



ORCHARD NETWORK

For Commercial Apple Producers

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Orchard Management

Doing Density

Leslie Huffman, Apple Specialist, OMAFRA Harrow

We've been talking about the concept of high density apples in Ontario for more than 20 years. In fact, I discovered some old slides I made on "Doing Density" for an apple meeting in 1990. In the early '90's, the OMAF Apple Team travelled the province to talk to the early innovators who brought their knowledge of intensive orchards from Europe. The information and experience gathered was presented at several Apple Schools, in a factsheet series, and a Cost of Production study showed that high density was the most profitable.

So high density orchards are not new, but many growers have difficulty accepting that it is the way to go – mainly due to the high investment, as well as the many changes in management required. However, there is a basic concept that is most important to understand why trees should be planted closer. "Doing Density" works because **fruit produced in the early years is much more valuable than fruit produced in later years.**

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ORCHARD NETWORK

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Think about this:

- If someone offered you \$100 now, or \$100 in one year, which would you take? Of course, you'd take the \$100 now.
- Similarly if your orchard produced 100 bushels this year, or 100 bushels next year, which would you take? Again, this year's fruit is more valuable.

This concept is called **Net Present Value (NPV)**, and is a basic economic concept. Think of NPV as the opposite of interest paid. NPV says that money received in the future is at a discounted value compared to its value today.

Choosing to plant at a high density ensures that early yields will be higher. And the higher the density, the higher the early yields will be. Each tree produces only a certain yield (depending on the quality of the nursery tree). So, a newly-planted orchard planted at 1000 trees/acre will produce double the yield of 500 tree/acre planting in the early years.

We've had much discussion about why orchards are planted at less-than-optimum densities: large equipment, lots of available land, high yields from large trees, high cost of nursery trees at high density, etc. But the fact remains that economic analysis over an orchard life has shown that early yields are far more valuable than yields produced in later years.

So, with many growers planning their new orchard plantings, the big question remains: Are you ready to "Do Density" and get those new plantings in at the density that will give you early yields, and early returns? Watch for future articles on other benefits of high density, including quality fruit, lower grade-out, and reduced labour.

High Density Orchard Systems - a View from British Columbia

Dr. John Cline, Associate Professor, Pomology and Tree Fruit Physiology, University of Guelph, Simcoe

One of the most striking features of the landscape in the Okanagan Valley of British Columbia is the abundance of high density orchard systems that have

been adopted by apple producers (Figure 1). These trellised systems, originally developed in Europe, have densities in some cases exceeding 1500 trees/acre (4,140 trees/ha). The impetus for change in British Columbia is linked to the provincial governments replant program. Since 1991, commercial BC fruit growers, and more specifically apple growers, have had access to a replant subsidy of \$3.50/tree for growers planting more than 1 acre. To be eligible for funding, planting densities must range between 1000-2000 trees/acre, (Figure 2), and must meet specific cultivar requirement and minimum support, irrigation, and nursery tree quality standards to help ensure success. While funding for this program is currently scheduled to end in 2010, it is clear that this program has dramatically influenced the adoption of high density super spindle systems.

Similar systems with local modifications are being planted more frequently in Ontario, and over the past 15 years there has been a noticeable shift from the Dutch Slender Spindle to the French Vertical Axis system, primarily to improve productivity afforded by taller canopies. The transition to super spindle orchards by Ontario producers is now occurring as apple growers realize further potential gains through even higher planting densities and fruiting wall canopies.

Clearly the increased costs of establishment and associated risks of crop loss are a major deterrent towards the adoption of the super spindle or higher-density variant of the vertical axis. This is justified. However before dismissing the concept altogether, one should objectively weigh the benefits carefully. The distinct advantages of higher-density spindle systems are: high precocity and production, greater light interception and penetration of pesticides, and improved fruit quality and production of marketable fruit (Figure 3). Furthermore, labour-savings through mechanization of thinning, pruning, and harvesting using mobile platforms will become possible with these very uniform hedge-row systems. An additional advantage is the ability to top-work the cultivar and re-establish production rapidly without replanting (Figure 4).

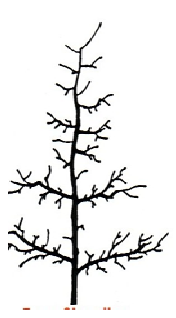
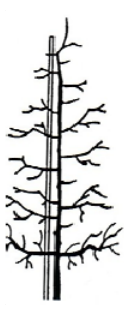
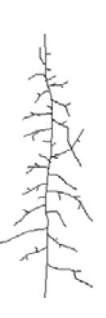
Characteristics of free-standing and supported systems for apple are indicated in Table 1. An on-line calculator to help determine establishment costs of trellised systems is available at www.plant.uoguelph.ca/treefruit/outreach/facts.html.

and rootstock being planted. A realistic estimate of market return, production risk, and analyses of enterprise budgets will ultimately help determine the orchard system that is most suitable for your operation.

As orchard renovation decisions for 2011 and beyond are being made, it is prudent to consider the benefits of high density orchard systems in conjunction with the cultivar

Additional pictures of super spindle orchard systems growing in the Okanagan can be viewed at: <http://tinyurl.com/superspindle>.

Table 1. Characteristics of four orchard systems used in apple production in Ontario.

	Central Leader	Slender spindle	Vertical Axis	Super Spindle
System				
Density	Low	Mod. to high	Mod to High	Very high
Trees/ha	741	1429	1250	2500
Trees/acre	300	578	506	1012
Rootstocks	M.26, MM.106, M.7	M.26, M.9, Bud.9, V.1	M.26, M.9, Bud.9, V.1	M.9, Bud.9
Tree support	Non	Individual post (2" wood)	Individual post (bamboo, wire)	Wire Trellis (individual posts not necessary)
Pruning central leader	cut back	prune to a weaker side branch	do not prune	do not prune
Pruning young trees	select scaffold limbs	minimal	minimal	minimal
Productivity (fruit/ha)	Low	Moderate	High	Very High
Precocity	Low	Moderate	Moderate	High
Tree height (m)	3 to 5	2-3	3-4	3-4
Management Level	Moderate	High	Moderate	
Between Row Spacing (m)	4.5	3.5	4	3-4
In-Row Spacing (m)	3	2	2	0.50-1.0
Initial Investment	Low	Moderate	High	Very High
Marketable Yield	Moderate	High	High	Very High
Requirement for Ladders	Large ladder	None	small ladder	small ladder or platform
Level of Management/Skill	Less	High	Moderate	Moderate
Labour for Pruning and Harvesting	High	Low	Medium	Medium
Cumulative yield after 4 years	Low	Medium	High	Very High

J. Cline, University of Guelph



Figure 3. By virtue of less dense canopies and structural wood, fruit from spindle systems is borne on 2-4 year old wood that is well exposed to sunlight for optimal quality.



Figure 2. Super spindle orchards, such as this 5-yr-old 'Ambrosia'/M.9 growing in Kelowna, BC, are common in the Okanagan.



Figure 4. A 2-yr-old super-spindle orchard grafted over (top-worked) to Pink Lady™. Arrow indicates grafting point.



British Columbia Firm Seeking Approval for Transgenic Non-browning Apple

Dr. John Cline, Associate Professor, Pomology and Tree Fruit Physiology, University of Guelph, Simcoe

A B.C. biotechnology company, Okanagan Specialty Fruits (OSF), has been working for more than a decade on developing apples that do not brown after slicing. The company has been making headlines recently after earlier this year submitting an application to the United States government to grow and market genetically modified apple cultivars that do not turn brown when sliced. The USDA's APHIS branch has considered about 100 petitions for genetically engineered or modified crops in the past. Those that have drawn the most attention have been engineered to withstand certain weed killers, but among those the agency has approved are tomatoes altered to ripen more slowly - the first genetically modified crop approved in the United States, and plums that resist a PPV. This is the first petition for apples in North America.

The technology licensed from Australia's national research organization (CSIRO), inhibits browning of the apple flesh by silencing a gene that produces the enzyme polyphenol oxidase. OSF has developed non-browning 'Golden Delicious' and 'Granny Smith' apple cultivars under the "Arctic" brand, and are also working on developing the technology for 'Gala' and 'Fuji'. The technology works by taking a specific section of the apple genetic code and flipping it backwards (called 'anti-sense') so the two copies of that bit of code interfere with each other. There are no foreign genes added to the cultivar. An eight-hundred base pair sequence of the 70 million base pairs that make up the apple genome, are affected. This ultimately prevents the production of the protein polyphenol oxidase (PPO), by silencing the gene that produces PPO. Polyphenol oxidase is contained in fruit cell vacuoles that react with antioxidants and phenolic when damaged or cut.

Not surprising, there are critics of the technology. OSF apparently is not pursuing approvals in Europe because of consumer acceptance and regulatory hurdles. Others object to altered apples because of possible repercussions of cross-pollination with conventional and organically growth orchards and gaps in knowledge about GMO's long-term environmental and human health effects.

The company argues that consumers have had available to them non-browning apple slices in fresh-cut prepared fruit trays and sliced bagged fruit using a solution of calcium ascorbate (calcium and vitamin C) to maintain the natural colour of the fruit. These products are expensive and propriety in nature. Opposition to the technology is being raised by Crunch Pak of Cashmere, Washington, a world-leader in the sliced apple market.

Most will agree that consumers will make the final call. They have accepted other genetically modified crops, but whether they will do the same with apples remains to be seen.

Cost of Planting New Orchards and Producing High Quality Apples

Sarah Marshall, Ontario Apple Growers; Leslie Huffman, Apple Specialist, OMAFRA, Harrow; John Molenhuis, Business Analysis and Cost of Production, OMAFRA, Brighton

Finally! – we've updated the Cost of Production for Ontario Apples. This project took two years to complete, and many versions of a spreadsheet, but now we can confirm some facts about growing apples in Ontario:

Since 2005, apple yields in Ontario have increased by 37% but costs have increased by 57%.

Cost of Production (Established Orchards)

32¢ per pound (based on
Ontario average yield of 27,745 lbs)

Note: The 2009 Marketer survey showed grower net return averaged 20¢ per lb (all varieties), including:

Gala 26¢ per lb
Honeycrisp 56¢ per lb
McIntosh 17¢ per lb
Empire 18¢ per lb

Cost of Establishment (full production by 7th year)

Total investment to plant and manage one acre is
\$44,164/acre (\$71/tree)

Note: new orchard is planted at 622 tree/acre, trellised, tile drained, trickle irrigated, with one year site preparation before planting

Note: This does not include returns for apples harvested or land costs

John Molenhuis, OMAFRA has analyzed this study and concludes:

At current average yields in Ontario (27,745 lbs/acre), there is no breakeven.

At 20 cents per lb net return, the yield needs to exceed 62,500 lb/acre in order to cover total annual costs

Yield needs to exceed 35,000 lbs/acre at a net return of 35 cents per lb to be profitable

The Ontario Apple Growers will be providing growers with a printed version of this report, to use as a planning tool.

Crop Protection

Increased San Jose Scale in Apple Orchards in 2010

Kathryn Carter, Pome Fruit IPM Specialist, OMAFRA, Simcoe

In 2010 we observed high levels of San Jose scale damage in several apple growing regions in Ontario. San Jose scale are insects that feed on the sap from bark, fruit and leaves of apple. Insect feeding causes bright red spots to appear on the fruit. This pest is increasingly a concern in packinghouses with the new high-tech grading equipment which is unable to differentiate scale damage from the foreground color on a bi-coloured apple.

San Jose scale overwinter as partially grown scales attached to the bark of trees. When the sap begins to run in the spring, the scales begin to grow, and are completely mature by late May. The adult males are small winged insects that emerge and mate with sedentary females. Females produce up to 150-500 live offspring known as crawlers. These crawlers begin feeding on the sap of bark, fruit and leaves with their piercing mouthparts. After three weeks, the young crawlers molt and lose their old skins, legs, and antennae to become a flattened sac with waxy caps. They remain attached to the trees with their mouthparts. There are two generations of scale each year.

Examination of bark and twigs during pruning may help to detect scale infestations. Scale infestations are often irregularly distributed throughout orchards and generally are found in the upper part of the tree canopy where spray coverage may be inadequate. Pruning orchards to remove infested branches and suckers can help to open the canopy and allow for better spray penetration.

Scale can be managed using dormant oil applications targeting adults. The crawler stage does not possess any waxy covering, and is the optimal stage for control. Insecticides (Movento or Diazinon) targeting crawlers can be applied mid-June and mid-August.

Equipment to Reduce Spray Drift in Orchards

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

The spraying season is over, leaving time to reflect a little and consider making changes for next year. Would you like to:

- Keep more of your product on target?
- To extend your spray window (a little)?

- Improve the overall effectiveness of your applications?
 - Reduce the risk of off-target deposition?
- Well, you can, by making some adjustments to your spray equipment to reduce pesticide drift.

Spray drift is everyone's responsibility. All reasonable precautions must be taken to prevent spray drift, especially near human habitats, open water and sensitive crops. Extremely low (or invisible) amounts of spray drift can be damaging, sometimes long after the application.

Generally, the goal is to produce a coarser spray quality and bring the nozzle as close to the target as possible, without compromising coverage or spray quality.

For airblast sprayers, the potential for drift can be reduced by:

- Adjusting the fan to the minimal effective air speed throughout the season. High fan speeds early in the season are almost never appropriate;
- Increasing droplet size by using lower pressures, air-induction nozzles or disc-core (or disc-whirl) nozzles that produce a coarser spray quality;
- Using deflectors to channel air into the target (not over or under);
- Using towers to reduce distance-to-target and direct air into the canopy. Be careful not to get any closer than 50 cm;
- Using foliage sensors that turn boom sections on and off to match the size and shape of the canopy; and
- Switching to a tangential, recycling, multi-duct, or multi-fan sprayer. These sprayers are rare in Ontario, but are available. Ask your local retailer. Many pay for themselves in saved pesticide.

Be aware that good equipment can reduce, but **does not eliminate** pesticide drift (see Figure 1). Weather still plays a large role.

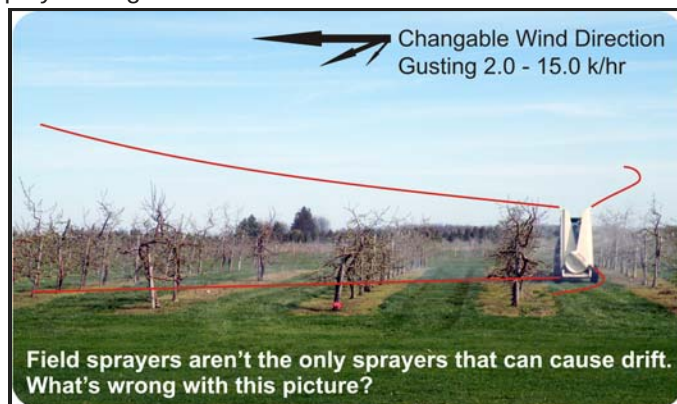


Figure 1. Even with the best equipment, weather plays a big role in increasing or decreasing the potential for pesticide drift.

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Check out OMAFRA factsheet 09-037W “How Weather Conditions Affect Spray Application”

www.omafra.gov.on.ca/english/crops/facts/09-037w.htm

A new OMAFRA Factsheet on Pesticide Drift will be available before next year's spraying season.

Also, here are two videos hosted by the Ontario Pesticide Education Program:

How to manage spray drift:

www.opep.ca/Video/video.cfm?name=video7

Spray drift reduction through air induction:

www.opep.ca/Video/video.cfm?name=video8

Considerations for Managing Replant Disease in Apples

Michael Celetti, Plant Pathologist, OMAFRA, Guelph

Apple replant disease (ARD) is a complex disease that occurs at sites where apples are replanted after removing old trees. Pathogens and/or parasitic nematodes build up around the roots of mature trees which can overwhelm young trees planted on the same site. These replant trees can be severely stunted and may die prematurely. Replant disease has significant economic implications on orchard productivity over the life of the orchard.

Unfortunately, the causal agents involved with ARD are complex and often differ between regions and orchards. Several soil-borne pathogens contribute to ARD including *Cylindrocarpon*, *Phytophthora*, *Pythium spp.*, *Rhizoctonia spp.* as well as parasitic nematodes and bacteria. The exact combination or types of pathogens involved differ between regions and orchards. In Ontario, the most common root rot pathogens associated with ARD are species of *Phytophthora*.

Sometimes, no specific pathogen or complex can be associated with the poor growth but other factors such as soil pH, toxins, poor soil structure, heavy metal and arsenic may be involved. Regardless, research showing dramatic tree growth in response to soil pasteurization and fumigation in replant sites suggests that ARD is primarily a biological phenomenon.

Fumigation with Telone, Vapam and Chloropicrin has been shown to significantly reduce or eliminate ARD at most sites. Unfortunately Telone will no longer be available in Ontario after 2011. Other fumigants are currently under re-evaluation by the Pest Management Regulatory Agency (PMRA) and may not be available. Options to replace fumigants are being evaluated, but will not be as convenient or consistent. An integrated approach utilizing several techniques will be necessary to successfully managing ARD in the future. The

following are some tips when replanting an old orchard site:

1. Remove old roots. The pathogens attributed to most ARD problems are harboured in old roots.
2. Test the soil. Nutrients, soil pH and nematodes should be tested prior to planting, and possibly additional tests for potential ARD pathogens. A DNA Multiscan is now available for multiple organisms.
3. Rotate to non-host crops. Some pathogens will die due to natural attrition when food sources like roots are not available. Leave the site fallow, or plant an annual crop or cover crop to reduce pathogens. Brassica cover crops such as Oriental mustards contain toxins that are released when chopped green and immediately incorporated to kill soil pathogens. Biofumigants can be as effective as fumigants to suppress pathogens to allow newly planted trees to establish, although there are many factors that affect success. Read more about biofumigants in the following article.
4. Improve soil drainage. Installing tile drains will reduce the potential of standing water for prolonged periods and the risk of spread of *Pythium* and *Phytophthora*.
5. Select tolerant rootstocks, especially to *Phytophthora spp.* Cornell University researchers have developed rootstocks with resistance to *Phytophthora* (eg. G65, G30, G16, G11, G202). M9 rootstocks tend to have some *Phytophthora* resistance where as M26, M7, M104 and MM106 are considered moderately to very susceptible.
6. Improve soil health. The addition of properly composted manures and growing cover crops such as pearl millet will significantly improve soil structure, provide additional organic matter and improve water permeability.

Cover Crops and Biofumigants For Apple Replant - An Update

Anne Verhallen, Soil Management Specialist, OMAFRA, Ridgeway; Leslie Huffman, Apple Specialist, OMAFRA, Harrow

This spring we started a new OMAFRA funded project looking at using biofumigant cover crops in tomato production and during apple orchard renovation for replanting. Chemical fumigants are expensive and are under close environmental scrutiny. Cultural options of non-host rotation crops like pearl millet or biofumigant cover crops offer some potential to suppress nematodes and disease complexes in these production systems.

Three apple replant sites were established in spring 2010. A full suite of soil samples were taken before cover crop establishment for fertility, nematodes, disease pests and soil health and analyzed at A&L Laboratories in London. Here is an update as we start analyzing the test results. The nematode results do not indicate significant numbers of nematodes present in any of these locations. The low nematode numbers may be a

(Continued from page 6)

result of the tillage and timing of sampling. The samples were also analyzed for the presence of a number of disease organisms including *Verticillium*, *Fusarium*, *Colletotrichum*, *Phytophthora*, *Pythium* and *Rhizoctonia*. It was encouraging to see the consistency of the results across the plot area.

Cover crops of mustard or pearl millet were grown over the summer and worked into the soil. All of the treatments within the plots will be re-sampled in the spring of 2011 just before the new trees are established. The early growth of the apple trees will also be monitored to determine the impact of the biofumigant treatments.

We will keep you abreast of the project through updates in this newsletter.

Pest Alert: Brown Marmorated Stink Bug

Hannah Fraser, Horticultural Crops Entomology Program Lead, OMAFRA, Vineland

Apple growers should be on the lookout for a potential new pest. The brown marmorated stink bug (BMSB) is an invasive alien species that was introduced to Pennsylvania about 10 years ago. Since that time, it has spread and has now been reported in over 26 states. The BMSB is an excellent hitchhiker and is readily moved over great distances in cargo and vehicles. In Canada, the BMSB has not been found yet in any crops; however, this pest was intercepted in some shipments of imported goods coming into several provinces including Ontario. It is likely only a matter of time before this insect shows up in the field. The United States Department of Agriculture does not regulate BMSB. The Canadian Food Inspection Agency (CFIA) has not formally communicated their decision on BMSB, but since it has spread over such a wide area in the US and because it is not possible to control the pathways for introduction, it is very unlikely that this insect will be regulated in Canada.

Why worry about the BMSB? This insect has a very large host range that includes over 100 plant species, such as stone and pome fruit, berries, grapes, vegetables (corn, tomatoes, peppers), soybeans and edible beans, hardwood and ornamental trees, and woody shrubs. Extensive damage has been reported in commercial tree fruit in areas where this pest has reached high population levels. **In apples, damage by stink bugs is easily confused with bitter pit** (see Figure 1).

Brown marmorated stink bug adults overwinter in sheltered areas that may include homes and other heated structures. As they can aggregate in large numbers, the BMSB has become a considerable

nuisance pest for home owners where established. While the bugs do not bite humans, they will release a foul smell when handled or otherwise disturbed. Aggregation in artificial structures is not common among stink bugs, and is a behaviour that may provide an early warning that BMSB has established in Ontario.

Common stink bugs and other similar looking insects are easily confused with the BMSB, including species of brown stink bugs, rough stink bugs (common in orchards), western conifer seed bugs (which also end up in homes), and squash bugs. All of these bugs have obvious alternating light and dark pattern geometric described as being “checkered”, a feature which may confuse the untrained eye. The BMSB is a relatively large stink bug (up to 17 mm), with smooth / untoothed “shoulders” (edges of the thorax), and with **two white bands on each antenna** that are not found on other common stink bugs (Figure 2); this feature is obvious on adults and on nymphs.

Timely identification of this insect while populations are low will facilitate response and allow for the implementation of management strategies to limit damage to agricultural producers. We could use your help with the early detection of BMSB. If you find suspect damage or suspect stink bugs, please submit a sample to the University of Guelph Pest Diagnostic Clinic, the CFIA, the National Insect Collection in Ottawa (they have an identification service, see <http://www.canacoll.org/NIS/NIS.html>) or an OMAFRA office.



Figure 1. Feeding damage in apple may be confused with bitter pit (Steve Jacobs, Entomology, Penn State Univ.)



Figure 2. Late instar BMSB nymph. Note the obvious white bands on the legs and the antennae. (Gary Bernon, USDA APHIS, Bugwood.org)

Post Harvest

Abstracts of Recently Published Research on the Storage of Apples

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

Effects of Preconditioning and Fruit Maturity on the Occurrence of Soft Scald and Soggy Breakdown in 'Honeycrisp' Apples

R.E. Moran (Univ. of Maine), J.R. DeEll (OMAFRA), and D.P. Murr (Univ. of Guelph)

HortScience 45(11):1719-1722, November 2010

Preconditioning, holding fruit at 10, 17.5 or 21°C temperatures for up to 7 days prior to placement in cold storage, was inconsistent in its effect on soft scald and soggy breakdown in 'Honeycrisp' apples in Maine and Ontario. In Ontario, 4 days of preconditioning at 21°C increased soft scald in one year, but had no effect in the next year. Five days of preconditioning at 10°C reduced soft scald, and had no effect on soggy breakdown in one year, but reduced it the next year. In Maine, 5 days preconditioning at 17.5°C was effective in reducing soft scald and/or soggy breakdown in 2002 to 2007 when starch index at harvest was 5.9 to 7.2. Seven days of preconditioning at 17.5°C increased soggy breakdown with an early harvest in two orchards, but only in one of two orchards with a later harvest. This same preconditioning had no effect on soft scald with the first harvest, but reduced it with the second. In the following year, the same preconditioning treatment increased soft scald and soggy breakdown with an early maturity, but had no effect with a later maturity in one orchard, but not in fruit from another. Conditions during preconditioning and subsequent cold storage temperatures varied from previous recommendations, and this may be why preconditioning was not consistent in our studies and in some cases increased chilling disorders.

The results indicate that preconditioning (or delayed cooling) is not always effective or consistent at reducing disorders in 'Honeycrisp' during storage.

Temperature and Carbon Dioxide Interactions on Quality of CA-stored 'Empire' Apples

C.B. Watkins and F.W. Liu (Cornell Univ.)

HortScience 45(11):1708-1712, November 2010

The storage potential of 'Empire' apples in controlled atmosphere (CA) storage has been studied. Fruit were treated with a range of CO₂ from 0 to 5% at storage temperatures of 0, 0.5, and 3°C. The predominant storage disorders that developed were external CO₂ injury, flesh browning (chilling injury), senescent breakdown (soft flesh

browning), and core browning. All disorders except external CO₂ injury increased with longer storage periods. The incidence of external CO₂ injury was usually greater with higher storage temperature, whereas flesh browning was worst at lower storage temperatures and senescent breakdown was higher at warmer storage temperatures. The effect of storage temperature on core browning was not consistent. External CO₂ injury, flesh browning, and core browning incidences were higher with increasing CO₂, especially above 2%. Flesh firmness was lowest at warmer storage temperatures and in the absence of CO₂. Orchard to orchard variation for all factors was high. Relationships of disorders with mineral concentrations were specific to disorder and storage conditions.

The results suggest that 'Empire' should be stored at 1 to 2°C, reflecting a compromise between risk of flesh browning at 0°C and risk of senescent breakdown and unacceptably soft fruit at 3°C and that CO₂ should be maintained below 2% and closer to 1%.

Reduced risk control options for apple postharvest diseases in long-term storages

D. Errampalli and L.I. Wainman (AAFC, Vineland), and J.R. DeEll (OMAFRA)

ISHS Annual Meeting in Lisbon, August 2010

Blue mould caused by *Penicillium expansum* and gray mould caused by *Botrytis cinerea* are the two important postharvest diseases of apples in Canada in long term storages. In recent years, 1-methylcyclopropene (1-MCP) has shown tremendous potential in maintaining fruit quality in apples during storage. The objective of this study was to determine if 1-MCP affects the control of postharvest blue mould and gray mould with reduced risk postharvest fungicides, fludioxonil (a phenylpyrrole), and pyrimethanil (an anilinopiramide) on 'Empire' and 'McIntosh' apple fruits. The fruit that had been wounded immediately after optimum harvest for long-term storage (as determined by internal ethylene content and starch staining) were treated with/without 1 ppm 1-MCP for 24 hours at 0°C. Control did not receive 1-MCP. In post-inoculation treatments, wounded apples were inoculated with 1 x 10⁴ conidia/ml of either TBZ-resistant *P. expansum* or *B. cinerea* and incubated for 18-20 hours at 13°C, and then drop treated with appropriate concentrations of fungicides. Treated fruit were incubated in cold storage at 2°C for up to 6 months, or in controlled atmosphere (CA) storages for up to 5 months ('McIntosh'; 3°C, 1.5% O₂ and 2.5 % CO₂) and 6 months ('Empire'; 1.7 °C., 2.5% O₂ and 2.5 % CO₂) and in a subsequent shelf-life study at 20°C for 7 days. Both fungicides were found effective against blue mould caused by TBZ (a benzimidazole)- resistant *P. expansum* and gray mould caused by TBZ (a benzimidazole)-resistant *B. cinerea* in apples in cold and CA storages. 1-MCP has neither positive nor negative effect on the control of blue mould or gray mould with postharvest fungicides.

(Continued from page 8)

Effect of short-term air storage after removal from controlled-atmosphere storage on apple and fresh-cut apple quality

P.M.A. Toivonen, P.A. Wiersma, C. Hampson, and B. Lannard

Journal Sci. Food Agric. 90:580–585, 2010

One of the realities of apple distribution for long-term stored fruit is that a controlled-atmosphere (CA) storage room will be unsealed and fruit held in air storage and marketed over several weeks. This work was conducted to determine the effect of post-CA air storage of whole fruit on potential shelf life for fresh-cut apple slices. Fresh-cut slices of 'Spartan' and 'Delicious' apples held in post-CA air storage for 2 or 4 weeks showed the least changes in cut surface color as compared with those made from apples immediately on removal from CA. Shelf life was most improved by post-CA air storage in the 'Spartan' apples, which were more advanced in maturity as compared with the 'Delicious' apples. Internal ethylene concentration, firmness, and respiration changed significantly with post-CA air storage, suggesting a relationship between physiological status of the whole fruit and shelf life of slices made from that fruit.

The results support the hypothesis that apples had suppressed physiological activity in CA storage and are susceptible to accelerated deterioration upon cutting. Holding fruit for 2 weeks in air storage allowed recovery of physiological activity, which resulted in greater resistance to deterioration in response to fresh-cut processing.

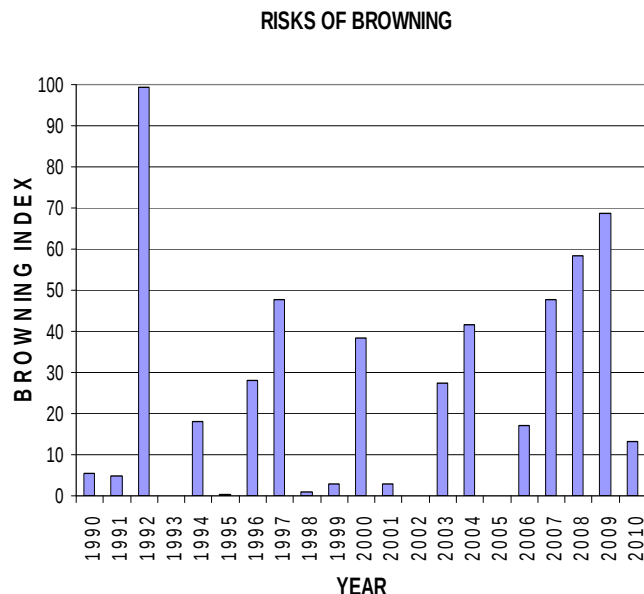
Slight Risk of Chilling Disorders for 2010-11 Storage Season

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

CIPRA is a computer-based program (developed by the research team of Dr. Bourgeois, AAFC-QC) that can use weather data to predict the risk susceptibility of apples to certain storage disorders (Bourgeois, DeEll, and Plouffe). According to CIPRA (utilizing weather data in July and August from Norfolk County), the risk for low-temperature or chilling-related disorders in apples during the 2010-11 storage season is lower than it has been for the past few years.

The figure below shows the results from 1988 to 2010 using weather data from Norfolk County in Ontario. The model indicates that there is a **13% risk of chilling-related disorders developing during storage this year** (i.e. flesh browning, low temperature breakdown, soft scald). Although this risk may seem relatively low, it would be wise to take samples from storage whenever

possible and check for chilling disorders. In addition, be sure to use the recommended storage temperatures for all cultivars. 'Empire', 'McIntosh', and 'Honeycrisp' are especially susceptible to chilling-related disorders.



Announcements

Calling all Ontario Cider Producers

We invite all Ontario cider producers to submit their best sweet cider to the **1st Annual Ontario Sweet Cider Competition**, at the Ontario Fruit & Vegetable Convention, St. Catharines on **February 23, 2011**. Bring two 4L jugs of your cider on Feb. 23. This competition is open to all Ontario cider makers, including those who use a custom presser. Plan to attend this workshop too.

Apple Cider Workshop, February 23, 2011.

- | | |
|----------|--|
| 9:30 am | Michigan's Sweet Apple Cider Industry
Dr. Bob Tritten, Michigan State University |
| 10:00 am | Developing a Sweet Cider Business in Michigan
Mike Beck, Uncle John's Cider Mill, St. John's, Michigan |
| 10:30 am | Best Management Practices for Ontario's Cider Producers
John Henderson, OMAFRA, Brighton |
| 11:00 am | Starting a Hard Cider in Michigan
Dan Young and Nikki Rothwell, Tandem Ciders, Suttons Bay, Michigan |

Ciders will be judged on Feb. 23, (afternoon). Judging is open to the public. Winning entries will be announced at the Apple Session on February 24, and will be available to taste before the session.

Ontario Fruit & Vegetable Convention 2011

We are looking forward to seeing you at the 2011 OFVC on February 23-24, 2011 at Brock University, St Catharines, ON. This conference gathers the best speakers from Canada, and the United States on the latest innovations and advances in the fruit and vegetable industry. Guest speakers include farmers, researchers and government specialists providing technical and applied information to produce quality fruit & vegetables.

In addition to the Apple Session and Apple Cider Workshop, several other sessions may be interesting to apple growers. Highlights of the sessions include:

- Talking to a skeptical society about pesticide safety, Dr. Steve Savage Cirrus Partners, Evergreen, CO
- Pest control with reduced pesticide and carrier rates in nurseries, Dr. Heping Zhu, Wooster, Ohio,
- Air assisted spraying— More air is not better, Dr Bernard Panneton, AAFC-QC
- Water sensitive paper—Saving time and money, Helmut Spieser, OMAFRA
- Matching Spraying to Canopy-Crop Adapted Spraying, Dr. Jason Deveau, OMAFRA
- Tips on getting a Permit To Take Water (PTTW), Harold Schraeder, MOE.
- Utilization of compost in fruit and vegetable production
- Economics of organic agriculture, Dr..Gregory Peck, Cornell university, NY
- Consumer trends in Organic Agriculture, Dr Isabelle Lesschaeve, VRIC

The Farmers and Friends evening event promises an abundance of tantalizing wines and savoury food. The Trade Show is almost sold out with exhibitors from as far away as Italy and California.

Registration forms and an updated program are available in the Fruit and Vegetable Magazine, at local OMAFRA Resource Centres, or online at www.ofvc.ca.

OFVC Apple Program

Thursday, February 24, 2011 - Room 202

- 9:30 a.m. **What We've Learned about McIntosh Dieback in Michigan**, Dr. Nikki Rothwell, Michigan State University
- 10:15 a.m. **Apple IPM is Changing: Emerging Pests and New Issues**, Kathryn Carter, OMAFRA, Simcoe
- 10:45 a.m. **Panel: Ideas on Orchard Renovation**
Keith Wright, Wrightland Farms, Harrow
Harold Schooley, Schooley Orchards, Simcoe
Chris Hedges, Simcoe
Dr. Ron Perry, Michigan State University

Lunch & Trade Show

- 2:00 p.m. **Growing Great Gala**
Leslie Huffman, OMAFRA, Harrow
- 2:30 p.m. **Updates on McIntosh and Empire Apple Storage – A New York Perspective**
Dr. Chris Watkins, Cornell University, Ithaca, NY
- 3:00 p.m. **Enhancing the Storability of Fresh Apples**
Dr. Jennifer DeEll, OMAFRA, Simcoe
- 3:30 p.m. **Vision Robotics for Orchards**
Tony Koselka, Vision Robotics, California

Ontario Apple Academy - "Harvest More Profits"

The Ontario Apple Growers is organizing this exciting school for growers and farm managers, focusing on business aspects of growing apples. Mark your calendar to include this 2-day program as part of your winter education.

February 8 & 9, 2011
Hockley Valley Resort
793522 Mono Third Line
Orangeville, ON

Registration: \$98 per person
Includes meeting materials, welcome reception, two breakfasts, two lunches, coffee breaks, and a buffet dinner, but does not include overnight accommodations.

This project is funded in part through the Agricultural Management Institute (AMI). The AMI is part of the Best Practices Suite of programs for Growing Forward, a federal-provincial-territorial initiative.

Look for more information from the OAG shortly.

Food Safety and Traceability Program, 2011

OMAFRA is currently in the process of finalizing the 2011 FSTI program, materials and information sessions.

Information sessions will be held in February 2011. There will also be WebEx sessions as well that you can log into via your computer. Please check the OMAFRA website at: www.omafra.gov.on.ca/ for a list of locations, dates and other information. Register on-line or via the Agricultural Information Contact Centre, 1-888-479-3931.

There are **small updates** to the Guide book and Application which will be available in early January 2011. **Please ensure you use the updated Application and Guide book (Version 3).**

Applications will be accepted in early March 2011.

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