit quality and storage disorders in apples. ‘McIntosh’ and ‘Spartan’ apples were studied through long-term storage in air and controlled atmosphere (CA).

‘McIntosh’ and ‘Spartan’ apples were harvested twice from commercial orchards and SmartFresh was applied either 1 day after harvest or 1 and 2 days after harvest. Similar fruit were also not treated with SmartFresh. Fruit were held in either air storage at 0.5°C for 3 or 6 months, or in CA storage for 6 or 9 months. CA for ‘McIntosh’ consisted of 2.5% O₂ + 2.5% CO₂ for 1 month, 3.5% CO₂ for the next month, and then 4.5% CO₂ thereafter, at 3°C. ‘Spartan’ apples were held in CA storage of 2.5% O₂ + 2.5% CO₂ at 0.5°C.

Results

- SmartFresh improved firmness and acidity retention, and reduced internal ethylene in both cultivars (but ‘Spartan’ in CA often maintained these attributes without SmartFresh).
- ‘McIntosh’ apples treated twice with SmartFresh were often firmer (<1 lb) than those treated just once.
- SmartFresh substantially reduced superficial scald and there was no difference in scald incidence among the treatments.
- SmartFresh increased the incidence of external CO₂ injury in ‘McIntosh’ from the first harvest.
- Core browning was generally reduced by SmartFresh, but fruit treated twice sometimes had higher incidence than fruit treated only once.
- ‘Spartan’ treated twice with SmartFresh had higher incidence of internal browning after 9 months in CA.
- Storage rots were greatest after 6 months of air storage and SmartFresh treatments usually reduced the incidence, regardless of application times.

These results suggest that using more than the traditional single application of SmartFresh may improve firmness retention, but there is also some risk associated with increased disorders, especially when storing apples long-term, such as for 6 months in air or 9 months in CA storage. Delaying SmartFresh application should be investigated.

Thanks to AgroFresh Inc., Pommes Philip Cassidy Inc., Norfolk Fruit Growers’ Association, Lingwood Farms Ltd., and the Ontario Apple Growers for their support to this project.

Controlled Atmosphere Storage for 'Honeycrisp' Apples?

Dr. Jennifer DeEll, Fresh Market Quality Program Lead, OMAFRA, Simcoe

'Honeycrisp' apple continues to increase in popularity and production due to its outstanding flavour and uniqueness in remaining firm during storage. However, flavour is not always consistent and there is risk of developing several physiological disorders. The objective of a recent study was to investigate the effects of controlled atmosphere (CA) storage and SmartFresh(1-MCP, 1 ppm) on the physical and sensory quality of 'Honeycrisp' apples during storage.

Fruit were harvested from commercial orchards in multiple years, treated with or without SmartFresh for 24 hours at 8-10°C, and stored at 3°C in air or varying CA regimes (2.5-3.0% O₂ + 1.5-2.0% CO₂) for 4 to 8 months. Physical and sensory attributes were evaluated during subsequent holding at room temperature (18-22°C) within 1 week. Drs. Isabelle Lesschaeve and Amy Bowen, at the Vineland Research and Innovation Centre, were responsible for the sensory analyses.

'Honeycrisp' treated with 1-MCP had less peel greasiness and internal ethylene concentration, and generally higher soluble solids and malic acid content, compared to those without 1-MCP. Peel greasiness was also reduced by CA storage. Soft scald incidence was higher in air storage than in CA, while the effects of 1-MCP on soft scald were inconsistent. Internal CO₂ injury was aggravated by 1-MCP and/or CA, bitter pit was exacerbated by 1-MCP, and senescent browning was reduced by 1-MCP in CA storage.

Sensory evaluations revealed that 'Honeycrisp' treated with 1-MCP had lower perceived intensities of "oxidized red apple" and "earthy" flavours, less perceived "skin thickness" and "chewy" textures, and higher "lemony", "fresh green apple" and "acid" ratings, compared to those with no 1-MCP. Fruit not treated with 1-MCP and stored in air had higher perceived "oxidized red apple" and "earthy" flavours, and less perceived intensity of "acid" taste than those held in CA.

Another study looking at "CA Storage of 'Honeycrisp' Apples" was published recently in HortScience (47:886-892, 2012) by Dr. C.B. Watkins and J.F. Nock. The abstract of that study follows:

<< 'Honeycrisp' is an apple that can be stored in air for several months, but the flavour becomes bland with prolonged storage. Controlled-atmosphere (CA) storage recommendations have not been made in some growing regions, however, because of the susceptibility of fruit to physiological disorders. In the first year of this study, fruit from six orchards were stored in O₂ concentrations of 1.5, 3.0 and 4.5% with 1.5 and 3.0% CO₂. In the second year, fruit from three orchards were stored in three storage regimes (2.0 + 2.0, 3.0 + 1.5, and 3.0 + 0.5% of O₂ + CO₂, respectively) with and without SmartFresh (1-MCP) treatment at the beginning or end of the preconditioning regime (10°C for 7 days) that is commercially used for 'Honeycrisp'. CA storage had little effect on flesh firmness, soluble solids concentration (SSC), and titratable acidity (TA) over the range of O₂ and CO₂ tested. Greasiness was generally lower in fruit stored in lower O₂ and higher CO₂. Susceptibility of fruit to core browning and senescent breakdown varied between years, but a high incidence of internal injury in fruit from some orchards occurred in both years. 1-MCP treatment decreased internal ethylene concentration and sometimes maintained TA but had little effect on firmness and SSC. Senescent breakdown and core browning incidence were reduced by 1-MCP treatment where orchard susceptibility to these disorders was high. However, 1-MCP treatment sometimes increased internal CO₂ injury, especially if treatment occurred at the beginning of the conditioning period. The susceptibility of 'Honeycrisp' to physiological disorders, and specifically internal CO₂ injury, is a major limitation to the application of CA storage for this cultivar. It is likely that CO₂ injury will be manageable by methods such as delaying the application of CA storage regimes and/or using diphenylamine (DPA). However, CA storage cannot be recommended for storage of New York-grown 'Honeycrisp' apples until management of CO₂ injury can be assured.>>

Announcements

Apple Information at Your Finger Tips – ‘ontario.ca/apples’

OMAFRA Apple Team

The biggest complaint about the OMAFRA website is to find what you are looking for. Your OMAFRA Apple Team heard you – we totally reorganized the apple page to help your search.

On our Apple index page, we linked information by topic – from newsletters, publications, factsheets, photos, audio clips, website links. To make it easy to remember, we created a shortcut URL. Go online, type in : **ontario.ca/apples** (if you want French, type **ontario.ca/pommes**). You don't even need to type in the “www” (but if you do, it will still work).

On the left, we linked in 10 commonly used sites:

- Orchard Network newsletter
- Hort Matters newsletter
- Ontario AppleIPM
- Planting New Orchards module
- Publication 360
- Publication 75
- Minor Use – Pome Fruit
- Apple Tracker
- CanadaGAP
- Crop and Pest Updates

On the right side – click on the cover image for publications or modules you want. Or scroll down to the Table of Contents – grouped into: Crop Management, Pest Management, Harvest and Postharvest, Business and Innovation, and other information you may need.

We'd love to hear if the new layout helps you find what you need, or what other information is needed. Take some time this winter to browse through Apple Information by OMAFRA – ontario.ca/apples.



Ontario Fruit & Vegetable Convention 2013

Apple Program

Thursday, February 21, 2013 – Ballroom A

9:30 a.m.

- **Growing Quality Apples at Columbia Fruit Packers** Tim Welsh, Horticulturalist, Columbia Fruit Packers, Wenatchee
- **Postharvest Research Results and New Storage Technologies** Dr. Jennifer DeEll, OMAFRA
- **Panel: Technology Choices for Apple Production** Moderator: Leslie Huffman, OMAFRA
Platforms: Pete Geerts, Birnam Orchards, Arkona
Frost fans: Dan Devries, Devries Orchards, Fenwick
Harvest Aid: Werner Zurbuchen, Simcoe
Tall Spindle Orchards/Irrigation: Paul Frankis, Sugar Apple Orchards, Kingsville

2:00 p.m.

- **Can You Adapt to the Threat of Spring Frosts?** Mark Longstroth, Michigan State University
- **What's New in Fire Blight Control?** Dr. George Sundin, Michigan State University, Lansing
- **The Times They are A-changin': Changes in Ontario Apple Pest Complex** Kristy Grigg-McGuffin, OMAFRA
- **The Washington State Apple Industry** Tim Welsh, Columbia Fruit Packers

Apple Cider Workshop (Sweet and Hard Cider)

Wednesday, February 20, 2013 - Room 205

9:30 am

- **The Quebec Apple Cider Industry** Hubert Phillion, Vergers Écologiques Phillion, Hemmingford, Quebec
- **Making Winning Cider at Al Ferri & Sons** Ray & Jim Ferri, Brampton, Ontario
- **More Than Meets the Eye: Assessment of Cleaning and Sanitation Practices** Dr. Robert Blenkinsop, Food Scientist, OMAFRA
- **Making Specialty Ciders at Vergers Écologiques Phillion** Hubert Phillion, Hemmingford, Quebec

Calling all Ontario Cider Producers

We are looking forward to our **3rd Annual Ontario Sweet Cider Competition on Feb. 20 in Niagara Falls**. Last year, our judges chose the best cider by Al Ferri and Sons of Brampton, and Ray will share their story at our workshop.



It was a tough year for apples in Ontario, but we know that Ontario's cider producers captured the best flavours of the harvest. Bring two 4L jugs of your cider on Feb. 20 to the Niagara Falls Convention Centre. This competition is open to all Ontario cider makers, including those using a custom presser.

Ciders judging will be Feb. 20 (afternoon), and is open to the public. Winning entries will be announced shortly afterwards, and will be available to taste.

This competition is sponsored by the Ontario Apple Growers, and we are happy it has become an annual event.

The Ontario Fruit and Vegetable Convention is an annual gathering of horticultural crop producers, primarily involved in the production of fruits and vegetables, from across Ontario. The 2-day convention is located at the Scotiabank Convention Centre in Niagara Falls, Ontario, and features a great line-up of horticultural experts, topical sessions, trade show exhibitors and great networking opportunities. Now entering its 11th year, discover for yourself why it is called Canada's Premier Horticultural Event.



Online registration now open

Save yourself some time and money and register for OFVC online. Online registration is quick, secure and easy to use. Visa and MasterCard accepted. For more information and registration details, visit the website at: <http://www.ofvc.ca>.

Deadline for pre-registration - February 12, 2013

Food Safety

Maintaining Proper Water Quality

Wayne Du

Water chlorination is an effective treatment method often used by producers to maintain proper water quality. There are two recommended methods of water chlorination:

Shock chlorination is used to treat wells, through a process of flushing the well and water system with a chlorine solution. Water should be tested for total coliforms and *E. coli* 2-5 days after the treatment to confirm that both counts are 0 cfu/100 ml.

Continuous chlorination is used for the treatment of dump tank water, through a process of adding chlorine to the water continuously. The chlorinated water must be monitored for free chlorine and pH levels to ensure effective water chlorination. At the start before any produce is added, free chlorine levels in the dump tank water should be 100 -150 ppm. After adding produce, maintaining 2-7 ppm free chlorine and a pH around 6.0–7.5 at all times will ensure the system is working properly.

Maintaining proper water quality can reduce the potential for contamination of food products on your farm. Food safety practices keep agri-food businesses competitive, productive and sustainable.

Proper Sewage Removal is Imperative

Sandra Jones

Proper removal of waste from portable toilets is a very important part of food safety on your farm. As a food safety best practice always take precautionary measures to hygienically remove waste on your farm. Portable toilets are often situated close to production areas and therefore require extra care to avoid contaminating produce or a water source (e.g. irrigation water pond). Another step to minimizing the risk of contamination on your farm is to have a plan in place to address a potential accident.

For more information contact the Ontario Ministry of Agriculture Food and Rural Affairs by phone 1-877-424-1300 or visit our website at www.ontario.ca/goodagpractices. Food safety practices keep agri-food businesses competitive, productive and sustainable.



Operators plan now to attend:

Airblast Sprayers 101

An interactive workshop with Dr. Jason Deveau, Application Technology Specialist from OMAFRA, that includes classroom demonstrations and dialogue with an experienced airblast technician.

Learn how to calibrate, maintain and adjust your sprayer to the crops you spray.

To register call (Nancy): **416.622.9771** ext **2221** or email: **admin@croplife.ca**

Brought to you by:



Workshop Date and Location

Feb 21, Niagara Falls 9:30 am-noon
Ontario Fruit and Vegetable Convention

March 7, Vineland: 8 am-noon
Lunch provided

March 12, Simcoe: 8 am-noon
Lunch provided

March 13, Leamington: 8 am-noon
Lunch provided

March 18, Georgian Bay: 8 am-noon
Lunch provided

\$25 Workshop Fee. Space is limited.

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

www.ontario.ca/omafra