



ORCHARD NETWORK

For Commercial Apple Producers

Volume 10, Issue 3

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ORCHARD MANAGEMENT

'Aurora Golden Gala™' Management Options

John Gardner, Apple Specialist, OMAFRA, London

The 'Aurora' apple is a high quality yellow skinned dessert apple that is grown in B.C. to an attractive high quality fruit with a 6 – 7 month storage life and good shelf life. Test trees of Aurora have been planted in Ontario by a number of growers. It matures in Summerland (B.C.) approximately 145-155 days past the 90% king bloom stage of bud development. The tree has an excellent growth habit and is highly suitable for high density apple culture. Under North East and specifically Ontario growing conditions, 'Aurora' can have a tendency to be small, green and squatty in shape when grown without any special treatment. Fruit quality on younger trees appears to be generally poorer when compared to more established trees.

A small-scale trial was installed in 2006 at the Birnam cultivar trial site in Lambton County to investigate whether or not a program using Promalin containing BA and the gibberellins A4 and A7, and the particle film known as Surround Crop Protectant would have any influence on the size and finish of this cultivar grown under Ontario conditions.

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This issue of the **Orchard Network
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Promalin was applied 3 times at label rates starting at petal fall and followed by a summer program of Surround applied 6 times from early June to the middle of August. Treatments were applied to individual apple trees on M9 rootstock in their 4th leaf in a replicated plot design. All trees in the trial were managed by chemical thinning and sprayed according to accepted IPM standards.

Trees treated with Promalin (3 applications) during the fruit-set period and Surround Crop Protectant during the summer produced fruit that averaged 182 grams in weight, were very typey and had a silky smooth lemon yellow finish. Control trees produced fruit that averaged 151 grams weight (Figure 2), were very squatty in shape and greenish in colour. See attached photo, Figure 1. This treatment regime for Promalin/Surround appears to enhance the performance of young 'Aurora' trees, in the absence of more mature trees to compare with.

In discussing this cultivar with Dr. Cheryl Hampson (AAFC, B.C.) the emphasis in crop culture of 'Aurora' in B.C. is on early thinning for best fruit size and finish.

'Aurora' should be harvested in a single pick, based on starch degradation between 4 and 5 on the Cornell generic starch chart. If fruit are left on the trees too long into the maturity cycle they could get waxy and some stem-end cracking could develop.

According to the folks at PICO who have been working to establish Quality Assurance Guidelines for Aurora Golden Gala™:

"Picking too early increases finger bruising. Texture retention in storage has not been a problem regardless of pick date and pre-harvest drop is negligible. Leave small or green fruit in the orchard. Fruit from young trees should be separated from fruit from older trees. Young-tree fruit tends to have russet and a more squatty fruit shape. Consider de-fruiting young trees to encourage tree growth."

Pruning: The tree puts out a large number of fruiting spurs. If using a superspindle system, this can be used to advantage to reduce thinning later, by judicious removal of fruit buds. The trees are less vigorous than Gala, and may need stronger pruning periodically to re-invigorate them. This is particularly true if the tree has been overcropped in the past, or overcropped in its early years. Spur renewal pruning is needed to keep the variety vigorous and productive, and to maintain good fruit size.

Chemical Aids: The use of ReTain is discouraged. Pre-harvest drop is negligible with Aurora Golden Gala™. The variety can be difficult to pick and the use of ReTain will accentuate this feature, leading to finger bruising."

Packing House Receiving

Fruit from young trees should be segregated, as it is likely to have more cosmetic defects. At PARC (AAFC, B.C.) we have successfully stored Aurora Golden Gala™ at 1°C in air until March or April. Keep Aurora Golden Gala™ away from direct blowing of the cooling system or it may develop some soft scald. Put a bin of Gala or some other non-susceptible cultivar on top of the stack, or cover the top bin with a tarp.

Grading and Packing

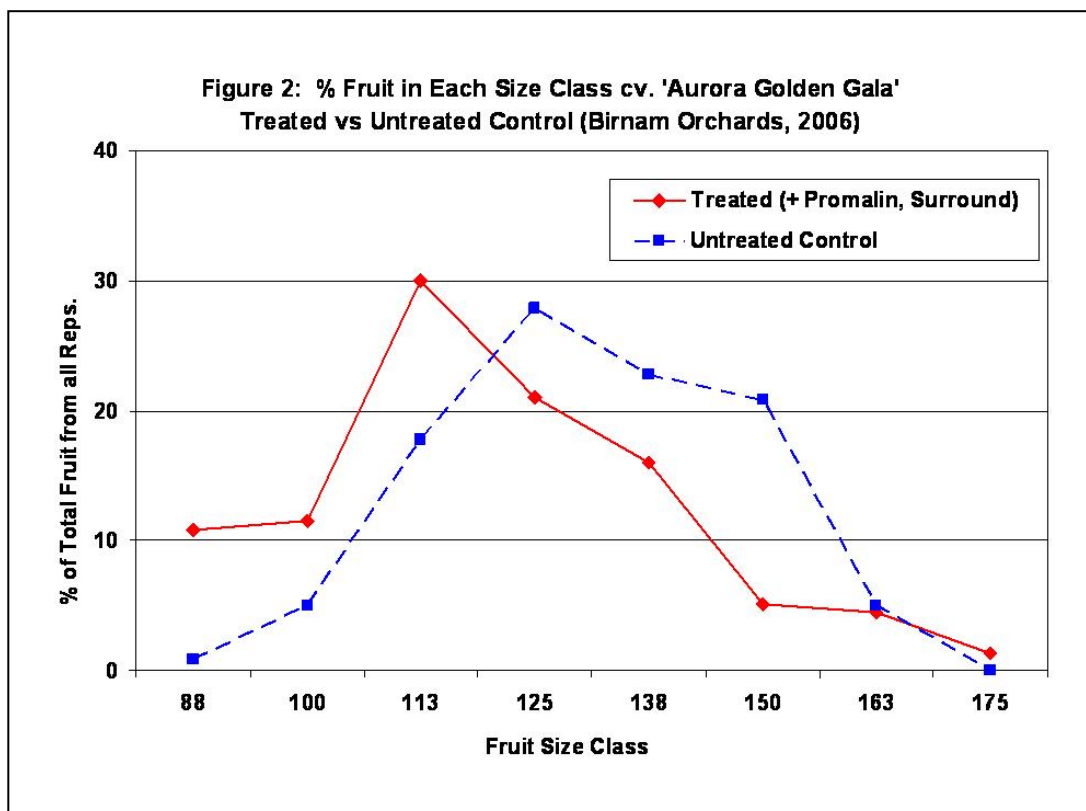
Storage life of Aurora Golden Gala™ is normally good. Pilot experiments at PARC (Pacific Agri-Food Research Centre) have demonstrated that holding the fruit for 6-8 weeks prior to packing can reduce packing line bruising. Warming the fruit slightly (to 12-15°C) prior to running it over the line also reduces bruising significantly. Green fruit bruise more and recover poorly.

The fruit will scabble bruise. It should be returned to cold storage after packing to allow the scabble bruising to come out. Early experience in B.C. suggests that this may take longer with Aurora Golden Gala™ than it does for Golden Delicious.

Consider imposing a cutoff on fruit size e.g. those below 138 to be rejected. Such fruit come from overcropped trees and they taste watery and bland. CA storage regimes have not been worked out. No MCP work has yet been done with Aurora Golden Gala™.



Figure 1 – Treated 'Aurora' trees produced fruit as shown on the left while untreated check trees produced fruit similar to what is shown by the apple on the right. See discussion on Promalin/Surround. These apples are from experimental trees at the Birnam Orchard site.



Light Management in Ontario Orchards on Red and Bicolour Cultivars Using Light Reflective Fabric Ground Covers

An HCO (Horticultural Crops Ontario) Funded Project for the 2006 Growing Season

John Gardner, Apple Specialist, OMAFRA, London

Installation of Materials: Ten 350-ft rolls of 12.5-ft wide reflective “Extenday” were distributed to apple growers in Middlesex and Elgin Counties just shortly after bloom during the 2006 growing season. Growers installed the fabric mulch on red and bicolour cultivars, including Honeycrisp, Empire, Marshall Mac and Gala cultivars shortly after the bloom period. We wanted to get some feedback from commercial growers on how it handled and what, if any, benefits accrued from its use.

Summer Field Tour: Ontario growers met on August 17th to look at field demonstration plots in the London area. Amongst those various plots looked at by the group were those that had “Extenday” mulch in use on both McIntosh and Honeycrisp plantings. See Figure 1.



Figure 1 - Field Tour Showing Extenday, 2006

Positive Findings

- Colour enhancement in lower canopy fruit
- Significantly higher volume of fruit in the first harvest
- Added photosynthetically active radiation in lower canopy
- Reduced cullage from poor colour, size and sugars

- Enhanced soil moisture from a reduction in evapotranspiration
- May provide stronger return bloom and fruit bud initiation in lower canopy (to be validated in the spring of 2007)

On the Other Hand

- Relative weight of material is heavy
- Potential mouse problems under the mulch
- Not a cost effective treatment for immature or low yielding blocks
- Material can get very dirty looking, especially in a wet year (See Attached Figure 2)
- Handling large amounts of material will have to be done mechanically – with specialized equipment
- Costly @ 100% coverage of the orchard floor
- Extenday fabric mulch could have a tendency to creep as the tractor moves down the row
- May be better suited to a more arid environment
- May have to push the material aside when summer pruning in order to mulch the prunings



Figure 2 - Extenday on a block of Marshall Mac, 2006

Plans for 2007

I will be following up with the producers that had the material in 2006. All of the inventory was lifted in the fall of 2006 and stored over winter. The net effects of the material on fruit bud production should be evident in the spring of 2007 where it was used in 2006. The added sunlight in the lower canopy area of the oldest blocks should have produced more fruit buds in those lower canopy positions. I will be following up to see if any of those effects occurred.

Funding for the Project:

The author would like to thank HCO for their support in funding this field study.

Co Operators:

Gerry and Paul Crunican, Elginfield

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Nutrient Removal by an Apple Crop

John Gardner, Apple Specialist, OMAFRA, London

Peter Zwart, Horticulture Nutrition Program Lead, OMAFRA, Guelph.

Back in the early 70's it was common to refer to the value of nutrients contained in a pound of apples. There were discussions with other horticulturists about that value being so many cents per pound and it was rationalized that yes a few pounds of apples is indeed worth between a nickel and a dime in terms of fertilizer value. This makes even more sense when we pay our fertilizer bills as an input for apple production. If we take this one step further we can indeed calculate what nutrients a large crop of apples will remove from an acre or hectare of managed orchard.

This doesn't include any nitrogen losses from pollen carried away by bees in the spring of the

year. Pollen itself is a nitrogen sink and a mature higher density planting of apple could easily produce over 100 lbs per acre of pollen. Pollen is protein rich and nitrogen is part of the amino acid complex found in pollen. This also does not include nutrients taken up by the tree and used to build tree structure or for the feeding of beneficial flora and fauna in the orchard.

This past growing season (2006) could be characterized by the apparent lack of crop in some blocks of orchard in the south west and in contrast some of the heaviest yields for other blocks and different varieties. When picking crews are not moving as fast as you think they should, it could mean one of two things. Either the producer has done a poor thinning job in the orchard or the crop is so heavy that it is holding the crew back. We would like to think that it is for the second reason.

If we take a metric tonne of apples, to see how much of each nutrient is in it, it works out to what is shown in Figure 1.

Back in 1999 at an IDFTA meeting in Hamilton Ontario we heard from Dr. Wolfgang Drahorad of the South Tyrolean Advisory Services talking about how much nutrient is contained in a 45 bin/ac or 45 metric tonne per hectare yield. Those figures are shown in Table 1.

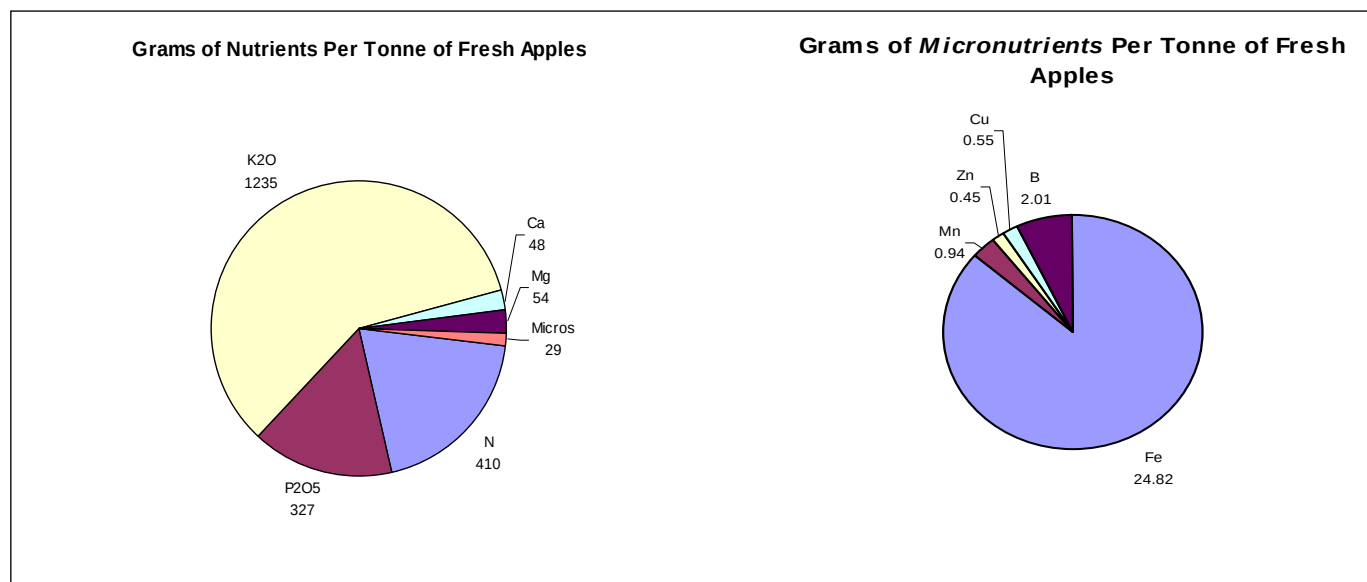


Figure 1. Typical nutrient content of apples in grams per metric tonne.

Table 1. Nutrients removed by a 45MT/ha apple crop

Nutrient	Kg/ha	Lb/ac
N	15.7-22.5	14-20
P2O5	9.9	8.8
K2O	54-72	48-64
CaO	3.3	3
MgO	3.6	3.2

In his talk, Dr. Drahorad explained that when deciding on how much fertilizer to use after harvesting a large crop of apples one has to look at the nutrient availability in the block by way of soil analysis. If the availability of nutrients is within a given standard, then it would make good sense to replace what was taken out by the crop plus a % more to account for other factors. Factors like nitrogen losses from pollen removal by bees or nutrient use in building tree structure have to be accounted for.

In our situation, we also have to account for nutrient use in the orchard for purposes other than fertilizing the trees. Some growers in Ontario may be using nitrogen on leaf litter to help resident bacteria break down scabby foliage. Some of this nitrogen will eventually end up as nutrient for the trees and can be considered as a fertilizer input.

In the Tyrolean district of Italy, where deficiencies are identified, it is recommended that nutrient supply should be increased by 50%. The supply should be reduced by 50% if there is a surplus of nutrients in the soil. A severe shortage of anything would trigger a doubling of quantities. If there is an outstanding or considerable surplus of soil nutrients, then the grower is advised to cut out uses for several years. In Ontario, it is common to maintain a foliar program of nutrients where soil applications are eliminated for one reason or another.

It is best to keep a soil/tissue testing service employed on a regular basis, as guesswork in fertilizing apples can result in a chronic condition of deficiency or oversupply and lost opportunity with any cultivar or block.

Black Rot and Chemical Thinning

Michael Celetti, Plant Pathologist Program Lead – Horticulture Crops, OMAFRA

John Gardner, Pome Fruit Specialist, OMAFRA

John Cline, Tree Fruit Physiologist, University of Guelph

Black rot in apple orchards has been increasing in incidence and severity recently. The pathogen that causes Black rot can infect limbs, trunks, leaves and fruit, resulting in reduced productivity as well as reduced fruit quality. The Black rot fungus *Botryosphaeria obtusa* is an opportunist that enters wounds on limbs and trunks created by the cold injury. One reason for the higher incidence of this disease in Ontario orchards these past few years may be due to the fungus invading wounds caused by winter injury on limbs sustained in some apple orchards during the 2004-5 winter. Cankers that developed in orchards last year (in 2005) provided the inoculum for the high incidence of frog-eye leaf spot and Black rot on fruit observed this year in several orchards.



Figure 1. Black rot on fruit associated with mummified fruitlets

Figure 2. The effect of thinner application timing on the incidence of Black rot infected apple fruit at harvest.

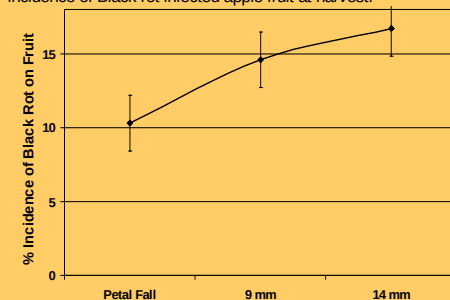
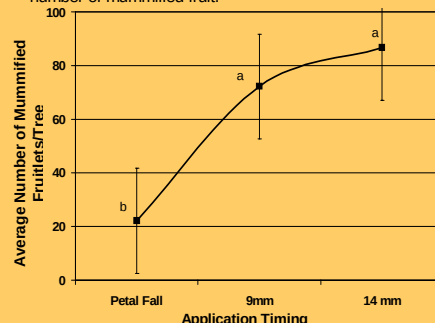


Figure 3 Effect of chemical thinner application timing on the number of mummified fruit.



Black rot on fruit has often been associated with mummified fruit left in trees after chemical thinning Figure 1. Often chemical thinners are applied when king fruit is around 8 mm or even late at 14 mm, which optimizes fruit number and fruit size. Unfortunately, the abscission layer between the stem of the fruitlet and the spur does not form properly when thinners are applied at this fruit stage and the fruitlet remains attached to the spur throughout the entire season. Fruitlets that become infected with the Black rot fungus and mummified remain as a source of inoculum, which can infect nearby fruit.

Recently a study was initiated to see if the timing, rate and types of chemical thinners influenced the number of mummified fruitlets left in trees and the incidence and severity of Black rot infected fruit. A low and high rate of thinners were applied separately to trees either at petal fall, 8 mm king fruit or 14 mm king fruit. Results indicate that applying a thinner at petal fall, regardless of rate or type, resulted in a pretty good thinning response, good fruit weight and size, and a lower incidence and severity of Black rot on the fruit (Figure 2). Furthermore, a significantly lower number of mummified fruit occurred in trees that received an application at petal fall (Figure 3). Applying thinners earlier may not maximize yield as much as applying them later, however, applying thinners earlier to reduce the number of mummified fruitlets and subsequently reduce the incidence of Black rot on fruit may result in better quality of yield. Future research into the best rate and timing is required to ensure that results observed this year are consistent before earlier timings are recommended.

Regulations for Organic

Hugh Martin, Organic Crops Lead, OMAFRA

On September 2, 2006, the proposed *Organic Products Regulations* were published in *Canada Gazette, Part 1*. Over 55 countries in the world have regulations for organic products. The organic sector has been working with the federal government on this new regulation for 15 years.

The draft regulations are available for public comment until Nov 16, 2006 at www.inspections.gc.ca and www.canadagazette.gc.ca. The 2006 revised standards are available at www.pwgsc.gc.ca/cgsb

For existing organic farmers, the organic certification system will continue much as it has with many existing certification bodies, except that now the CFIA will be responsible for oversight of the organic system and there will be a greater level of enforcement. This will also enhance trade opportunities with other countries such as the USA and Europe.

The regulations will include products regarded as bearing organic indications if the product is described by the following terms: organic; biodynamic; biological; ecological; or words of similar intent.

The organic standards and certification system apply to:

- unprocessed plants and plant products, livestock and livestock products; and
- processed agricultural crop and livestock products intended for human consumption that are derived from the items mentioned previously.

Products can be labeled as organic if they contain over 95% certified organic ingredients (not including salt and water). Products with 70-95% organic content may list the "made with xxx" organic ingredients on the product label but cannot claim the product to be organic.



There is also a new Canada Organic logo and it may be used for products that meet the requirements of being certified organic.

The new regulations are expected to be in effect for the 2007 season but full details of the implementation period are not yet available.

All certified organic farms and processors operating in Canada will have to meet the new regulations and standards. This will make a more uniform approach to organic across Canada, including the use of the new organic logo or mark. Experience in the USA was that the organic market increased significantly after introduction of their regulations and the consumer recognition of the organic logo. The new Canadian regulations and standards are expected to be equivalent to the US and European standards as well as those used in many countries around the globe.

Ruts and the Orchard Floor

Anne Verhallen, Soil Management Specialist - Horticulture, OMAFRA, Ridgeway

After one of the wettest harvests in living memory there are lots of ruts, holes and packed areas out in orchards, particularly any of the later harvested varieties. Visible rutting seems to be in three main areas – usually moderate soil packing to rutting in the inter row area, moderate to extensive soil disturbance at row entrances or wherever there is turning with a load and finally access roads or lanes, especially the grassed ones are really chewed up. The problem is not so much the weight and axles under any one load. It is the sheer number of trips under wet soil conditions that eventually causes the soil structure to fail (Figure 1)

Common knowledge suggests that once you get a rut in an orchard there will always be a rut. Lets take a look at the options.

To start there is little in the scientific literature concerning remediation or getting rid of ruts in orchards. The impact of compaction has been measured and we are just cautioned to avoid rutting and compaction. Several studies have measured the soil density in the trafficked inter-row areas. Not surprisingly, orchards do have denser soils over the tractor path - usually 2-4 times the width of the tractor tires - no matter how straight you drive. This soil density is something that accumulates over time with repeated trips to spray and harvest. See Figure 2.

For now though:

- For badly packed and rutted areas – check your tile maps and take a look at your tile outlets to ensure that the tile are still running well. Rutting and compaction in lanes crossing tile runs may have compressed the tile.
- Scraping down packed lanes if soil moisture conditions allow, helps to level the lane and redirect surface water. Puddles and holes just get worse if you continue driving through them.
- Shallowly rutted areas of the orchard will level out with time and some scraping/leveling will happen during mowing. Freeze-thaw and winter rains will also help to break down the edges and fill in shallow ruts.
- Deeply rutted areas may need more extensive grading or tillage to make the area passable.



Figure 1 – Continuous rainfall in October, 2006 created extremely difficult conditions in which to carry out harvest operations.

- Take a critical look at surface water flow in your orchard, some of the worst ruts are in areas that have some side hill seep or tend to accumulate water from adjacent rows – this may be a good spot for some gravel or even a French drain.
- For areas where ruts have formed on hills, some tillage may be needed to cover in the ruts and prevent the channeling of winter rains and spring melt water.

The best strategy will vary with each location based upon soil type, topography and a number of other factors. Keep in mind that we can expect soil conditions to continue to be wet with little real chance of drying at this point.

A final note:

In order to get a better handle on the impact of this years harvest conditions I have started to look at soil density in a few area orchards and hope to continue with a few more yet this fall and then follow the soil conditions in the rutted areas for a few years. If you have a rutted or marked up orchard and are thinking of trying some different remediation strategies – please let me know. Anne Verhallen 519-674-1614.



Figure 2 – Flag height reveals the depth to which a wire rod can be pushed into the soil in the space between tree rows. The higher the flag, the more compact the soil is.

Affecting the Maturity of 'Honeycrisp' Using Calcium Chloride Sprays for Bitterpit Control

J. Gardner, Apple Specialist, OMAFRA, London

'Honeycrisp' apples are typically harvested during the middle of September in Southwestern Ontario. This cultivar is considered to be a bicolour apple and growers usually harvest this variety using multiple picks starting in mid September. 'Honeycrisp' requires adequate thinning to achieve optimal fruit quality. Colour can be considered as a very important trigger in determining readiness. Long-term storage of 'Honeycrisp', as with other apple cultivars, depends on relative starch degradation during the ripening process. Fruit quality can be compromised by late harvest dates. Waiting for more colour may mean a lower quality product.

Because of its inherent tendency to bitterpit on younger trees, growers customarily treat 'Honeycrisp' with calcium sprays.

A small controlled experiment was done during the 2006 growing season to determine if 'Honeycrisp' trees treated with calcium chloride sprays from two commonly used materials would influence maturity and starch degradation in the time period leading up to the typical first pick dates for this cultivar in Southern Ontario.

A replicated and randomized experiment was conducted using single tree sub-plots and comparing an aggressive treatment regime of calcium sprays starting when the fruit were golf ball size until late August for a total of five sprays. Sprays were applied using a handgun to achieve adequate wetting of fruit surfaces and canopy. Fruit from treated trees were compared to untreated check trees and to the growers' own treatment. The grower applied a total of 7 lb/ac actual calcium over six sprays. While the experimental treatments delivered 13 lb actual calcium per acre based on the use of dilute spray applications to individual trees at the equivalent of 1000 l/ha of spray solution.

Fruit samples were collected on September 7th well after the first few apples had started to drop from treated trees in the experiment. Apples were sectioned and tested with a standard prepared mix containing iodine in order to determine how far starch degradation had progressed in treated fruit compared to untreated checks and the growers' own treatment regime. Fruit of trees treated with calcium sprays exhibited an advanced maturity when compared to the untreated check trees. Treated

trees in the experiment produced a maturity similar to the grower managed trees which had also been sprayed with calcium to manage potential bitterpit problems.

The attached photo (Figure 1) shows the control or untreated check at the top left and the two treatments in the experiment to the right of the check, with the grower managed fruit samples at the bottom centre.



Figure 1. Control treatment is at the top left. The other two spray treatments are to the right of the control. The grower's own treatment is at the bottom centre.

Do You Have an On-Farm Food Safety Program?

Pam Fisher, Berry Crop Specialist, OMAFRA, Simcoe

The first step in an on-farm food safety program is awareness. In recent years, most of us have become much more aware of the grower's role in food safety and how to prevent microbial contamination of fresh fruit and vegetables. Irrigation water quality, the importance of worker hygiene, best management practices when using manures, and composts are familiar topics to most growers. Many growers have expanded and added hand washing stations for customers and workers on their farm. Irrigation water quality is routinely tested. These are just a few of the practices that are now common on fruit and vegetable farms in Ontario.

But after the awareness building phase, what comes next? There is a well used slogan that describes the challenge growers are facing: "Say what you do, do what you say and prove it!"

“Say what you do” means that growers need a formal way to show their awareness of on-farm food safety and good agricultural practices. This means you need a working document with checklists.

“Do what you say” means that some sort of action plan is required. Act on the steps you must take to complete the checklists.

To “Prove it”, the steps taken in the action plan must be documented. Documentation is important for your credibility. Some buyers will even require third party audits in order to verify that good agricultural practices are in place. In most cases, however, self-audits will go a long way to showing that you are serious about food safety on your farm.

If you are still wondering how to get started on the “prove it” part of a food safety program, here are three good places to start:

1) Two grower groups, The Eastern Ontario Berry Growers and the Eastern Ontario Fruit and Vegetable Growers, together with the Agricultural Adaptation Council helped fund the development of “Best Management Practices and Self-Audit checklists”. These checklists, developed by two horticultural consultants and an OMAFRA specialist, are very appropriate and easy to use. A limited number of copies are available from Kevin Schooley, at kconsult@allstream.net.

2) The Canadian Horticultural Council (CHC) and the Canadian Federation of Agriculture are responsible for developing on-farm food safety programs for Canadian growers. The Ontario Fruit and Vegetable Growers Association represent fruit and vegetable growers at the table where these programs are being developed. On-Farm Food Safety Guidelines for fresh fruit and vegetables are available on line at the CHC website www.hortcouncil.ca, or you can buy them on a CD from the Ontario Fruit and Vegetable Growers Association, 519-763-6160, for \$15.

3) Our neighbours in the USA have been very active in developing resources, kits and checklists for growers. The website www.gaps.cornell.edu provides a comprehensive list of resources, checklists and worksheets for self-assessments. Be sure to check it out.

Information is also available from the OMAFRA Agricultural Information Contact Centre at 1-877-424-1300. They can give you the websites just mentioned, and put you in touch with OMAFRA specialists who can help.

CROP PROTECTION

Great Lakes Fruit Workers – Update from the Tortricid Working Group

Hannah Fraser, Entomology Program Lead – Hort Crops, OMAFRA, Vineland

Ontario was well-represented by OMAFRA staff and several private consultants at the recent Great Lakes Fruit Workers Tortricid Working Group (TWG), held in Ithaca, NY, November 8th, 2006. The TWG consists primarily of researchers, extension workers and private consultants from Ontario, New York, and Michigan. It was originally established to discuss the management of obliquebanded leafroller (OBLR) in apple, but has since evolved to include other tortricid pests of tree fruit such as oriental fruit moth (OFM) and codling moth (CM).

The multi-state / provincial nature of the working group allows for timely transfer of information on potential issues (resistance, new pests), discussions on pest alternative management strategies (insecticide rotations, models, trapping and monitoring techniques, new products, advances in sprayer application technologies, etc) and potential collaborations between production regions. Pest incidence and population development patterns from each region are also discussed, allowing for a pro-active approach in dealing with potential new pest management problems.

While it is difficult to present all of the information covered at the TWG meeting in a short article, there are a few trends and highlights that are definitely worth sharing.

Research has demonstrated resistance in OBLR populations in some apple growing regions to organophosphate (OP) insecticides, such as Guthion (azinphosmethyl) and Imidan (phosmet), and pyrethroids. Cross-resistance between OP insecticides and insect growth regulators like Confirm (tebufenozide) and Intrepid (methoxyfenozide) has also been documented. While there are other products available for managing OBLR in Ontario, these have short residuals, must be applied when larvae are small, and with consideration of appropriate pH levels (which differ) in the spray solution. Good timing is essential. Some problems associated with management of OBLR by growers in the Great

Lakes region may be attributed to inappropriate product use.

Codling moth resistance to OP insecticides is widespread in Michigan and must be addressed in Ontario. Trials conducted by Dr. Larry Gut and Dr. John Wise have detected CM populations in the Northwest, Southwest, West Central and Fruit Ridge production areas that are highly resistant to Guthion. Preliminary trials using topical bioassays were initiated in Ontario this past season, and these should be expanded in 2007. Vigilance in managing potentially resistant CM populations, using existing alternative strategies, is required. It is important to note that lack of control can be attributed to several different factors including poor timing, inadequate coverage, rates, or a reduction in susceptibility (resistance) to insecticides.

Mating disruption for CM has been successfully used by growers in New York, Michigan, and has been demonstrated in Ontario. However, mating disruption does not appear to be a stand-alone strategy for management of this insect pest. Trials in the US have incorporated other products, such as CM granulosis virus and the neonicotinoids Assail (acetamiprid) and Calypso (thiacloprid), to help manage CM populations and keep damage below economic thresholds. Isomate C-Plus Codling Moth Pheromone is registered for use in Canada.

Researchers in the US have developed improved strategies for using CM granulosis virus. The virus is target specific (kills only CM) and breaks down quickly in the environment. It must be ingested by the larva, which is not immediately killed. The virus is quite lethal to CM, however, and the larva only needs to consume a single virus particle. The optimal use of the virus targets eggs just before hatch, so that it is present when the larvae hatch and before they enter the fruit. Research conducted in the US indicates that weekly applications at a low rate are a better approach than high dose sprays applied at wider intervals (low dose, frequent applications); the strategy is intended to ensure an adequate residual during the target pests' activity period. What is particularly interesting is that the virus appears to be "vertically transmitted" within the population – in other words, it is passed from one generation to the next via infected females. Virosoft is a CM granulovirus product registered for use in Canada; however, the label makes no

reference to the aforementioned low dose frequent application nor has this strategy been evaluated in Ontario. Granulosis virus should be used in conjunction with mating disruption for CM or other control measures.

Mating disruption for OFM in tree fruit (apples, tender fruit) is a highly effective pest management strategy, as repeatedly demonstrated in fruit production areas within the Great Lakes region. However, with the exception of apple growers in a few areas, rates of adoption have been limited in Ontario. There are new mechanical application technologies for mating disruption being evaluated by researchers in New York, using modified tractor-mounted spray equipment to apply pheromone-impregnated wax to the canopy. One application per generation appears to provide excellent control. Other pheromone dispensers are also being tested, each with the goal of reducing the application time. It is anticipated that the level of adoption will increase in the Great Lakes region and that mating disruption will become a standard pest management tool for OFM. Insecticides recommended for management of OFM include the neonicotinoids Assail and Calypso, and the insect growth regulator Rimon (novaluron). Assail is already registered in Canada; Calypso and Rimon are in the Canadian regulatory system and will hopefully be available to growers in 2007.

Managing Insects and Diseases in Organic Crops

Hugh Martin, Organic Crop Production Program Lead, OMAFRA, Guelph

There are many ways to manage pests on organic farms. The overall strategy should always be to try to manage your cropping system to avoid the insects, diseases, weeds, etc. Easier said than done but here are some strategies. Each pest will have their own weakness.

You will however have competing interests and need to decide which is more important. For example, adjusting the planting time to be later may exclude some insects or weeds but may result in slightly lower yields – assuming there were no pests. You also have to have the capacity to do all of the important things that need doing in a timely manner.

Pest Management Strategies

Crop rotation should be your number one strategy. Growing a high frequency of the same crop or same crop family will lead to more problems. Rotating from cabbage to another crucifer species such as broccoli does not help. Rotating grass type plants and broadleaves is ideal but not always practical. Growing a wide diversity of crops will give you more options for crop rotation. Use cover crops whenever possible.

Resistant varieties work well for many pests, especially diseases. Varieties can lose their resistance over time, so keep watching for newer varieties with improved resistance. Know your problem diseases and which resistance traits that you need in a good variety.

Crop health is very important. Anything you can do to keep the crop healthier will help the plant to resist and tolerate pests.

- optimum nutrition – not excessive and not deficient
- good soil conditions – good structure, no compaction, active soil OM
- no moisture stress – neither too much or too little
- maintain correct plant population
- use clean seed and healthy transplants

Beneficial organisms are very important partners. These can be beneficial soil organisms (critters and fungi), beneficial insects that prey on other insects or weeds, beneficial fungi that suppress plant diseases or fungi that become a disease to insect pests and weeds. Many of our cropping practices have an impact on these. Some beneficials can be added to the field/crop but these will not be useful if your field conditions are not conducive to them surviving. Mating disruption and pheromone traps can also be useful for some insects. Encourage beneficial plants in boundary areas to host predator insects and pollinators.

Sanitation is critical to prevent the spread from one field to another and from one season to another. Clean bins and storages after use. Clean equipment from one field to another. Maintain field margins to prevent spread of diseases and weeds. Do not spread your problems around.

Mechanical equipment, vacuums, flaming, row covers, and hand harvesting can all work but may have high cost. Some strategies work well but must be suited to the crop situation and scale of production.

Biopesticides (that are organically approved) is another set of tools that are becoming more readily available for the organic farmer pesticides but I will write more about these in a future issue. Do not depend on biopesticides as the main means of control, they are tools to complement the other strategies listed above when needed.

Pest management starts with knowing your crop and pests and when there is a problem. What is the threshold for action? What were your problems this year? What worked? What did not? Eliminating the pest is not a realistic goal but reducing it to tolerable levels is. Knowing how to prevent the problem is key. The biopesticides and mechanical options are last resorts when there is a problem. No one single strategy will be a success. A successful pest management program uses “many little hammers”.

POSTHARVEST

Browning Potential of New Apple Varieties for Fresh-Cut Slices

*Dr. Jennifer DeEll, OMAFRA, Simcoe, and
Dr. Peter Toivonen, AAFC-Summerland, BC*

The 2005/06 storage season was the second year of a study to evaluate the browning potential of several new apple varieties, including ‘Ambrosia’, ‘Aurora Golden Gala’, ‘Galarina’, ‘Goldrush’, ‘Honeycrisp’, and two selections from Quebec. Fruit from each variety were harvested during the commercial harvest and stored at 0-1°C for 1 and 3 months. Several fruit were then removed and sliced within 1 hour. After cutting, the slices were rinsed in running tap water, allowed to drip dry, and placed into zip-lock bags. Slices in bags were held at 5°C for 1 week and then assessed for browning (deterioration) using the UC Davis 1-9 scale, with 9 being excellent and 1 being extremely poor. Overall, the Quebec selection A38 (recently named ‘Eden’) showed the least amount of browning, while ‘Ambrosia’ and ‘Imperial Gala’ also showed less browning in BC. Results suggest that growing location may be a factor in browning potential. ‘Honeycrisp’ and ‘Aurora Golden Gala’ deteriorated quickly in both locations.

Table 1: Visual quality (1-9 scale) of fresh-cut apple slices after 1 and 3 months at 0-1°C

	Simcoe, Ontario		Summerland, British Columbia	
	1 month	3 months	1 month	3 months
Imperial Gala	2.45 g	2.53 e	6.14 b	5.83 a
Royal Gala			4.03 cd	3.63 e
Honeycrisp	2.00 h	2.25 g	3.42 e	3.15 f
Empire	3.42 d	3.30 c		
Empire (QC)	2.63 f	2.84 d		
Aurora Golden Gala	2.50 g	2.52 e	3.80 de	4.47 cd
Ambrosia	3.77 c	3.82 b	6.73 a	5.12 b
A16	3.00 e	2.87 d		
A38 ('Eden')	5.51 a	6.13 a	5.83 b	3.80 e
Crispin	3.84 b	2.43 f		
Cortland			3.92 de	3.23 f

* Values with different letters within a column are significantly different.

Risk of Low Temperature Storage Disorders for 2006/07

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

CIPRA is a computer-based program used to predict disease and pests of several horticultural crops, based on weather data. The program was developed by the research team of Dr. Gaétan Bourgeois, Agriculture and Agri-Food Canada, St-Jean-sur-Richelieu, Québec. More recently, CIPRA has been expanded to predict the risk susceptibility of apples to certain storage disorders (Bourgeois, DeEll, and Plouffe). CIPRA is presently being used commercially in Quebec, while it is currently being evaluated and adapted for Ontario (Bourgeois, DeEll, and Nichols).

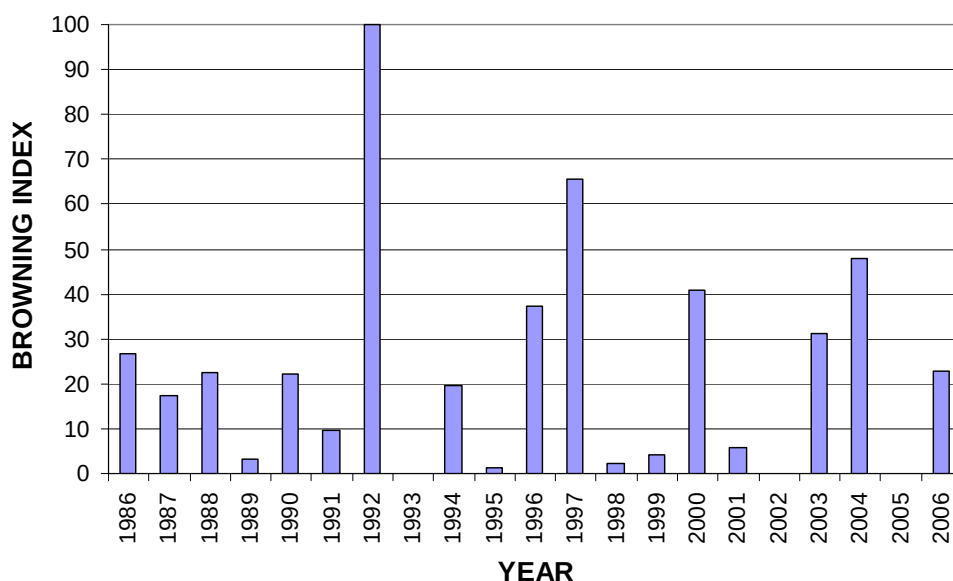
A risk model has been developed for low-temperature disorders using CIPRA, based on weather data observed during July and August. The figure below shows the results from 1985 to 2006 using weather data from the Simcoe-Delhi area in Ontario. The model indicates that there is **23% risk of low temperature disorders developing during storage this year.**

In general, low-temperature disorders develop in apples during storage following cool and wet conditions during the months of July and August. As CA storage temperatures

drop below the critical level of 3°C, the incidence and severity of these disorders increase.

Low-temperature breakdown (internal flesh browning) begins as diffuse browning of the outer cortex. This is often a well-defined area, and is separated from the skin by some normal tissue. It is different from senescent breakdown, in that the brown tissue is usually moist rather than dry and mealy, and in the early stages is separated from the skin by an area of healthy tissue. Low-temperature breakdown is favored by light crops, large apples, advanced fruit maturity, cool weather in the latter part of the growing season, and high levels of humidity and carbon dioxide in storage. It has also been associated with low levels of phosphorus, and to a lesser extent low levels of magnesium and potassium. Increased calcium levels in the fruit help to reduce the incidence of low-temperature breakdown.

RISKS OF BROWNING



Vascular breakdown develops as browning of the main vascular bundles and some of the adjacent cortical tissue. The incidence and severity varies with the season, orchard and tree. Vascular breakdown is associated with cool growing seasons and becomes significant after 6-7 months of storage.

Core browning is characterized by diffuse browning of the flesh next to the carpels, with no clear distinction between normal and affected tissue. It rapidly becomes more extensive when the fruit is removed to warmer locations. Core browning is likely to be more prevalent in apples that are large, picked early, have high nitrogen content, from shaded parts of the tree, and harvested after an extended period of cloudy, wet and/or cool weather. Either excess or a deficiency of boron can induce core browning. Core flush is reduced by phosphorus sprays, calcium sprays, dips in diphenylamine (DPA), and waxing. In CA storage, a high concentration of CO₂ is likely to increase core browning, particularly if O₂ is also high. Low O₂ (<2%) is one of the most effective treatments for controlling core flush. In McIntosh apples, core browning is often accompanied by browning of the skin and underlying flesh in the stem cavity.

Effects of DPA, 1-MCP, and CO₂ Concentration on External CO₂ Injury of 'Empire' Apples

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

The following article is based on work done by F. Razafimbelo, J.F. Nock, and C.B. Watkins at Cornell University, New York (2006, HortScience 41(4):978)

The susceptibility of 'Empire' apples to external CO₂ injury during controlled atmosphere (CA) storage is substantially increased with 1-MCP treatment (DeEll et al., 2003). This physiological disorder is characterized by bronze, rough, sunken well-defined lesions in the skin.

Razafimbelo et al. (2006) investigated the effects of 1-MCP on external CO₂ injury of 'Empire' apple using several approaches:

- 1) Fruit were treated with 1%, 2.5%, or 5% CO₂ during storage. Higher injury levels were associated with exposure to higher CO₂ concentrations.
- 2) Fruit were exposed to 2.5% or 5% CO₂ for 3-week periods throughout storage, with CO₂ otherwise kept at 1%. Most injury occurred in fruit treated with elevated CO₂ during the first 3

weeks of storage, and 1-MCP did not extend the period of susceptibility to injury.

- 3) Exposure of fruit to CA with 5% CO₂ after harvest was delayed for up to 14 days. Susceptibility to injury remained high during the delay in 1-MCP-treated fruit in contrast to untreated fruit.
- 4) Fruit were treated with 250, 500, or 1000 ppm of diphenylamine (DPA). DPA eliminated injury in 1-MCP treated fruit, even at concentrations of 250 ppm.

This data confirms that 1-MCP increases susceptibility of 'Empire' apples to external CO₂ injury and extra care is therefore required to avoid fruit losses. Only DPA application has been shown to eliminate the risk of injury.

Effect of Preharvest Application of Pyrimethanil and Calcium Chloride for the Control of Postharvest Blue Mold and Gray Mold of Apples

(Ghosh, Pirgozliev, Errampalli, Wainman, Murr, DeEll, Sholberg, and Stokes)

Preliminary experiments were conducted to evaluate the efficacy of preharvest application of pyrimethanil (800 g/ha) and calcium chloride (12 kg/ha) on the control of postharvest blue mold caused by *Penicillium expansum* Link and gray mold caused by *Botrytis cinerea* Pers.:Fr. in apples. Cultivars tested were, 'McIntosh' and 'Empire' in Ontario (ON) and 'Gala' and 'Jonagold' in British Columbia (BC). Apples were inoculated with 1x10⁴ conidia/ml of either thiabendazole (TBZ)-resistant or -sensitive isolates of *P. expansum* or *B. cinerea* immediately after harvest and stored at 0°C or 1°C for 20 weeks. Observations were recorded at 4-week intervals in ON and after 20 weeks in BC. In 2004-2005, pyrimethanil + calcium chloride, applied 2 weeks prior to harvest significantly decreased the incidence of both diseases compared to the application 4 weeks before harvest in all the 4 cultivars in both locations.

In 2005-2006, the treatment of pyrimethanil + calcium chloride, applied 2 weeks prior to harvest gave significant control of postharvest blue mold for up to 8 and 12 weeks in 'McIntosh' and 'Empire', respectively. The combination treatment significantly reduced blue mold in 'Gala' and 'Jonagold' in BC and gray mold in all four cultivars in both locations; however, the diseases increased with time in 'McIntosh' and 'Empire'.

Studies on the Effect of Postharvest Treatment of a Biological Control Agent, *Pseudomonas Syringae*, on Post Harvest Blue Mold and Gray Mold of Apple

(Errampalli, Ghosh, Pirgozliev, Wainman, Murr, DeEll, Sholberg, and Stokes)

Blue mold of apple (caused by *Penicillium* sp.) was identified as one of the reemerging postharvest diseases of apple in Ontario. In 2004, a project, funded by the AAFC IFSP, Minor Use Program, was initiated to test the efficacy of biological control agents on blue and gray mold development on stored apples. Three concentrations of BioSave were tested on 'Empire' and 'McIntosh' at Vineland, and on 'Gala' and 'McIntosh' at Summerland. At Vineland, the evaluation of disease incidence after 168 days in cold storage showed that both apple cultivars, 'Empire' and 'McIntosh', treated with the three concentrations of BioSave alone or in combination DPA resulted in significantly lower disease incidence of blue mold than control.

Treating apples with 2.38 g/L of BioSave provided the highest blue mold disease reduction. There is some indication that mixing BioSave with DPA may have a detrimental effect on BioSave efficacy on blue mold. This will be tested further in the 2006-07 season. There was a significant reduction of gray mold with BioSave in both 'McIntosh' and 'Empire' apples.

Water treated apples had a high percentage of gray mold incidence, and this could be due to the nature of *B. cinerea*, a nesting pathogen, in that the pathogen was spread over the neighbouring fruit in the crates and masked the effect of BioSave treatment. Placing of apples after cold storage resulted in an increase of blue and gray mold incidence. At Summerland, the application of BioSave reduced blue mold and gray mold diseases in 'McIntosh' and 'Gala' apples. In summary, during the 2-year study (2004-05, 2005-06), the postharvest treatment of *Pseudomonas syringae* in combination with DPA gave effective control of blue mold and gray mold on 'McIntosh' and 'Empire' apples for up to 168 days in CA and cold storage.

ANNOUNCEMENTS

Apple Program as Part of the OFVC, February 21, 2007

John Gardner, Apple Specialist, OMAFRA, London

It is always a challenge to come up with an original program these days, especially for such a high profile industry as the North American apple industry. News travels really fast, as most growers recognize. As a result, it is tricky to come up with some thing growers have not heard before.

The 2007 version of the Apple Program has been planned to include a mix of speakers on timely and valuable topics for the average grower.

We have Tom Auvil coming from Washington State Fruit Research Commission to fill us in on what they have been doing with orchard design and robotics. This discussion should fit in well with the interest Ontario growers have in higher density plantings and specifically tall spindle and super spindle tree training methods. This type of tree shape does lend itself to a paradigm shift in the way the trees and crop can be handled. For example, the labour costs for handling a flat wall of tree canopy in a row can be significantly reduced for the same volume of production. Tom's discussion will focus on what the future holds for "Orchard Design and Mechanization in High Density Apple Plantings"

Dr. Ian Merwin will discuss two topics including "Management options for Apple Replant Problems ". Ian has been researching this problem area of apple production for many years, as a professor of Horticulture Science at Cornell University in New York State. His focus is on agroecology and specifically how it relates to the production of tree fruit. In Dr. Merwin's second talk he will focus on the Effects of groundcover management on Nutrients in Trees, Soil and Groundwater.

Dr. Andrew Landers of Cornell University, Geneva, N.Y. directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Andrew Landers is author of the classic text book, Farm Machinery: Selection, investment and management. Dr Landers will speak on "Developments in Pesticide Application Technology in the Orchard."

It's one thing to grow and harvest quality fruit, however what is done with that fruit when it leaves the orchard could determine success or failure. With this in mind, Dr. Peter Sholberg from the Summerland Research facility of AAFC has been asked to address the issues around "Identification and Control of Postharvest Pome Fruit Diseases". Peter has collaborated on several projects with researchers in Ontario dealing with postharvest fruit quality assurance".

Some of the best information discussed at the Apple Program the last few years has been presented by Ontario growers. This year we have Ontario growers Michael Versteegh from Denfield, Shane Ardiel from the Georgian Bay area, Rob Montgomery from Newcastle and Kirk Kemp from Bowmanville discussing the cultivar 'Honeycrisp' in a panel presentation. This cultivar has taken the apple world by storm in the last few years. Find out from experienced growers how they grow it and handle it. 'Honeycrisp' is one of the cultivars that requires top notch management skills to bring a quality product to market.

This program has been organized by horticulture staff of the Crop Technology branch of the OMAFRA. John Gardner, Apple Specialist, Kathryn Carter, Apple IPM specialist, and Margaret Appleby, IPM systems specialist, were instrumental in putting the program together.

Obliquebanded Leafroller Workshops

This winter OMAFRA will be offering several half day workshops on obliquebanded leafrollers (OBLR) across the province. The workshops will focus on the biology of OBLR, monitoring techniques, managing the pest (timing sprays, pesticides options), pesticide resistance and the importance of spray coverage and thinning on managing this pest. The tentative dates and locations for these workshops are as follows:

January 9 - Simcoe, OMAFRA
 January 11 - London, Best Western Inn
 January 23 - Waterdown, Plainsman restaurant
 January 25 - Clarksburg
 February 6 - Leamington, Colesanti's
 February 14 - Colborne, Keeler Centre

More information on these workshops will be available in the Ontario Apple Growers newsletter. For more information contact the OMAFRA Agricultural Information Contact Centre at 1-877-424-1300.

Ontario Fruit & Vegetable Convention Walker complex, Room 215

Apple Program February 21, 2007

- 9:30 a.m. Orchard Design and Mechanization in High Density Apple Plantings
Tom Auvil, Washington Tree Fruit Research Commission, Washington, U.S.A.
- 10:15 a.m. Management Options for Apple Replant Problems
Dr. Ian Merwin, Cornell University, Ithaca, N.Y.
- 10:45 a.m. Developments in Pesticide Application Technology in the Orchard
Dr. Andrew Landers, Cornell University, Geneva, N.Y.
- Noon – 2:00 p.m. – Lunch & Trade Show
-
- 2:00 p.m. The Challenge of Growing "Honeycrisp"
 A panel presentation by Ontario Producers.
Moderator: John Gardner
Panelists: Michael Versteegh, Denfield
Shane Ardiel, Georgian Bay
Rob Montgomery, Newcastle
Kirk Kemp, Bowmanville
- 3:00 p.m. Orchard Groundcover Management Effects on Nutrients in Trees, Soil and Groundwater
Dr. Ian Merwin, Cornell University, Ithaca, N.Y.
- 3:30 p.m. Identification and Control of Postharvest Pome Fruit Diseases
Dr. Peter Sholberg, AAFC, Summerland, B.C.