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ORCHARD NETWORK

For Commercial Apple Producers

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In this issue...

Orchard Management

Are Hedgers in Your Future?

Leslie Huffman, Apple Specialist, OMAFRA

The shape of apple trees in today's high density orchard is different. Growers are training trees into a fruiting wall by investing in taller nursery trees and trellis supports, and spending time training trees in the early years. A key driver for this change is the need to reduce labour cost and move toward efficiency in the orchard. Mechanizing orchard tasks will be the next step, and tree hedgers look promising to reduce pruning costs.

Many growers grimace to remember the hedgers used in the 1970's, which severely sheared large trees, and promoted excessive regrowth and more problems. Today's hedging will be used gently – more for shearing and shaping than "knocking down" big trees.

Research in Europe and in the U.S. has shown that hedgers can be precisely timed to achieve different results. Each grower may decide which time to hedge for different aged trees or different cropping history:

- Dormant to early spring – used to stimulate growth on weaker trees
- Late June (as fruit bud initiation begins) – cutting new shoots to encourage short regrowth and some additional fruit bud formation
- August – used to improve sunlight penetration

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

Caution must be taken to prevent several potential problems:

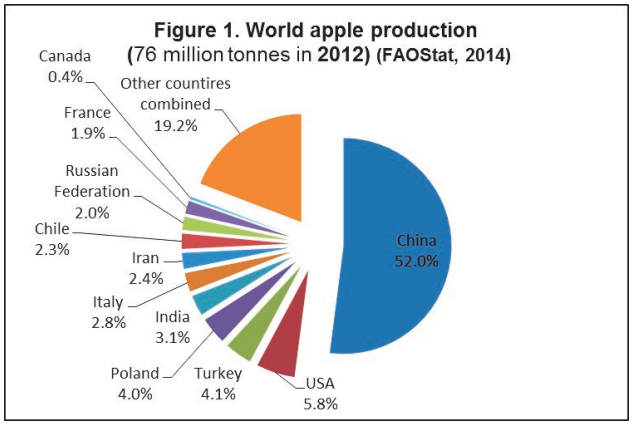
- Freshly exposed fruitlets can quickly sunburn. Apply sunshade products before hedging.
- Fire blight bacteria can infect open wounds. Do not hedge if fire blight is present, and choose warm, dry days to hedge for quick wound healing.
- Trellises must be straight, and drive rows need to be smooth to avoid damage to hedging equipment or trellis.

Hedging may replace most of the pruning requirement for one or two years, while the third year may require full hand pruning to re-establish the correct tree structure and limb renewal. This could be a significant advancement in reducing costs while maintaining high fruit quality for today's high density orchard.

Gala, Honeycrisp, and Ambrosia® – Strong Contenders in the Ontario Apple Market

John A. Cline, Associate Professor of Pomology, Department of Plant Agriculture, University of Guelph, Simcoe

Apples are one of the world's leading fruit commodities second only to citrus, with major production in both northern and southern hemispheres. Apples can now be stored twelve months of the year and be shipped around the world, making them a truly global fruit crop. China, the USA, and Turkey are among the top three producers (Figure 1) (FAO, 2012). Based on the latest available production statistics Canada ranks 35th just below The Netherlands (Fig. 1). Apples are one of the few horticultural commodities where consumer purchase is based on cultivar, unlike for example, most citrus, peaches, cherries, and strawberries. Over a decade ago, Golden Delicious, Red Delicious, Gala, Granny Smith, Fuji, and Jonagold were predicted to be the top five cultivars by 2010 (O'Rouke, 2003). At that time, Honeycrisp, and Ambrosia® were not even recognized on the list of 38 cultivars forecasted (O'Rouke, 2003).



The first statistics for Gala production in Ontario were recorded in 1997, and later for Honeycrisp and Ambrosia® (OMAFRA, 2014). While the cultivar mix may not vary much from year to year, it can change dramatically in a decade making vital the decision of which cultivar to plant challenging when establishing new blocks. Orchards are expected to produce for 15-20 years, and the choice of cultivar is a predominant factor in determining profitability.

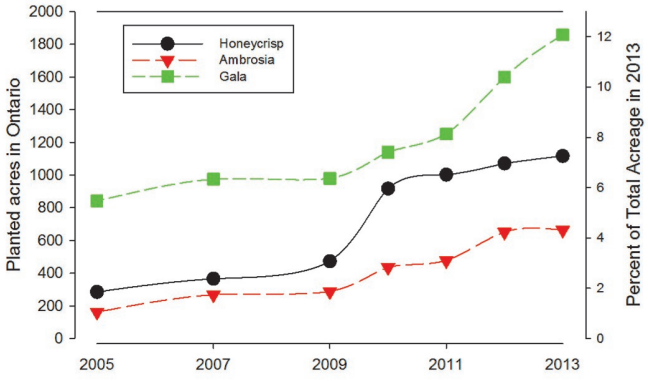
With harvest behind us, there is more time to reflect on which cultivars to plant in the spring of 2015 and beyond. The manner in which new apple cultivars have been introduced has changed significantly since the mid-1990s. In an effort to capitalize on the genetics and intellectual property, public and private breeders, and variety management companies protect new introductions through various mechanism such as trademarking and plant variety protection rights. A survey of nursery catalogues quickly reveals that producers now have an overabundance of new and improved strains to choose from or new introductions that promise

improved quality or disease characteristics not available before. Furthermore, new cultivars are often released under 'club' licenses restricting propagation, cultivation and even testing by many growers or are released with high royalty costs without the guarantee of proven market returns. Agreements among grower associations, nurseries, supermarkets and breeders are becoming more common in the growing and marketing of new cultivars. However, it is unclear if this system will be successful in the long term, especially with limited shelf space devoted to apples in the supermarket.

To help navigate the challenging waters of cultivar choice, it is meaningful to seek the input of local wholesale apple packers and review the planting statistics in Ontario. When I approached three of the largest packers in the province, Gala, Honeycrisp, and Ambrosia® were all indicated as the most promising from a marketing perspective (K. Kemp, K. Martin, T. O'Neill, personal communication). In short, the relative high returns for these three cultivars are impacted by their strong consumer demand, and this trend is expected to continue for some time into the future.

Ontario growers are responding. Since 2005, there has been a 291%, 309% and 120% increase in acreage of Honeycrisp, Ambrosia, and Gala plantings (Figure 2) while all other cultivars (except Fuji and Gingergold) are declining in planted area. Honeycrisp, Ambrosia, and Gala represent an overall production area of 7.2%, 4.2% and 11.9%, respectively -- nearly 25% on Ontario's total when combined. While these cultivars are not suited to all regions of the province, most are currently grown in at least one of the five growing districts.

Figure 2. Area of Gala, Ambrosia, and Honeycrisp grown in Ontario between 2005 and 2013
(Source: Ontario Apple Growers, OMAFRA)



With respect to Gala, Mr. Kirk Kemp, President of Algoma Orchards, recommends Gala strains that have a stripy blush and more intense red colour than Royal Gala typically produces – such as *Brookfield Gala*®. Other strains to consider might include *Buckeye*® *Gala*, *Crimson*® *Gala, Pacific*® *Gala,* or *Treco #42 (etc.)*[1]. Mr. Tom O'Neill, General Manager of the Norfolk Fruit Growers recommends that target fruit size should range between 88-113's; however there is also demand for bagged 113-163's.

While there are no guarantees in the apple business, grower sentiment seems to indicate much greater optimism than the 1990s. Cultivar choice is one of numerous decisions that must be made when establishing or renovating your orchard – but one that is fundamental in determining long-term profitability. While Honeycrisp presents numerous horticultural and postharvest challenges, the local wholesale and retail market forecast look very favourable for this cultivar. Ambrosia® production is currently restricted to Canada leaving Canadian growers with a unique marketing opportunity. Gala was introduced over 50 years ago, and because of its crisp, fresh, aromatic flavor has generated wide appeal making it one the top five cultivars produced worldwide. The future for Gala, Honeycrisp and Ambrosia® in particular, look favourable from this position in time.

[1] Mention of trade names and commercial products does not constitute endorsement or recommendation for use by the author of their affiliation.

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Platform for Success: Apple Labour Savings Study – Orchard Platforms

John Molenhuis, Business Analysis and Cost of Production Program Lead, OMAFRA

When you can buy apple ladders for less than $200 each, it can be hard to wrap your head around spending $45,000 to $60,000 on an apple platform to replace them. How could the numbers pencil out to make that pay?

A project, coordinated in co-operation with Ontario Apple Growers and OMAFRA, looking at that question has been completed.

The tightly spaced, uniform canopies of many newly planted orchards lend itself to the potential for mechanical orchard aids such as platforms.

Where were platforms used?

Establishing orchards

- installing wires
- installing bamboo or other tree supports
- tying tree leaders

Mature orchards

- dormant pruning
- hand thinning
- tree training
- summer pruning
- harvest

The growers using platforms see potential in expanding this list and commented that their platforms were starting to see more hours than some of their tractors.

Figure 1. Orchard workers tying tree leaders in young, high density orchard

As you would expect, the savings varied by orchard operation and varied across the grower orchards. Table 1 presents the results of the labour study.

Table 1 – Apple Platform Labour Savings

Operation	% Savings	Potential $/acre savings*
Hand Thinning	52%	$173
Summer Pruning	29%	$48
Dormant Pruning	27%	$116
Harvest	18%	$158
Tying tree leaders	68%	$10

** based on hours per operation reported for a mature orchard in 2010 Apple Cost of Production study*

Hand thinning

- most consistent savings with the platform across the orchards

Summer pruning

- Given the tree structure of the higher density plantings, many of the orchards in the study did not require summer pruning

Dormant pruning

- Savings depended on whether ladders were typically used in pruning
  - if workers used pruners on poles and walked along the ground, time savings was not as significant as when they needed ladders for tree tops

Tying tree leaders

- orchards spent a small amount of time on tree training for the mature orchard but significant hours during establishment period
- a limited sample of installing wires and bamboo/pole supports was also timed with savings in the 30-35% range

Harvest

- using the platform in harvest has its challenges:
  - timing the bins within the row to have a new bin available when the current bin is full
  - having a bin available for workers on the ground picking the bottoms of the trees without obstructing the platform

  These factors limit platforms use for harvest to only a few orchards at this point.
- when growers and orchard workers become more familiar with using platforms using it for harvest may increase.

Figure 2. Dormant pruning with the orchard platform

The machinery cost per acre for the platform depends on the size of orchard and the platform purchase price but using the 60-acre orchard size of the Apple Cost of Production study conducted by the Ontario Apple Growers, the per-acre cost estimate is between $160 and $190 per acre. From Table 1 you can see that using the platform in some operations can quickly pay for itself. And the labour savings continue to add up the more operations it is used. Like any machine, using it to its capacity is a big factor in controlling its costs.

There are some advantages mentioned by the growers that are hard to put a number on, but still add to the attraction of platforms over ladders:

- more uniform pruning or thinning, especially at the tops of the tree
- less worker fatigue
- consistent in-row travel speed
- able to simplify tasks
- worker safety was better with platforms versus climbing ladders
- worker comfort was better with platforms with less physical labour moving and climbing ladders in warm weather
- workers like working on them!

The Vineland Apple Breeding Program, 2011 - Present

Beatrice Amyotte, Graduate Student, Applied Genomics, Vineland Research and Innovation Centre

In 2015, the Vineland Research and Innovation Centre will enter its fifth season of breeding apples for Ontario, Canada and the world.

Since 2011, Vineland has been selecting excellent quality apple varieties to serve as parents for the next generation of commercial apples, and conducting thousands of cross-pollinations between these varieties each year.

Today, Vineland's test nursery is home to eight thousand unique apple seedlings with adaptation to the Ontario environment, and with the potential to produce top quality apples desired by Canadian consumers. The first fruits from this nursery will be harvested next year, and those with the best tastes, textures and flavours, according to consumer preference, will be chosen to move forward for multi-year, replicated testing.

While we are very excited for what comes of our first harvest and look forward to testing these new potential varieties, we are of course continuing to develop and grow our apple breeding program.

In 2013 and 2014, we established the Vineland Apple Mother Tree Block of 60 elite apple varieties on the Vineland home farm. The 60 Mother Tree varieties were selected to be the genetic sources of ideal fruit quality, excellent storability, broad adaptability and important resistance traits. Having established the Mother Tree Block as a key genetic resource for apple breeding, we will soon be able to collect pollen, conduct cross-pollinations, and harvest seeds all in one location. The Mother Tree Block will be accessible, efficient, and most importantly, it will enable us to design specific crosses to meet the needs of apple producers, distributors and consumers alike.

Although the Apple Mother Tree Block will not be ready until 2015, the 2014 season has in itself brought significant innovation to the Vineland apple breeding program.

This past spring, we adopted a new cross-pollination strategy that is both faster and higher yielding than other methods. Using our new crossing strategy, we were able to produce more than 30,000 seeds from 35 unique cross combinations. In order to manage this large and valuable breeding population, we're using advanced DNA screening techniques to predict seedling performance in terms of fruit quality, storability, and other key traits. Those top seedlings whose genetic makeup identifies them as potential great apple varieties will move beyond the greenhouse and become part of the test nursery in Vineland. Applying this DNA-based strategy to manage and enrich our breeding populations will allow us to conserve land and input resources by advancing only the 8,000-10,000 seedlings annually that have the best chance of producing superior fruit.

Moving forward, we will engage the Vineland consumer insights group and the Ontario apple industry to assist with selecting high performing and high quality apple varieties for commercialization.

Crop Protection

Apple Leafcurling Midge

Kristy Grigg-McGuffin, Simcoe and Margaret Appleby, Brighton, OMAFRA

The apple leafcurling midge (ALCM) is increasingly becoming a foliar pest across Canada, in provinces including British Columbia, Nova Scotia, New Brunswick, Quebec and Ontario. In the past 4 years, OMAFRA specialists have been working on trials to understand the biology and management of this pest.

The ALCM pupate in silken cocoons in the soil or in curled leaves. Adults (1.5 to 2 mm) begin to emerge in late May to early June. After egg hatch, maggot-like larvae feed on the edges of tightly curled leaves for 2 to 3 weeks (Figure 1). Margins of infested leaves are rolled in towards the mid-vein and become purple or red and brittle (Figure 2). A curled leaf usually contains 20 to 30 larvae; however, as many as 500 larvae can be found in an infested leaf.

Figure 1. ALCM larvae rolled in the leaf

To understand the life cycle of ALCM in Ontario conditions, pheromone traps to monitor adult populations were placed in orchards in Durham, Niagara and Norfolk County at pink (early May). Traps were monitored twice a week throughout the growing season and the number of adults present were recorded. Over 4 years of monitoring, we found that a small peak in trap counts late May to early June was followed by peaks in early June and again in early August. This indicates that there are at

least 2-3 generations of ALCM in Ontario each year with adult emergence beginning as early as pre-bloom. Terminal assessments indicated that infested terminals were present in the orchard immediately after monitoring began.

Figure 2. Infested leaves roll towards the mid-vein, turning purple-red and brittle.

In recent years, Ontario field trials using Movento have been quite successful in the management of ALCM when applied at petal fall. In 2013 and 2014, field trials expanded to include alternative products, Closer and Delegate.

In 2013, pheromone traps were installed at pink in a Durham region orchard with historically high ALCM pressure. When the cumulative catch of adult midges in the traps exceeded 10, which corresponded with petal fall, the following insecticides were applied:

- Delegate @ 420 mL/ha
- Closer @ 400 mL/ha
- Movento @ 365 mL/ha

All treatments were re-applied 10 days later. Closer and Delegate treated blocks had less terminal damage caused by ALCM one week after treatment compared to Movento. Due to its mode of action, Movento is a slower acting product and typically takes 2-3 weeks for effects to become evident. However, residual activity is longer lasting for this product, as seen by Week 4 in this orchard. It should be noted that in this trial, Closer was applied 3 days earlier than the other products, which could explain the higher damage in that block by Week 4.

In 2014, different rates of Closer (300 mL/ha and 400 mL/ha) were applied and compared to the high rate of Delegate (420 mL/ha) in the same Durham region orchard as 2013. All sprays were applied June 8 and again 10-11 days later. Preliminary results show that the Delegate block had less terminal damage caused by ALCM and the residual activity lasted longer for Delegate compared to Closer.

In 2014, Delegate (420 mL/ha) was also compared to conventional petal fall sprays of Calypso (440 mL/ha) and Diazinon (1kg/1,000 L water) in a Norfolk County orchard. A second application of Delegate and Calypso was made 10 days later. Preliminary results show that while the Diazinon block had the lowest terminal damage, the Delegate block also had lower ALCM damage compared to Calypso.

The OMAFRA Apple Team have also been involved in an ALCM parasitoid project. Collections will continue next season to determine if native parasitoids are present in Ontario apple orchards, while laboratory tests will survey other parasitoids that could potentially be used as biological control for ALCM.

Managing Bitter Rot in Apples

Michael Celetti, Plant Pathologist Horticulture Crops; Kristy Grigg-McGuffin, Pome Fruit IPM Specialist; Margaret Appleby, IPM Systems Specialist, OMAFRA

Bitter rot is a serious disease of apple fruit caused by the fungal pathogen *Colletotrichum fioriniae* (formerly *C. acutatum*). This disease has caused significant losses in apple growing regions that experience very warm and humid conditions such as in some Southern US states and Central and South America. This disease has not been a major issue for Ontario apple growers in the past. However, something has changed recently and more bitter rot has shown up in some Ontario apple orchards over the past couple of years.

Epidemics of this disease occur when warm to hot weather occurs early in the growing season together with rainy periods that extend into the summer. Recognizing the disease is an important first step towards management. The pathogen can infect fruit at any time during the growing season from as early as bloom right up until harvest. However, symptoms often show up mid-late season after a period of warm to hot weather accompanied by rain or a thunderstorm. The initial infection appears as small grey or brown spots that quickly enlarge into circular sunken light to dark brown rots on infected fruit (Figure 1). Warm temperatures hasten the rotting process. Under humid conditions, cream to salmon-coloured masses of spores are produced on the surface of the rotting fruit which is very diagnostic. These spores can then be rain splashed to other fruit resulting in further infections and more rotten apples. If the spores land on fruit just before or during harvest, infection can occur and small bitter rot lesions will develop slowly while in cold storage. These small spots will begin to enlarge within a few days as the fruit warms up. As the fruit lesions enlarge, a diagnostic V-shaped rot may progress towards the core (Figure 2),

but this does not always occur and may not be the most reliable symptom for disease diagnosis.

Figure 1. Bitter rot appears as a circular sunken rot with cream to salmon-coloured spore masses produced near the center of the lesion.

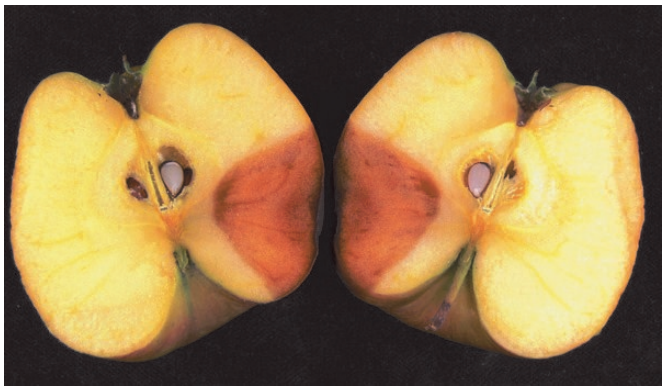

Figure 2. Bitter rot lesions develop a diagnostic V-shaped rot that progresses towards the core.

The pathogen can overwinter in infected mummified fruit left on trees or on the orchard floor, as well as in colonized cankers caused by other pathogens such as fire blight or black rot. There have been some reports of more bitter rot appearing in orchards that also had fire blight possibly due to the pathogen surviving in the fire blight cankers and spreading to fruit later in the growing season.

Management of bitter rot is through good orchard sanitation. Removing old cankers, as well as mummified fruit left in the trees from chemical thinning will remove the potential primary source of this disease from the orchards. Mulching or removing infected fruit on the orchard floor will also reduce inoculum and the potential of spreading the disease. Some fungicides registered for the management of apple scab and other summer diseases may provide some protection against infection from the bitter rot fungus. However, there is still more to learn about managing bitter rot in Ontario. More research into the efficacy of new fungicides, timing of fungicide application, protection of fruit going into storage and other potential solutions for managing bitter rot is required.

Ambrosia Beetles in Apple Orchards

Hannah Fraser, Entomology Program Lead (Horticulture Crops), OMAFRA

Last month at the Great Lakes Fruit Workers' meeting in Traverse City Michigan, we heard about a new problem affecting apparently healthy apple orchards in New York (as reported by Deborah Breth, Cornell Cooperative Extension): black stem borer (BSB, *Xylosandrus germanus*) (Figure 1). Over the last couple of years, growers have been reporting dying trees with signs of borers and oozing sap. Since 2013, 25 affected sites with dying apple trees have been identified, ranging from new to 15 year old plantings.

M. Jure, University of Ljubljana

Pennsylvania Dept. of Cons. & Natural Resources

Figure 1. Black stem borer, *Xylosandrus germanus*

The BSB belongs to a group of insects known ambrosia beetles (Subfamily Scolytinae, Tribe Xyleborini). Many of these, including the BSB, have been introduced to North America and are continuing to expand their ranges. The BSB was first identified in Long Island, NY in 1932, and in Canada near Point Pelee, ON in 1994.

While ambrosia beetles typically invade cut or distressed trees, some will attack apparently healthy trees. For example, another recent arrival in Ontario, granulate (Asian) ambrosia beetle (GAB, *Xylosandrus crassiusculus*), is a serious pest of nursery material and fruit trees in parts of the US (including apple *Malus*, pear *Pyrus*, and peach *Prunus*). Host range of ambrosia beetles is often broad.

Ambrosia beetles such as the BSB and the GAB bore 1.5 mm tunnels through the bark and into the heartwood of trees, to a depth of 1 or 2 cm . In contrast, related bark beetles or shothole borers tunnel through the bark and form shallow galleries running parallel to the wood grain; if you were to peel back the bark of trees, you would see the galleries. With ambrosia beetles, you would see a series of shotholes but no galleries under the bark. Both bark beetles and ambrosia beetles can attack fruit trees. Females excavate a series of short galleries off the main tunnel (or a single large brood chamber) where eggs are laid and larvae reared (Figure 2).

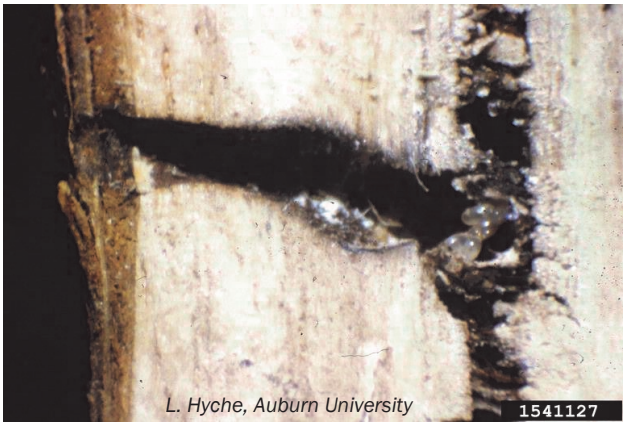

Figure 2: Brood chamber where eggs are laid.

Larvae do not feed on the wood. Instead, females introduce and cultivate an ambrosia fungus (often specific to a given beetle species) within the galleries that is used as a food source by the developing larvae. Adult BSB overwinter in chambers at the base of infested trees, and females move to new sites in the spring. Development from egg to adult takes about 30 days, resulting in 2 generations per year.

Branches and stems of affected trees may wilt and die, and larger branches and trunks may become riddled with galleries, creating weak points that are subject to breakage. Toothpick-sized tubes of sawdust can be seen coming out of large branches and the trunk. Heartwood that is infested with ambrosia beetles is typically stained dark brown or black along gallery walls. In addition to the direct damage caused by boring into heartwood, females may also introduce *Fusarium* fungus, resulting in the formation of cankers and withering of crowns. Damage is sometimes confused with fire blight.

Options for managing ambrosia beetles are limited. Maintaining tree vigour, latex paint on trunks, removal of infested trees / branches (plus burning or chipping) can help to reduce infestations. Trap logs - fresh cut pieces of hardwood logs 1-2 metre long placed at intervals along orchard edges - have been used with some success; logs must be removed and destroyed before any new adults emerge. Trunk sprays are also being evaluated at Cornell.

We are interested in tracking ambrosia beetles in fruit trees in Ontario. If you think you are seeing injury from bark beetles, please let us know.

Coming Soon! 2015 Publication 360, Guide to Fruit Production Supplement

The supplement of the OMAFRA Publication 360, Guide to Fruit Production will be available in February 2015 in time for the Ontario Fruit & Vegetable Convention. This is an update to the full 2014-2015 Publication 360 edition, published earlier this year and includes information on new product registrations and changes from January 2014 to January 2015.

This supplement can be downloaded from the OMAFRA website at www.ontario.ca/crops. Refer to this website for updates throughout the year. Printed copies along with many other factsheets, publications and resources can be ordered from Service Ontario:

- Online at ServiceOntario Publications – www.publications.serviceontario.ca/pubont/servlet/ecom/
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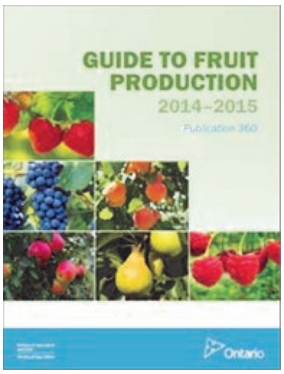


New Products for Ontario Apple Growers in 2015

Kristy Grigg-McGuffin, Pome Fruit IPM Specialist, OMAFRA

With the 2015 Publication 360, Guide to Fruit Production Supplement becoming available shortly, here is a list of new product additions Ontario apple growers can look forward to seeing for the upcoming season.

The following are new product registrations or uses for 2015:

- **Fruitone L** *(1-naphthaleneacetic acid)* is a plant growth regulator registered for thinning, return bloom and preharvest drop. This is a new formulation of the currently registered Fruitone N and will replace this product when existing supplies have run out. For thinning and preharvest drop, apply 14.8-118.3 mL/378.5 L water (1.2-9.7 ppm) at petal fall (3-7 mm fruit size) and early fruit set (8-10 mm fruit size). Application to fruit >15 mm may result in misshapen or pygmy fruit in sensitive varieties. For return bloom, use 10-20 ppm 2 weeks prior to harvest. Effects will start 1-2 days after application, lasting for 7-10 days. Re-apply at 10 ppm 1 week prior to harvest.
  Preharvest interval (PHI): 5 days;
  Re-entry period (REI): when dry;
  Maximum # of applications per year (on label): 2.

- **Isomate OFM TT** *(pheromone)* is a mating disruption pheromone registered for reduction in mating of oriental fruit moth and lesser appleworm (not a common pest in Ontario). This is a new formulation that will be replacing the currently registered Isomate M100 and M-Rosso when existing supplies have run out. Apply 125-250 dispensers/ha before adult emergence begins in the spring. The dispensers are designed to last for the entire season. Apply supplemental control measures when/if needed. For more information on using mating disruption, see Mating Disruption in Fruit Crops, 2014-2015 Pub 360.
  Preharvest interval (PHI): not specified on the product label;
  Re-entry period (REI): not specified on the product label;
  Maximum # of applications per year (on label): 250 dispensers/ha/season.

- **Nealta** *(cyflumetofen)* is a Group 25 miticide registered for control of European red mite and two-spotted spider mite at 1 L/ha. Apply when there are 5 or more active mites per leaf. This product has rapid knockdown activity on all life stages, including eggs, nymphs and adults. Similar to other miticide products, thorough spray coverage is essential for good control and is best applied alone. For resistance management, do not use more than once per season.
  Preharvest interval (PHI): 7 days;
  Re-entry period (REI): 12 hours;
  Maximum # of applications per year (on label): 2.

- **Phostrol** *(mono- and dibasic sodium, potassium and ammonium phosphites)* is a Group 33 fungicide registered for the control of fly speck and sooty blotch at 4.4 L/ha. Begin coverage for these diseases at petal fall if they were a problem in the past. Re-apply on a 7-14 day interval if conditions favouring disease development continue. Use the shorter interval under higher disease pressure or on susceptible varieties. This product may have some activity on other summer diseases, but there is currently no research on this from Ontario orchards.
  Preharvest interval (PHI): 1 day;
  Re-entry period (REI): 12 hours;
  Maximum # of applications per year (on label): 6.

- **TwinGuard** *(sulfoxaflor + spinetoram)* is a Group 4C + 5 insecticide registered for control of rosy and green apple aphid and suppression of woolly apple aphid at 250 g/ha, control of San Jose scale, codling moth, oriental fruit moth, obliquebanded leafroller and suppression of apple maggot and plum curculio at 500 g/ha, and control of spotted tentiform leafminer at 250-500 g/ha. Re-apply, if necessary, after 14 days. This is a pre-mix formulation of Closer (sulfoxaflor) and Delegate (spinetoram), so timing for the above pests will be similar to that listed in the apple calendar for these products alone. As well, for resistance management, do not rotate TwinGuard with these products. Do not apply during bloom or when bees are active in the orchard. Refer to the label for specific bee toxicity statements.
  Preharvest interval (PHI): 7 days;
  Re-entry period (REI): 12 hours;
  Maximum # of applications per year (on label): 2.

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

- **Fontelis** *(penthiopyrad)* contains mineral oil in the formulation. If tank-mixing with oil-sensitive products, such as captan and sulphur, read and follow their label restrictions.

- Due to the decision by the Pest Management Regulatory Agency (PMRA) to phase-out diazinon insecticides, **Diazinon 500 E** (PCP #11889) and **Diazinon 50 WSP** (PCP #29976) will no longer be permitted for use on apple after December 31, 2016. While product is still available, additional changes to current application practices specific to apples have also been implemented on all diazinon labels:
  * Use of hand-held sprayers as an application method on tree fruit is prohibited where the use of field sprayers is considered more effective. Spot applications using hand-held sprayers will still be permitted with a maximum limit of 500 m^2 per day.
  * Updated buffer zones are required for airblast applications. See product label for this information.

DA Meter Assessment of Apple Maturity: Myths, Realities and Challenges

Dr. Peter M.A. Toivonen, Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, BC

There has been much hype about maturity assessment of tree fruit using the DA meter developed at the University of Bologna, Italy and distributed by T.R. Turoni S.R.L. While the use of the instrument has been relatively straightforward for peaches and pears, the story has not been so simple for the apple. However, with continued research, we are beginning to get a better understanding of issues regarding mode of use, variability of the fruit and relationship of I_{AD} values (generated by the DA meter) to other maturity indices such as internal ethylene, firmness and starch clearing.

One of the issues causing difficulty for progress of adaptation for this instrument to apples is the myth that all maturation processes are synchronized for all varieties of apples. In fact, we are finding that the synchronicity of various maturation indices in Ambrosia® and a few other new apple cultivars can occur in some years, but not others. For example, for Ambrosia®, starch clearing index and I_{AD} values were correlated in a similar manner in 2012 and 2013 in the Okanagan Valley, however the relationship was quite different in 2014 with starch clearing advancing more quickly than the decline in I_{AD} values.

It is important at this point to discuss ripening indices and just what I_{AD} values represent in regards to maturity. While some claim that I_{AD} values correlate to firmness, that is generally considered to be a secondary association, i.e. firmness changes during maturation parallel changes occurring with I_{AD} values but the two processes are not directly linked with each other. It has to be emphasized that **all I_{AD} tells you is how much chlorophyll is in the peel of the apple – nothing more**. Johnston et al. (2009) published a very good paper discussing how ethylene might regulate different ripening process in apples. In essence they state that flesh softening and peel colour change (i.e. loss of greenness in the background colour) are processes having stronger dependencies on ethylene concentrations, but neither process is very sensitive to ethylene (i.e. you have to have high ethylene levels to induce the change). In contrast, starch degradation and loss of acidity are not strongly dependent on ethylene levels, but changes in these indices are induced by very low concentrations of ethylene. However, there can be other environmental and biological factors influencing these four maturity indices that occur during ripening. In regards to biological factors, many of the new apple varieties do not produce a lot ethylene until well after they are mature for harvest (e.g. 'Fuji', Ambrosia®, Aurora Golden Gala™, Salish™, etc). As a consequence, the coordination of ripening events seen for older cultivars, which show an earlier climacteric rise, does not necessarily apply with the new cultivars. In a cultivar such as 'Gala', the internal ethylene concentrations, starch clearing and I_{AD} indices are fairly well coordinated and so I_{AD} may well be used as a surrogate for internal ethylene or starch clearing, however year-to-year variability in this correlation has yet to be assessed. The operational word is "surrogate", which emphasizes that the correlation is not a true estimate for the other two measures of maturity, it only works as long as the other two indices change in coordinated manner with the decline in I_{AD} index (i.e. the loss of chlorophyll as the background colour of the peel turns from green to yellow).

The picture can get more complicated with the use of treatments such as Harvista™ in the field. Since Harvista™ blocks ethylene action and catalytic production, it blocks the changes associated with ripening induced changes in ethylene production. As a consequence, if Harvista™ is applied, then the relationship that existed between internal ethylene concentrations and I_{AD} in untreated fruit will disappear. Researchers at Dr. Chris Watkins laboratory at Cornell University reported this observation at the International Horticultural Congress in Brisbane this past August. The disassociation of I_{AD} with internal ethylene in Harvista™ treated apples is supported by the understanding developed by Johnston et al. (2009). Peel chlorophyll loss was not influenced by the internal ethylene in the apple, since that process has low sensitivity to ethylene any ethylene produced internally would rapidly dissipate, and not accumulate to induce chlorophyll loss of the peel even in a conventional early climacteric type apple (e.g. 'Gala'). Since ethylene was not an issue in the untreated apple, treatment to block ethylene would not have any effect on peel degreening. We have made a similar observation when measuring I_{AD} values over time in storage. SmartFresh^{SM} has no significant effect on the rate of chlorophyll loss (i.e. decline in I_{AD} values) in air or CA storage (Toivonen and Hampson, 2014).

The question that might be raised is whether the DA meter is of any value for maturity assessment. **I believe the answer is yes, but the users need to understand what the measures are telling us. In general the measures are telling us how the peel itself is maturing on the tree**. That information is useful for understanding susceptibility in storage to peel-related disorders, not firmness, not starch clearing, etc. Our data to date is showing that two peel-related disorders that can affect Aurora Golden Gala™ in some years, soft scald and lenticel breakdown, are associated with harvesting the apples at a very low I_{AD} value (i.e. advanced peel maturity). Starch index has been found not to be as sensitive as I_{AD} and since this apple shows a very late ethylene climacteric that index cannot be used to assess susceptibility to these two disorders. Similarly, I_{AD} may be useful to assess maturity in Ambrosia to reduce risk of soft scald in years where harvest maturity can mitigate

the disorder. DeLong et al. (2014) show a similar relationship in 'Honeycrisp'.

However, even with this understanding, there are yet a few other issues that must be reconciled for effective use of the DA meter, whether it is used as a surrogate for other maturity indices or as a direct indicator of peel maturity. First and foremost, the supplier of the instrument and some researchers underestimate the influence of stray sunlight on the accuracy of the measurements in the field or in a sunlight-exposed window of a lab. In our early work we realized that since this is a light-based instrument, that **stray light impinging from the sun or from a bright lamp can alter the reading**. Why? The DA meter measures the difference in absorbance of two wavebands of light 670 and 720 nm and this difference is used to calculate the I_{AD} value or "relative chlorophyll content". Sunlight has significant amounts of a wide range of light wavelengths and these overlap the two used by the instrument – therefore the apple peel section being measured has to be shaded from sunlight exposure during measurement. We have designed a light shroud from soft rubber and attach it to the instrument with Velcro® (see Figure 1). The shroud-fitted DA meter will allow reliable measurements in the field. We have three years of experience with this configuration in research plots and commercial orchards.

Figure 1: A light shroud-fitted DA meter in use in an orchard.

Chlorophyll physiology must also be considered in order to get reliable measures of maturity using this instrument. Chlorophyll content of the peel has been recognized as an indicator of maturity Blanpied and Silsby (1992), however that work did not consider the use of an instrument such as the DA meter, which only measures a very small area of whole apple (~ 1 cm diameter). Chlorophyll content of any one section of the peel can be affected by many factors including light exposure levels, excessive light (i.e. sun damage), and disorders on the peel. While many like to make measures on two sides of an apple using the DA meter, we have concluded that measuring one side of the fruit is a better approach in order to reduce variability. Please refer to the report on the Summerland Varieties Corporation website regarding the variability encountered when measuring two sides (Toivonen, 2011). The intent of the use of the DA meter is to monitor declines in peel chlorophyll that are only related to maturity change. Chlorophyll production is very much influenced by light, therefore a deeply shaded side of an apple (a side with little or no blush colour) will have less chlorophyll at any time than a more light-exposed side of the apple. Therefore, it is important to avoid using the shaded side for making measures. In contrast, the side of the apple which is exposed to direct sunlight, will likely suffer lethal or sub-lethal sunscald or heat injury. Such injury causes chlorophyll bleaching which may not be visible to the naked eye, but results in much lower chlorophyll values than on sides not exposed to direct sun. **The best, most reliable place to measure the apple is a side not exposed to direct sun or deep shade, preferably on the north-facing side of the fruit.** It is important to always measure on the same side of all fruit measured. Location on the tree, or, of the tree in a block can also influence the readings. Apples at the top of the tree can have different chlorophyll levels than those lower in the tree if there is significantly more foliage in the lower part of the tree. An outside row of a block will also have different chlorophyll levels than a tree in a block due to higher light levels on the outside of a block.

Keeping all of the cautions in mind, it is possible to get reliable and repeatable measures of I_{AD} values that can allow you to measure peel maturity in apples. In some varieties and some cases (when Harvista™ is not used), the I_{AD} values can be used as a surrogate for other maturity indices. But you need to evaluate each variety and situation before moving ahead. This brings me to my final point, there needs to be more research to evaluate use of this instrument on a case by case basis, until our knowledge has improved well beyond our current understanding.

References for further reading

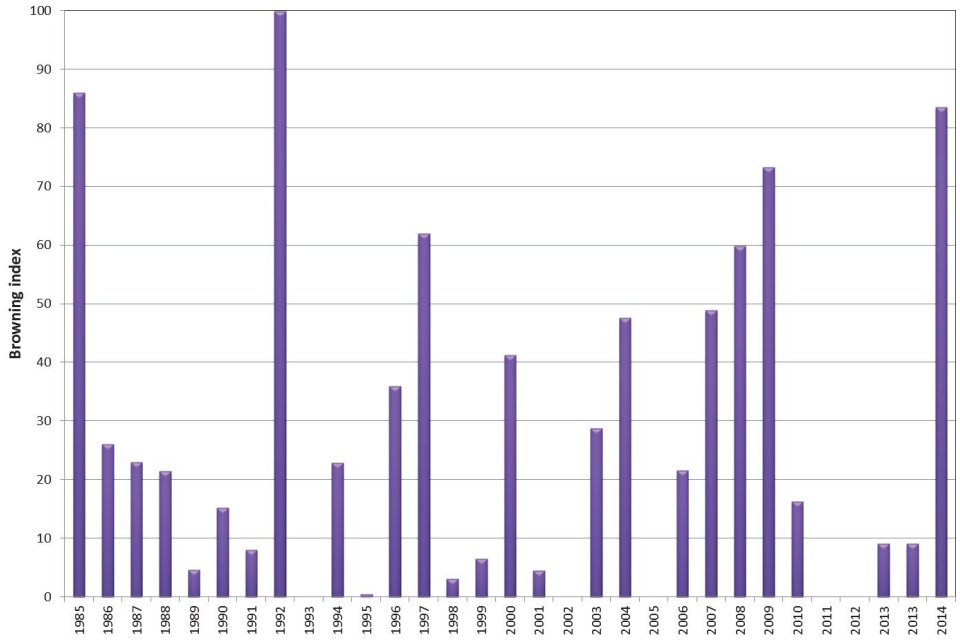
- Blanpied, G.D. and K.J. Silsby. 1992. Predicting Harvest Date Windows for Apples. Cornell Cooperative Extension Information Bulletin 221, 12 pp.
- DeLong, J., Prange, R., Harrison, P., Nichols, D. and Wright, H. 2014. Determination of optimal harvest boundaries for Honeycrisp™ fruit using a new chlorophyll meter. Canadian Journal of Plant Science 94: 361–369.
- Johnston, J.W., K. Gunaseelan, P. Pidakala, M. Wang and R. J. Schaffer. 2009. Co-ordination of early and late ripening events in apples is regulated through differential sensitivities to ethylene. Journal of Experimental Botany 60: 2689-2699.
- Toivonen, P.M.A., C.R. Hampson 2014. Relationship of I_{AD} index to internal quality attributes of apples treated with 1-methylcyclopropene and stored in air or controlled atmospheres. Postharvest Biology and Technology 91: 90-95.
- Toivonen, P.M.A., Mostofi, Y., Wiersma, P.A., and Hampson, C.R. 2012. Evaluation of Non-Destructive Instruments for Assessing Apple Maturity and Quality: 2011 Results. Agriculture and Agri-Food Canada (AAFC)/Agriculture et Agroalimentaire Canada (AAC), 21 pp. Available at: www.summerlandvarieties.com/research_and_development

High Risk of Chilling Disorders for 2014-15 Storage Season in Ontario

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

CIPRA is a computer-based program developed by the research team of Dr. Gaétan Bourgeois (AAFC-QC) that uses weather data to predict the risk susceptibility of apples to specific storage disorders (Bourgeois, DeEll, and Plouffe). According to the model within CIPRA (using weather data from Simcoe, Ontario), there is very high risk of chilling-related disorders developing this storage season. In fact, this year's risk is the 3rd highest since 1984 (Figure 1).

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



* Graph supplied by D. Plouffe, AAFC-QC

Announcements

Ontario farmers – the deadline for filling in the Ontario Pesticide Survey is **February 13, 2015**.

This information is very useful for:

- understanding trends in pesticide use,
- identifying potential needs of farmers and,
- identifying research needs.

All Ontario farmers who grew any conventional or organic crops in 2014 can fill out the anonymous survey at, www.ontariopesticidesurvey.ca

Thank you for your cooperation. Farm & Food Care will also accept mail-in, fax or email returns of the survey.

For more information contact: Bruce Kelly, Environmental Program Lead, Farm & Food Care Ontario, bruce@farmfoodcare.org or (519) 837-1326.

Apple Cider Workshop (Sweet and Hard Cider)

Wednesday, February 18, 2015 - 9:30 am

Beyond the Plastic Jug – Innovative Cider Products - *Cheryl Peck, The Cider Keg, Vittoria*

Invest in Sanitation to Invest in Cider Quality - *Louise Agius, Risk Management, OMAFRA*

Making Winning Craft Cider at West Avenue Ciders - *Chris Haworth, West Avenue Cider, Toronto*

Quality Factors in Cider Making - *Claude Jolicoeur, Author, The New Cider Maker's Handbook*

Calling all Ontario Cider Producers

Our Ontario Cider Competitions are organized with two goals in mind: to encourage excellence in cider making, and to raise consumer awareness of Ontario's cider products.

Last year, at our **4th Annual Ontario Sweet Cider Competition,** our judges chose the best sweet cider by Larry Short of Sun Ray Orchards. At our **1st Annual Ontario Craft Cider Competition**, our judges chose the best hard craft cider by Chris Haworth of West Avenue Cider Company. Chris will be sharing his story at our workshop.

We hope to see more entries at the **2nd Annual Ontario Craft Cider Competition** and **the 5th Annual Ontario Sweet Cider Competition** on **February 18, 2015** in Niagara Falls. Bring your entries to the Niagara Falls Convention Centre by noon on Feb. 18. We will need either two 4L jugs of sweet cider, or 3 x 750 ml bottles (or equivalent) of hard cider. Jugs or bottles should be unlabelled. This competition is open to all Ontario cider makers, including those using a custom presser. The Craft Cider Competition is open to commercial producers licensed by the AGCO.

New this year will be two categories of craft cider – common cider, and specialty cider. Each commercial cidery can enter once in each category. More details to come for specifications.

Ciders will be judged on February18 (afternoon), and the judging is open to the public. Winning entries will be announced at the Farmers and Friends Reception on February 18, and the winning sweet ciders will be available to taste on Thursday morning at the Apple Session.

Apple Program

Thursday, February 19, 2015 - 9:30 am

Managing Summer Fruit Rots in Apples - *Dr. Dave Rosenberger, Cornell University, Professor Emeritus*

Response of Gala to Multiple Applications of Chemical Thinners - *Dr. John Cline, University of Guelph, Simcoe*

Cultivar Trial Update - *Nick Ibuki, Summerland Varieties Corp., Summerland*

Panel: Views from the Next Generation of Orchard Managers

Gerbe Botden, Botden Orchards, Thornbury
Manus Boonzaier, Algoma Orchards, Newcastle
Brian Rideout, Manitree Orchards, Blenheim
Lisa Hill-Alexander, Vanessa Hill Orchards, Vanessa

2:00 pm - **Modern Pruning Concepts for Precision Cropload Management** - *Dr. Terence Robinson, Cornell University, Geneva*

Moving Towards Ecologically-Based IPM in Eastern Apple Orchards - *Dr. David Biddinger, Pennsylvania State University*

Labour Efficiency with Platforms - *John Molenhuis, Cost of Production Lead, OMAFRA, Brighton*

Orchards of the Future - *Dr. Terence Robinson, Cornell University, Geneva*

Fire Blight Management

Wednesday, February 18, 2015 - 9:20 am

The Fire Blight Situation in 2014 - *Michael Celetti, OMAFRA*

Fire Blight Management Begins with Prevention *– Dr. George Sundin, Michigan State University*

Fire Blight in My Orchard: Now What? *– Dr. David Rosenberger, Cornell University, New York*

Alternative and Novel Products for Managing Fire Blight *– Dr. Antonet Svircev, Agriculture and Agri-Food Canada, Vineland*

Grower Perspective: My Experience Managing Fire Blight

Cathy McKay, Apple Grower/Consultant
Murray Porteous, Apple Grower
Lindsay Pink, Consultant
Paul Frankis, Apple Grower

Q & A Grower/Expert Panel:

Dr. George Sundin
Dr. David Rosenberger
Dr. Antonet Svircev
Cathy McKay
Murray Porteous
Lindsay Pink
Paul Frankis

Pollinators in Horticulture

Thursday, February 19, 2015 - 9:30 am

Native Pollinators in Ontario Agriculture *- Nigel Raine, University of Guelph*

Honeybees in Agriculture *- Ernesto Guzman, University of Guelph*

Integrating Pollinators Into Pennsylvania Apple IPM *- David Biddinger, Pennsylvania State University*

Creating Pollinator Habitat within Farm Systems - *Susan Chan, Farms at Work*

Panel: Making it Work – Encouraging Pollinators on Your Farm - *Kyle Mauthe, Long Point Region Conservation Authority, Sam MacLean, Berry Grower*

2:00 pm **- Ontario Honeybees in the Maritimes Pollinating Lowbush Blueberries** *- Chris Hiemstra, Commercial Beekeeper*

Lowbush Blueberries in Northern Ontario *- Trevor Laing, Northern Ontario Blueberry Grower*

Linking Pollinator Services to Northern Blueberry Production - *Les Eccles, Ontario Beekeepers' Association*

Expert Panel Pollination in Ontario – Your Questions Answered - *N. Raine, E. Guzman, S.Chan, L. Eccles*

IPM and Pollinators - *Hannah Fraser, OMAFRA*

Apiculture in Ontario Update - *Paul Kozak, OMAFRA*

Hort Soils Workshop

Wednesday, February 18, 2015 - 2:00 pm

Dirt Poor or Soil Rich - *Adam Hayes, OMAFRA. Soil health: management practices to improve soil health*

Nitrogen Management 4Rs - *John Lauzon, University of Guelph. Getting the most from your nitrogen dollar means knowing rate, source, timing and placement.*

Getting the Right Rate - *Christoph Kessel, OMAFRA. A soil test is a key tool in planning your 4R program*

4Rs on the Ground: Field Examples - *Adam Hayes, Christoph Kessel, John Lauzon, Greg Patterson, A&L Canada Laboratories Inc*

Hort Engineering

Thursday, February 19, 2015 - 2:00 p.m.

Deer Damage: Analysis and Prevention - *Ben Hindmarsh, OMAFRA*

Spend Cents, but Save Dollars Around Your Cold Storage and Packing Facility - *Hugh Fraser, OMAFRA*

Horticulture Robotics: Where we are, and gaps that need addressing - *Medhat Moussa, University of Guelph*

SmartFresh for Non-CA Cold Storage of Apples and Pears - *George Burkholder, AgroFresh*

OFVC Registration

ONTARIO FRUIT & VEGETABLE CONVENTION

The Ontario Fruit and Vegetable Convention is an annual gathering of horticultural crop producers involved in the production of fruits and vegetables from across Ontario. The 2-day convention is located at the dynamic Scotiabank Convention Centre in Niagara Falls, Ontario, and features a great lineup of horticultural experts, educational sessions, trade show exhibitors and great networking opportunities. Now entering its 13th year, discover for yourself why it is called Canada's Premier Horticultural Event.

Online Registration is NOW Open!
Early bird registration ends February 10, 2015
Its fast, easy and convenient!

Visit www.ofvc.ca for more information
or click on the REGISTER button to reserve your spot at Canada's Premier Horticultural Event.

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