



ORCHARD NETWORK

For Commercial Apple Producers

VOLUME #11, ISSUE #4

DECEMBER, 2007

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Orchard Management

Some Lessons from the 2007 Growing Season

John Gardner, Apple Specialist, OMAFRA, London

One of the things that continues to challenge estimators during the growing season is the potential size of any crop. Sayings like "a small crop gets smaller and a big crop gets bigger" can carry some truth. What is truly amazing this year was how we managed to produce the volume of fruit in Ontario that has been reported through the harvest season after seemingly over thinning some blocks and in one of the hottest and most rainfall deficient growing seasons ever.

Crop volume of course is directly related to fruit numbers and average fruit size. This year, I believe we had the fruit numbers right from the start; it was the challenge of fruit sizing that was at question during the 2007 growing season. Surprisingly, some growers did report the largest crop they had ever grown. Other growers reported very large volumes of smaller sized fruit, which is understandable when considering the 2007 growing season.

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This issue of the **Orchard Network Newsletter** was compiled by Client Service Representative, Marian Desjardine, OMAFRA, London.

We had a couple of things going on in the early part of the season that helped get us off to a good start in many areas. Soil moisture reserves in the spring were there. We had one of the better bloom/fruit set periods that we have seen in a number of years. This was in spite of the fact that many growers had the perception of thinning programs where they had sprayed too much fruit off the trees in late May and early June.

I have always maintained that if you can easily find the apple fruitlets with a casual stroll between tree rows in the middle of June, there is a good chance you have not taken enough of the crop load out of the canopy to achieve the right leaf to fruit ratios. It is common that trees that typically look overthinned in the early part of the growing season can produce a nicely balanced and well sized crop at harvest.

Some blocks in 2007 never received rain when growers needed it and producers everywhere had difficulty keeping up with evapotranspiration losses even though they pumped water at capacity for most of the growing season. It was a good year to test the theory about how to size fruit load under extreme heat, UV, and soil moisture deficits.

An interesting observation that was made by more than one grower this year was that trees well pruned to smaller diameter wood produced larger fruit when compared to trees poorly pruned or not pruned at all during the previous dormant season in the same block. This really drives home the point of good pruning practices (Figure 1) and their influence on fruit quality. This is one area of crop culture that a grower should look at carefully before cutting corners. If trees that were well pruned had any lack of nitrogen supply, canopy thinning would have been extremely helpful. The root system would in theory pick up as much nitrogen and distribute it to the crop without starving any part of the canopy.

And yes, a thorough and heavy pruning program can mean cutting back substantially on nitrogen as an input but care should be exercised so as not to starve the tree in the process. Under fertilizing can cost yields and quality while over fertilizing has both environmental and financial implications. Soil testing on a regular basis should be combined with tissue testing and comparing results to known standards.

Figure 1. Trees in higher density plantings with excessively strong or large caliper limbs arising from the main trunk have to be removed otherwise they will prevent the production of preferable smaller diameter branches on the same side of the tree.



Managing Problem Deer Populations

*Kathryn Carter, Pome Fruit IPM Specialist,
OMAFRA and John Gardner, Apple Specialist,
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As the snow starts to fall, deer start congregating in wintering grounds and actively seek high energy sources of food for survival. Dormant apple trees with both healthy fruit buds and new shoot growth provide an excellent food source during the winter months. Anyone who drives or lives in southern Ontario is aware that deer sightings have increased. In the U.S., the national deer population is estimated to be 25 million to 30 million. Deer have become well adapted to living in environments near suburbia, and they have benefited from warmer winters and a decline in hunting in some areas. Deer prefer fragmented habitat that consists of both woodland for cover and open crop land. The USDA estimates that total deer damage from auto collisions and crop and timber losses reaches at least \$1 billion a year (Mullen, 2002).

Deer damage to young non-bearing and mature apple trees can be troublesome. Smaller more compact apple trees in higher density plantings make a greater proportion of the tree canopy available for browsing by deer. Feeding on soft tender shoot tips and terminal growth as well as fruit buds in winter and early spring often results in an acute reduction in bearing surface, and changes in tree shape. Smaller trees can be damaged or destroyed by rubbing of antlers to remove velvet, in a process called 'horning'. This type of injury is usually seen in orchards from September to mid-November. Controlling deer damage in orchards can work where an integrated approach is used, which includes regulated hunting (with authorization), scare devices, repellents and fencing (conventional and electric). For a given deer density, the potential for economic damage can be often greater on large plantings than on small ones, as a result large areas often require more substantial fencing designs to achieve a level of protection similar to small areas. Nursery trees in large blocks can require exclusion fencing to ensure recovery of quality nursery stock if there are large herds in proximity to these young trees.

Fencing

There are several different types of fences available, including woven wire fence, which is an excellent option for areas where deer densities are high and

the likelihood of damage is great. The permanent woven wire fence provides a barrier that requires little maintenance but can be expensive to install. The costs of these fences often limit their use around orchards, with the exception of nurseries. The 8 ft high, vertical fence is constructed from two 4 ft sections of 6 X 12 inch wire mesh, joined with hog rings. Two or more strands of barbed wire spaced 10 inches apart are added to the top of the structure extending the overall height to 10 ft or more. Based on research in New York, blocks larger than 50 acres usually require this type of fencing to reliably prevent deer from entering the area if feeding pressure is high.

Invisible fencing

Another type of fence is mesh fencing. This fence is considered to be strong, long lasting, virtually invisible and easy to install. The fence is made of a series of 4-inch square UV resistant polyethylene mesh. Each strand has a breaking strength of 175 lb. The mesh is stretched 20 ft between poles that can be used to support it. The entire area that needs to be protected must be enclosed in order for the fencing to be effective. This fencing is considered to be very effective because deer have relatively poor vision and depth perception. The barrier and accessories are black in colour so the deer can not judge where the fence starts or stops. They fear the fence and will run around its perimeter but will generally not challenge it vertically. This fence provides a humane and discreet barrier that keeps deer out of sensitive areas without relying on chemicals or electricity.

High-tensile electric fence

This fencing has emerged as the preferred method to exclude deer from orchards in New England. These fences are easy to erect, repair and maintain. In addition, the high voltage low impedance chargers can electrify long fence lines (up to 5000 ft or more). Temporary electrified fences are simple, inexpensive and useful. Baiting the fence with peanut butter, apples etc. may enhance the effectiveness of electrified fences. Deer are attracted to these fences by appearance or smell and are lured into contacting the fence with their noses. The shock trains the deer to avoid the fenced area. Permanent high tensile electric fences provide year round protection from deer and are best suited to orchard crops. In New York they consider these designs to be best used under light deer pressure or for relatively small areas. Low profile fences seldom provide satisfactory protection of commercial orchards in the winter especially if

snow restricts deer from using alternative food sources. Landowners must check local ordinances to determine if electric fences can be used on their property.

Scare devices

Frightening deer using scare devices may be effective and economical in some situations, particularly when they first become a problem in the orchard. However, once deer establish a pattern of movement it is difficult to get them to change. Propane cannons, cap exploders, strobe light, sirens, fire works and gunfire can be used as a temporary method of scaring off deer. However, deer often become accustomed to them within a week or two, even when the devices are occasionally moved. Scare devices are usually a short-term solution. Some growers use dogs to help scare deer. Dogs are kept behind an 'invisible fence' using a radio transmitter, an underground copper wire and a special dog collar with receivers. Dogs are placed inside the fence, and the dogs chase the deer out of their territory. If they attempt to pass the invisible fence they receive a mild harmless shock. Be aware that a family pet may not provide adequate protection because it is not patrolling all the time. Often large aggressive dogs work best.

Repellents

There are two types of repellents that can be used for deer. They are contact and area repellents. Contact repellents are applied to the plants and repel by taste. Area repellents are those used most commonly in orchards and are applied near the plants to be protected and repel deer by smell alone. Some area repellents include suspending bars of hand soap to the trees or hanging bags of human hair from the tree. Some growers have reported that the use of Surround Crop Protectant containing kaolin clay acts as a deterrent to deer feeding while getting trees established. Unfortunately these repellents may only be a temporary solution to the problem.

Hunting

During the hunting season, problem deer in orchards can be hunted by licensed hunters. Agricultural deer removal authorization is another way of managing deer populations. Applications can be obtained from the Ministry of Natural Resources (MNR) to hunt outside of the normal sport hunting season. These permits can be used to harass and/or remove deer that are causing significant agricultural damage, when other

reasonable methods to prevent damage are ineffective. Only those animals that are damaging crops can be removed. Orchardists may apply for an agricultural deer removal permit through their local MNR district office. Applicants are normally required to document and describe all other non-destructive attempts to control a damaging population of deer. Applicants must meet certain criteria and a site visit is usually completed. Authorizations are closely controlled and complement local deer management objectives. Deer removal authorizations can not be used to provide recreational out of season hunting opportunities or personal gain.

New Pomology Website - New and Archived Research and Extension Information for Tree Fruit

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

In an ongoing effort to extend research information to tree fruit producers of Ontario, the Pomology Research Program at the University of Guelph (based in Vineland and Simcoe) has updated its website to make available the research and extension activities to interested growers and stakeholders. The website is located at: <http://www.plant.uoguelph.ca/treefruit>

The site is searchable and includes information on existing research projects, current and archived articles, presentations made to growers, stakeholders, and scientific audiences, links to a wide array of other tree fruit related websites, as well as information about our research program and facilities in Simcoe and Vineland. The site will also be used to inform growers of upcoming seminars, field events, workshops, and twilight meetings

I would like to thank Mr. Andy Tallman, (Summer Student, University of Guelph, Vineland), Mr. Mike Peppard (University of Guelph, Plant Agriculture) and Jonah Hu (Summer Student, University of Guelph, Guelph) for designing and developing this site. I would also like to acknowledge the funding of the Ontario Summer Experience Program in helping make this possible.

For further information contact Dr. John Cline, Department of Plant Agriculture, Simcoe at Jcline@uoguelph.ca or 519-426-7127 ext 331.



Influencing Fruit Finish on Yellow Skinned Cultivars

John Gardner, Apple Specialist, OMAFRA, London

One of the most difficult things to manage in orchard culture is the look of the skin on varieties that have a tendency to roughen up and russet as the season progresses. This is in part related to a number of factors. The list of items involved in fruit russetting is somewhat endless. Primarily it is related to the cultivar itself and its inherent inability to wall off all those factors that can infect, disrupt, wound or otherwise prevent the apple from developing that award winning look that consumers pay for.

On the list of russet causing factors are things like mildew infection, frost, yeast infections, high heat and UV, copper compounds applied at the wrong time, excessive wetting, inappropriate combinations or mixes of chemicals and so on. What is consistent from year to year is the influence of the spring weather on the % cullage in varieties like Golden Delicious.

We know from experience that a cool wet spring will produce more russetting than a warm dry spring. Some varieties of apple have a more absorptive skin and water that is left on the skin during the cell division stage of growth can absorb and burst epidermal cells under the developing cuticle or waxy surface leaving a lot of wound tissue that never heals smoothly.

One of the harshest treatment regimes that can be used on apple while it is growing is the copper family of compounds. Applied at the wrong time of the growing season, one is guaranteed to produce symptoms of russet. Straight copper sulphate or even fixed copper on a susceptible cultivar after growth has started in the spring can produce disastrous results. The copper family of compounds is also indispensable on crops such as sweet cherry during the dormant season for control of bacterial diseases. This is also the same material that is useful in defoliating apple nursery stock in the fall of the year.

One of the projects I have been involved with for several years now is the finish of cultivars like Crispin, Golden Delicious and now Aurora Golden Gala. I have had some very promising results from the use of specific treatment regimes that are based on the use of particle film technology.

This past season I was paying particular attention to a group of Aurora trees that I was treating with Promalin and Surround Crop Protectant particle film. The past growing season was extremely hot with very high UV indices through the growing season. Typically, during the midday hours, an apple sitting in full sunlight would be at least 20 degrees warmer on the sunny side of the apple than on the inside of the fruit. To the touch, the fruit would feel warm on the outside while the inside would feel cool. In order to cope with these types of temperature differences an apple produces a different lenticel structure and will move more water through that side of the apple to keep from burning up. This is where the particle film comes in. Temperatures are moderated and lenticels do not get that prominent and coarse look.



Figure 2 - Promalin/Surround treated trees of Aurora Golden Gala at harvest in late September. Fruit size averaged more than 180 grams for treated fruit.

Treatments of Surround were applied from mid June to mid August after a 3-spray regime of Promalin starting at king bloom petal fall.

At harvest, fruit from treated trees were compared to fruit from untreated trees. What was outstanding was the difference in finish of the fruit. Treated trees produced a lemon yellow coloured fruit with a silky smooth finish and inconspicuous lenticels while untreated trees produced fruit with a rougher finish that was characterized by a much higher % of lenticel spotting and more of a greenish yellow colouring with a prominent and bronzy orange wash on the hot side of the apple.



Figure 3 - Fruit from treated trees in the top row compared to fruit from untreated trees in the bottom row. Fruit on trees from both treatment regimes were spray thinned and then hand thinned in mid June to 20 cm apart. Trees in both treatment regimes were irrigated.

Fruit size differences were not as noticeable as they were in the previous year in the absence of hand thinning. I would hypothesize that the particle film enabled treated trees in the previous year (2006) to carry and finish a heavier crop load of larger fruit due to greater net photosynthesis and more carbon being sent to the crop.

Spent Mushroom Substrate

Donna Speranzini, Nutrient Management Planning Specialist, OMAFRA, Vineland.

After an open fall and particularly after a dry season I get a lot of questions about organic matter additions to the soil. Growers have driven around the neighbourhood all summer and noticed how some fields faired the dry conditions better than others.

Most often this can be related to a field history of added organic matter and good crop rotation.

There are several different organic matter sources available to growers. One that is often overlooked is spent mushroom substrate. There are always lots of questions surrounding the use of this product.

Lets start with - What is it?

It is a by-product of mushroom production and is produced in large quantities in Ontario year round.

Mushrooms are grown on a composted and pasteurized mixture of horse manure, straw, chicken manure and gypsum that is laid out in beds in a mushroom house. This substrate is then inoculated with the mushroom fungus and covered in a mixture of soil, peat moss and lime. The environmental conditions in the growth rooms are then manipulated to encourage fungal mycelium growth and produce mushrooms. After several pickings the substrate is exhausted or "spent" of its potential to produce mushrooms. The substrate is then subjected to a steam treatment and removed from the growing houses.

What to look for?

It can be available fresh from the mushroom farm, or weathered by further composting. Both types of spent mushroom substrate should have an earthy odour and be free of an ammonia or rotten egg sulfur smell. The particle size should be uniform and it should be fairly homogenous and resemble soil.

Moisture contents between 30 and 50% are easiest to evenly field apply and incorporate.

All SMS should arrive at your farm with an analysis. If not, have an analysis done. Ask for a "Compost Analysis Test" from the labs, not a manure analysis. This gives you macro-nutrient content, carbon to nitrogen ratios, dry matter, pH, and total salts. You may want to add an additional test for nitrates.

What is the nutrient content/or value of spent mushroom substrate?

The nutrient content varies with different sources.

A typical analysis has:

- Dry matter between 40-60%
- pH between 6-8
- Carbon to nitrogen ratio that is generally below 30:1, which means it will give up nitrogen rather than tie up available nitrogen.

A 10 ton/ac fall application typically gives 80 lb/ac of nitrogen, 105 lbs/ac of phosphorus and 175 lbs/ac of potash. The nitrogen is about the same total

value as dairy manure, only more of the nitrogen is in the organic form and is more slowly released over time. Studies in vegetables in the US have shown that there is less nitrogen leaching from spent mushroom substrate than from commercial fertilizers. As for the phosphorus and potash values, they are actually higher per ton than raw dairy manure. This is not unexpected since the composting process tends to concentrate mineral nutrients.

Not to be overlooked are the micro-nutrients found in spent mushroom substrate. It contains appreciable amounts of iron, manganese, zinc and boron.

Now - What about those salts?

The compost analysis will also give you a measure of the total salts in spent mushroom substrate. Studies in Ontario by Dr. Calvin Chong have shown that a 50:50 mix of spent mushroom substrate and bark chips that is properly managed will have no appreciable salts left 1 week after transplanting nursery stock. When added to the entire soil and incorporated, the salts are not high enough to cause root damage. Banding spent mushroom substrate with transplants is probably not a good idea. If there is concern over the salts then a fall application is ideal. It will not take much rain to reduce the salt load in the root zone.

Spent mushroom substrate is a high nutrient, low odour, and weed free way to incorporate organic matter into your soil, reduce some nitrogen leaching potential in vulnerable areas and provide both macro and micro-nutrients to your crop.

Postharvest

Current Technology for Fruit Preservation

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

At the recent Essex County Associated Growers' Annual Meeting and Trade Show, **Jim Schaefer**, owner and President of Storage Control Systems Inc. (Sparta, Michigan), spoke on the subject of ***Preserving Your Fruit for Days and Beyond***. He began with a few fundamentals on fruit respiration and then explained the current techniques available to slow down product deterioration. These range from simple refrigeration to modified or controlled

atmosphere storage, plus the most recent use of SmartFresh. Storage at low temperature in ambient air is a short-term solution to extend the marketing window, whereas some sort of atmospheric modification is needed for long-term fruit storage.

Modified atmosphere (MA) usually involves the addition of CO₂ and/or reduction of O₂ at the beginning of the storage period, with no further monitoring or active control. The major factor for success with MA is constant temperature, but this is often difficult throughout the cold chain. As such, this type of storage is more common for short-term holding of berries than for long-term storage of apples.

Controlled atmosphere (CA) is the norm for long-term storage of apples. Similar to MA, there is a reduction in O₂ and an increase in CO₂ at the beginning of CA storage, but the atmosphere is then monitored regularly and corrected frequently. In addition to the typical large CA storage rooms used for apples, there are also methods to utilize CA on a smaller scale. In cases where there is a need to place only a few pallets into CA, plastic pallet covers or zipper tents can be used. These can be made for 1 to 48 pallets and have the economical benefit of utilizing an existing cold room. The covers or tents are air tight and hold the CA, so that the cold room itself does not need sealing.

For all CA set-ups, one can choose either manual or automatic gas control, depending on cost preference. Similarly, one can choose between using bottled nitrogen (for reducing O₂), which is often inconvenient and expensive over time, or purchase a nitrogen generator that is customized for whatever the need. Storage Control Systems Inc. (SCS) is the only North American supplier of Permea™ nitrogen generators. These have the advantage of using hollow membrane fibers, and thus have fewer moving parts, less maintenance requirements, and reduced chance of breakdowns (compared to the pressure-swing type generators). The use of lime to reduce (and maintain) the amount of CO₂ in the CA room versus acquiring a more efficient and convenient carbon scrubber is another choice for the storage operator. The advantage of the latter is automation and precise control of specific CO₂ concentrations, which greatly benefit certain apple cultivars.

The most recent advancement for long-term storage of apples is the use of **SmartFresh (1-MCP) technology**. Successful application requires an air-

tight environment and therefore, the easiest method of application is simply within a sealed CA room. However, there are other methods for treating smaller loads. SCS supplies a **Corner Room**, which looks like a two-sided heavy-duty plastic tent, with a zipper for easy access. Any size can be manufactured for any room, but the ceiling and other two room walls must be air-tight. A **Splitter Room** is another option, where one side (or half of the room) can be treated with SmartFresh while the other side is being loaded or unloaded. This provides the benefit of reducing the time between harvest and treatment, which ultimately affects the efficacy of SmartFresh. Again however, the ceiling and other room walls must be air-tight. Similarly, a **Divider Room** can consist of a single curtain that divides the end of a CA room to create a separate treatment area or a stand alone five-sided zipper tent within the room. These can be made any size for any need.

The **SCS SmartChamber** is considered the Cadillac treatment room, in that it moves up and down to eliminate treatment of void space and moves side to side for treating different loads very rapidly. This can also be made for any size treatment area and it has inner batons to maintain its shape. The reinforced vinyl material reduces the chance of tearing. An additional advantage of the SmartChamber is that it does not rely on any framework or air tightness of the storage room, as do the other treatment methods mentioned previously.

For more information on any of the above products and technology, please contact Jim Schaefer at 1-800-487-7994 or e-mail Jim@storagecontrol.com

Postharvest Treatment of Whole Apples Influences Browning of 'Empire' Slices

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

One of the major cultivars used for apple slices is 'Empire', but there are several practices that can affect whole fruit quality during long-term storage. Consequently, such factors will also influence the fresh-cut slice quality. As part of a larger project (*Evaluation of New Apple Varieties and SmartFresh (1-MCP) for Fresh-cut Apple Slices*) in collaboration with Dr. Peter Toivonen (AAFC, BC) and supported by Pride Pak Canada, Ontario Apple Growers,

AgroFresh Inc., and the Agricultural Adaptation Council, the following study was conducted during the 2006 storage season.

'Empire' apples sprayed with and without ReTain (200 ppm, 2 weeks prior) were harvested locally on September 25th and October 2nd. Half of the apples from each treatment were then drenched with DPA (ShieldBrite, ~900 ppm) and Mertect (0.5 g·L⁻¹). All fruit were cooled overnight to 3°C and then half of the apples from each treatment combination were treated with SmartFresh (1 ppm, 24 hours). Apples were stored in standard CA (2.5% O₂ + 2% CO₂) at 0.5 or 3°C for 6, 9, and 10 months.

After 6 months of standard CA storage, slices made from 'Empire' from the second harvest (but still within the optimum maturity window) had substantially more decay development than those from the first harvest. 'Empire' treated with SmartFresh (1-MCP) also resulted in higher incidence of decayed slices. ReTain and DPA had no significant effects on slice browning. Slices from apples stored in CA at 0.5°C and from fruit held for 7 days in ambient air (0.5 or 3°C) prior to slicing had less browning than those held in CA at 3°C and those held for 2 days, respectively. Hence, a few days of holding apples in refrigerated ambient air after CA storage appears to improve slice quality. There were no significant interactions of 1-MCP and/or DPA and/or ReTain on slice quality. Storage disorders were very prevalent in all treatment combinations after 10 months of CA storage, so no slices could be made.

Unusual high amounts of low temperature breakdown (LTB) and core browning developed in 'Empire' apples in this study after 6+ months of CA storage. Confirming previous studies, there was no significant effect of SmartFresh (1-MCP) on LTB. However, apples treated with 1-MCP had more typical core browning, but less spotted core browning than those not treated. Typical core browning largely developed in CA storage at 0.5°C, whereas spotted core browning was only found in fruit held at 3°C. The highest incidence of spotted core browning was found in control (non-treated) apples from the second harvest. This is the first year that differences in core browning development have been observed in 'Empire' from CA storage, so further examination and study is required. ReTain-treated apples had less LTB and core browning, whereas DPA also reduced the incidence of these disorders, as well as decay development.

This entire study using 'Empire' is currently being repeated for the 2007 harvest season.

Crop Protection

Exploring Fire Blight Management, Part 3: Antagonists of *Erwinia amylovora*

Neil Carter, formerly with OMAFRA, Vineland

Fire blight reached epidemic proportions in Switzerland in 2007 and much of the rest of Europe as well (Duffy *et al.* 2007). Early, warm weather was conducive for fire blight infections during a long synchronous bloom, exposing many more blossoms than usual to the causal pathogen, *Erwinia amylovora*. Losses were significant across Europe and were compounded by strict regulations on antibiotic sprays. The European Union has a strong stance against the use of antibiotics for horticultural production which has encouraged the search for alternative management strategies. Many areas around the world, including in North America, have witnessed the increase in various antibiotic-resistant strains of *E. amylovora*. This has also hastened the search for new methods of limiting fire blight.

One area of research has focused on finding organisms that are antagonistic to the *E. amylovora* bacteria. Antagonistic organisms are intended to out-compete the disease-causing bacteria where they occur in blossoms. There is a limited amount of resources where infection can occur, so bacteria or fungi that can grow quickly and deprive *E. amylovora* of food or space and, at the same time, not cause disease are helpful for fire blight suppression. It is not nearly as simple a process as that sounds though. Recent research shows that having some virulent *E. amylovora* present on the nutrient-rich flower stigma actually enhances the yield of other non-disease causing bacteria (Johnson *et al.* 2007). Johnson *et al.* suggest that *E. amylovora* actually modify their habitat by the expression of "pathogenesis-related genes" and increase resources (nutrients) available to themselves and co-occurring bacteria and fungi. A suppression of host resistance could also be occurring, but in any case, it is not just a simple situation of resource competition. The fact that *E. amylovora* create a "biofilm" (Koczan *et al.* 2007), which is a complex aggregation of bacteria, other molecules and sugars, also makes the process of antagonistic competition even more complicated. *E.*

amylovora thrive in the biofilm they create but the biofilm also provides a niche for many other bacteria and microorganisms.

One bacterial antagonist of *E. amylovora* that is already registered for use in Ontario is *Pantoea agglomerans*. Two different strains of *P. agglomerans* are registered as “Bloomtime” and “BlightBan” and since I’ve written about those products recently (Carter and Celetti 2006), I won’t go into any great detail on them here. Researchers in Oregon (Stockwell *et al.* 2007) are exploring ways of integrating antioibiotic sprays with antagonists (*P. agglomerans* and *Pseudomonas fluorescens*) for improved control of the blossom blight phase of fire blight. Preliminary work suggests that antagonists applied at around 70% bloom followed by antibiotic spray (in this case oxytetracycline) later in bloom may provide reasonable control with reduced antibiotic use from standard management practices.

Another antagonist that is undergoing field tests in Europe is “Blossom Protect”, which contains two yeast strains (*Aureobasidium pullulans*) antagonistic to fire blight bacteria (Ertl *et al.* 2007). A suitable formulation is now in limited use after many years of work, not least of which was the determination of a fermentation process capable of producing commercial amounts of the yeasts. These particular yeasts must be applied early and frequently through flowering since they propagate in the flower and prevent infections by *E. amylovora*. Preventative use at 10%, 40%, 70% and 90% open blossoms may be lowered to two applications as more is known about the biology of the yeasts. Work continues to lessen fruit russetting if the product is used too late and to reduce the relatively high cost of the product.

With the number of antagonists under study now, it is very likely that some form of *Erwinia* antagonists will become a standard recommendation in the future for management of fire blight in Ontario. Integrating their use with antibiotic applications will be an area requiring a great deal of field work in the future.

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Exploring Fire Blight Management, Part 4: Antibiotics

Neil Carter, formerly with OMAFRA, Vineland

Fire Blight, the most serious disease of pear and apple in Ontario, is normally suppressed by the combination of cultural management techniques and antibiotic sprays. Some antagonists are now registered (Carter and Celetti 2006) and the plant growth regulator prohexadione-calcium (“Apogee”) has also been added to our short list of fire blight management products (Cline 2006).

Antibiotics are a traditional approach to managing bacterial diseases of horticultural crops but there is strong pressure against their use in some areas including the European Union. The United States has had other antibiotics registered for use against fire blight for some time (e.g. oxytetracycline) but there are continuing concerns with their use in horticulture. Since streptomycin and oxytetracycline have uses in human medicine, there are concerns with development of resistance by human pathogens. More disturbing from a horticultural perspective is that there has been widespread resistance developed in many regions to streptomycin by *Erwinia amylovora*, the causal agent of fire blight (McGhee *et al.* 2007, Russo *et al.* 2007, Adaskavag 2007, Evans 2007, Sholberg and Boulé, 2007).

Even though there are streptomycin resistant *E. amylovora* in some regions, streptomycin is often still the standard against which other control

measures are evaluated. However, in all cases and for all products used to manage fire blight, one should be very cautious of putting too much stock in any single field trial or experiment. Stockwell *et al.* (2007) presented an excellent summary of 16 years of fire blight trials in Oregon at the 11th International Workshop on Fire Blight in Portland, Oregon in August 2007. All products, whether antagonists or antibiotics - including streptomycin, showed a wide variability in level of control when examined over the long-term. This summary of trials was a good reminder that seasons, plants, bacteria and applications are all variable, and you can not expect anything to work perfectly in every case. The other side of that coin is that limited field trials that show success should be viewed cautiously since there may have been low levels of *E. amylovora* to start with, or environmental conditions that did not favour infection, or any number of other reasons for unusual or unexpected results.

A relatively new antibiotic that is not yet available in Ontario holds good promise as an alternative fire blight management tool. Kasugamycin ("Kasumin") is a fermentation product of *Streptomyces kasugaensis* and can be a useful adjunct to other antibiotics for several reasons. Kasugamycin has no uses in human medicine, so concerns over human pathogen resistance are immaterial. Also, it appears that almost all streptomycin-resistant strains of *E. amylovora* are not resistant (at present) to kasugamycin. This fact would make kasumin an excellent rotational tool for antibiotic-based fire blight management (Evans 2007). The integration of kasugamycin with bacterial antagonists (see part 3 of this series of articles) in fire blight management programs will require further investigation since it appears that kasugamycin may be a stronger inhibitor of bacterial biocontrol agents than streptomycin (Johnson *et al.* 2007).

Other antibiotics continue to be studied for use against *E. amylovora* as do various plant extracts such as sea buckthorn juice (Sholberg and Boulé, 2007). For now though, streptomycin remains as our primary chemical method for fire blight control and following resistant management strategies is critical to maintain its effectiveness. The addition of new antibiotics to our available products would be an excellent way to keep streptomycin effective and help to manage fire blight sustainably.

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OMAFRA Apple IPM Projects Update 2007

This past growing season was a busy year for IPM projects in apples. Fortunately with funding and support from several chemical companies, the pest management centre, Hort Crops Ontario, and the Ontario Apple Growers we have been able to get a lot done this year.

The following are a list of some of the products initiated this year:

OMAFRA led projects in apple IPM

- Evaluating the efficacy of Rimon (novaluron)

and Altacor (rynaxapyr) in managing obliquebanded leafroller (K. Carter, M. Appleby) (funding from Chemtura, Dupont and OAG). Rimon (novaluron) is an insect growth regulator (IPM friendly insecticide) that was registered in 2007 for use on apple against a variety of insect pests (codling moth, oriental fruit moth). Research in the US has shown that this product can provide effective control of obliquebanded leafroller populations when applied at petal fall in apple orchards. Altacor (rynaxapyr) is a new chemistry of insecticide that is also considered to have good efficacy against obliquebanded leafroller. Submission has been made for the registration of Altacor™ for the control of pests like obliquebanded leafroller, codling moth, oriental fruit moth, and spotted tentiform leafminer. The goal of this project was to compare the efficacy of these two new insecticides to Intrepid (methoxyfenozide) another product that is already registered for obliquebanded leafroller. Insecticides were applied at petal fall and were re-applied 10-14 days later. Although the data has yet to be analyzed, all of the products provided good control of leafrollers. None of the products appeared to have a negative impact on phytophagous mites (european red mite and two-spotted spider mite) populations.

- **Evaluating miticides in managing mite populations** (K. Carter) A project was initiated to compare the efficacy of high and low rates of application of Acramite to manage european red mites in Ontario apple orchards. The results of this trial have yet to be analyzed.
- **Evaluation of the use of mating disruption in managing the apple clearwing moth (*Synanthedon myopaeformis*)**. (Project lead: H. Fraser; collaborators: D. Beaton, K. Carter, N. Carter). The apple clearwing moth (*Synanthedon myopaeformis*) was first noted in BC in 2005, and a single orchard with this pest was found by the CFIA in Ontario in 2006. Surveys in 2007 found that although this pest is still present in relatively high numbers at one orchard in Ontario it has not been found at any other orchards. The goal of this project is to work with the grower to implement mating disruption to manage this pest. This is the first year of a multi-year project.
- **Evaluation of the use of Calypso (thiacloprid) in managing early season pests of apple** (K. Carter, M. Appleby) The goal of this demonstration trial was to get a better

understanding of how Calypso fits into our existing apple IPM program. Petal fall applications of Calypso were used to evaluate the efficacy of this product against mullein bug, and oriental fruit moth. Two orchard blocks were set up, one that received Calypso and another that received a conventional treatment. Monitoring for aphids, leafhoppers, and mullein bugs was conducted prior to spray application and June 5th. The results of this demonstration trial suggest that Calypso was effective in managing mullein bug populations, aphids, and oriental fruit moth.

- **Evaluation of black rot in Royal Gala apples in response to chemical thinning** (funding from HCO) (Project leads: M. Celetti, J. Gardner and J. Cline, collaborator: K. Carter) A preliminary study in 2006 indicated that the application of chemical thinners Fuitone and Maxcel at petal fall may result in less black rot infected fruit caused by *Botryosphaeria obtusa* at harvest but may not be optimum for reducing fruit load and maximizing fruit size. A second experiment was conducted in 2007 to further investigate the effect of timing of the chemical thinners Fuitone and Maxcel on the incidence and severity of black rot on fruit and to compare these treatments with hand-thinning. The incidence of black rot was lower on fruit from trees that were thinned when developing fruit were 6-8 mm in diameter than from trees thinned when developing fruit were 12-14 mm in diameter. Hand thinned trees had significantly fewer mummified fruitlets and a lower incidence of black rot infected fruit at harvest, in comparison with trees that were chemically thinned. Best thinning was observed when treatments were applied to trees when developing fruit were 6-8 mm or 12-14 mm in diameter. Trees that received 6-BA had significantly fewer fruit than trees that were hand thinned. Applying chemical thinners when developing fruit were 6-8 mm in diameter reduced the crop load, maximized fruit size and minimized black rot infected fruit at harvest.
- **Validation of an oviposition model for timing insecticide sprays against plum curculio (PC) in Ontario** (funding from HCO) (Project lead: H. Fraser, collaborators: K. Carter, M. Appleby) This preliminary study will validate the usefulness of the NY PC model under Ontario growing conditions and will help growers improve pesticide timing and reduce unnecessary pesticide use. OMAFRA staff will evaluate the effectiveness of two types of traps for monitoring PC in apple orchards. Weather data will be collected at each site and incorporated

into the NY model to predict insect emergence and time insecticide sprays. Traps will be used to monitor insect activity in several orchards. OMAFRA staff will use two different types of insect traps at 9 orchards throughout Ontario to monitor PC populations and evaluate the accuracy of the traps in monitoring pest populations. We have preliminary data from this project in 2007, and are hoping to continue on this research in 2008.

- **Refinement of a developmental model for obliquebanded leafroller and insecticide timings using new, reduced-risk pest control products** (funding from HCO) (Project lead: H. Fraser, collaborators: K. Carter, M. Appleby) This study will track both the flight patterns of OBLR adults and compare predictive models with observed insect lifestages (eggs, various instar larvae, pupae) present in the field. OMAFRA staff will place pheromone traps in several orchards and monitor weather conditions in eight sites throughout Ontario. The Ontario model will be compared to more sophisticated models to determine the most accurate model for predicting insect development in Ontario. We have preliminary data from this project in 2007, and are hoping to continue on this research in 2008.

Projects led by other researchers, in which OMAFRA participated:

- **Evaluating the use of GF 120 (spinosad+bait) in managing apple maggots in Canada.** (Project lead: J. Reekie, AAFC-Kentville, NS), collaborators: K. Wilson/Lindsay Pink private consultant; K. Carter, Appleby, and H. Fraser, OMAFRA) (funding from PMC and OAG) The objective of this project was to evaluate the efficacy of GF 120 a spinosad bait in managing apple maggot in organic apple orchards. In Ontario, two organic 'Novaspy' orchards were used for the evaluations, while in Nova Scotia three organic and one IFP orchards ('McIntosh', 'Cortland', 'Rhode Island Greenings' and a seedling mix orchard) were used. In each orchard there were four replications of four treatments and a control. Treatments included three rates of GF-120: 1x, 1.5x and 2x label rate and Surround. Insecticide treatments were applied on a weekly basis following capture of the first adult apple maggot on a yellow sticky board. Harvest assessments were conducted in September to evaluate the different treatments. During harvest assessments 20 apples were collected from 10 trees in each plot; in control plots 20 apples from

16 control trees. Fruit were incubated at room temperature for 2 weeks. Fruit were cut into quarters and apple maggot damage was recorded. Based on the findings of this study, it can be concluded that GF-120 is as effective as Surround in the control of apple maggot. Therefore, it is recommended that GF-120 be used to control apple maggot in organic and conventional orchards.

Evaluation of Rapid Apple Scab Fungicide Resistance Monitoring

Wendy McFadden-Smith, McSmith Agricultural Research Services

Two methods for determining the level of resistance to apple scab fungicides were tested in Ontario orchards. One method screens conidia from primary lesions collected from unsprayed trees and takes 7 days to give results. The assessment of practical resistance is assessed by determining the proportion of the population that is not inhibited by a specific dose of fungicide. When more than 40% of the isolates have reduced sensitivity, the orchard is considered to be at "practical resistance" and unreliable control will be provided by the fungicide in question.

The other method screens ascospores collected from artificially or naturally overwintered infected leaves and takes 3 days. This method relies on comparisons between reference orchards (where the fungicide does or does not work) and test orchards.

The first two years of the trial were a learning experience with several technical set-backs so no data were generated. The apple scab pathogen population was screened for resistance to myclobutanil (Nova) and dodine (Equal) in 2007 when 7 orchards from Niagara, Middlesex and Durham counties were successfully screened using the 7-day method. The populations in 3 of the 8 orchards had shifted from sensitive to fungicide tolerant. A 4th site was still in the sensitive range but had experienced a significant shift. All 7 of the orchards were at baseline sensitivity to dodine.

The 3-day method was used on only 6 orchards as the artificial overwintering protocol was unsuccessful and a second sample of leaves had to be collected in June, after the leaves from the wild-type (no fungicides sprayed) had been thoroughly mowed. It

was difficult to interpret the results from the 3-day method because no reference orchards had been designated. However, the trend for the two methods was the same: orchards with a larger proportion of resistant isolates using the 7-day method also had a higher growth on the fungicide than those with a lower proportion of resistant isolates.

Both methods can differentiate “sensitive” and “tolerant” orchards. The challenge is deciding what to do with “intermediate” rankings, the ones where control may break down with high disease pressure. However, this is a challenge with both techniques.

How can the information generated by either method be used? When a grower feels that a particular fungicide is no longer effective, a screen for resistance can tell whether or not the population has started to shift and how close it is to “practical resistance”. When trying to decide whether to use a fungicide such as dodine in the spray program, a grower could have the orchard screened before the season started to determine whether the pathogen population is sensitive to the fungicide. This is what is being recommended in NY. When control failures occur, screening the pathogen population could be used to determine whether the failure was due to a buildup of fungicide tolerance or disease management problems.

The main difference between the two techniques is the time frame when results can be provided. The Koller method relies on collection of primary infections. Even with the more rapid turnaround compared to the original method, the grower would not have results for most of the primary scab season, when critical decisions regarding fungicide use must be made. The line intercept method can provide this information before the growing season begins.

The 3-day method provides a rapid and timely answer to the question of relative fungicide tolerance in an orchard, and orchards are ranked the same way as in the 7-day method. In order to use this method, “reference” orchards would have to be identified and used to rank test orchards. The artificial overwintering protocol is still being perfected.

Acknowledgements:

The assistance of Margaret Appleby and Kathryn Carter of OMAFRA was invaluable in completing this project. Financial support by Dow AgroSciences and Cheminva Inc. and product donation by NORAC Concepts are also gratefully acknowledged.

2007 Year End in Review Ontario

*Kathryn Carter, Pome Fruit IPM Specialist,
OMAFRA, Slmcoe*

Weather

This summer was very hot and dry in many regions of Ontario. Many of the varieties were harvested several days earlier than usual. There was some difficulty in getting the fruit to colour up at harvest, especially varieties such as McIntosh. There were several hailstorms that went through the apple growing region east of Toronto.

Diseases

Despite the extreme dry weather there was a lot of apple scab in orchards throughout the province. There was considerable discussion about why this may be occurring (resistance, timing etc). Many growers assumed that their fungicides applied around bloom would provide 3-5 days protection. However, I think the extremely hot weather during bloom may have resulted in accelerated growth and may have reduced the fungicide residue distribution uniformity. Currently Dr. Wendy McFadden Smith (McSmith Ag services) is conducting some research to test for resistance to SI's in Ontario. Currently SI resistance has not been documented in Ontario.

Insects and Mites

Aphids (rosy apple aphid, and green apple aphid) appeared in apple orchards early in the season this year, and in high numbers. Codling moth was a problem again in several Ontario apple orchards. Last year (2006) OMAFRA conducted a bioassay (based on research conducted by L. Gut) to evaluate levels of OP resistance in codling moth (CM) populations at two orchards in Norfolk county. Although the sample size was small, the preliminary results suggest that OP resistance in codling moth populations in some of the orchards may be a problem. Dr. Ian Scott was recently hired as a toxicologist with Agriculture and Agri-food Canada and he hopes to conduct a survey to evaluate if OP resistance is present in CM populations in Ontario. Mite populations were high this year in some orchards, likely a result of the hot dry summer.

Other

Last year CFIA announced that all counties in Ontario are deemed infested with Japanese beetle (prior to last year it was only found in southern Ontario). This year we saw more incidence of Japanese beetle damage in apple orchards, however, it is still considered to be a sporadic pest.

Honeycrisp appears to be a variety that is preferred by Japanese beetle.

Last year surveyed orchards throughout Canada for the apple clearwing moth (*Synanthedon myopaeformis*). This pest was first noted in BC in 2005, and a single orchard with this pest was found in Ontario in 2006. Surveys in 2007 found that although this pest is still present in relatively high numbers at one orchard in Ontario it has not been found at any other orchards. This year OMAFRA initiated a project to evaluate the efficacy of using mating disruption to manage this pest.

Minor Use Label Expansion Granted for Intrepid 240F Insecticide for Control of Leafrollers on Pome Fruit

*J. Chaput, OMAFRA, Minor Use Coordinator,
Guelph*

The Pest Management Regulatory Agency (PMRA) recently announced the approval of a minor use label expansion for **INTREPID 240F** insecticide (methoxyfenozide) for control of oblique banded leafroller (OBLR) and three-lined leafroller (TLLR) on pome fruit (apples, pears, crabapples, Oriental pears, quinces) in Canada. Intrepid 240F was already labeled for management of Lepidopteran pests of apples in Canada. This is the 1st label expansion for Intrepid 240F insecticide in Canada.

This minor use submission was sponsored by Agriculture and Agri-Food Canada, Pest Management Centre (AAFC-PMC) in the fall of 2006 in response to minor use priorities identified by Canadian pome fruit producers and extension personnel.

Access to new insect management tools is a high priority for pome fruit producers and the label expansion of Intrepid insecticide will provide pome fruit producers with an effective and useful leafroller management tool.

Intrepid 240F insecticide can be applied at a rate of 750 mL product per ha in a minimum spray volume of 1000 L per ha to a maximum of two times per season. For control of the overwintering generation apply Intrepid during late bloom to early petal fall when larvae are actively feeding and before they roll up in the actively growing terminals. For

suppression of the summer generation apply Intrepid at 1st egg hatch (as determined by degree days). A second application can be made at 10-14 days after if monitoring indicates a need. Field monitoring and degree data for leafrollers is needed to time these applications accurately. A maximum of 2 applications per season is permitted. The pre-harvest interval for pome fruit is 14 days.

Intrepid 240F insecticide should be used in an integrated pest management program and in rotation with other management strategies. Follow all other precautions and directions for use on the Intrepid 240F insecticide label.

This minor use submission was sponsored by AAFC-PMC as a result of priorities established in consultation with producers. We also wish to thank the personnel of **Dow Agrosciences Canada Inc.** for their support of this registration and the personnel of the Pest Management Regulatory Agency for evaluating and approving this important pest management tool.

For copies of the new minor use label contact Kathryn Carter, OMAFRA, Simcoe (519) 426-4322, Jim Chaput, OMAFRA, Guelph (519) 826-3539 or visit <http://www.dowagro.com/ca/en/index.htm>

Announcements

OFVC Apple Program February 20, 2008, Brock University

John Gardner, Apple Specialist, OMAFRA, London

One of the real shockers for the last 12 months in North America has been the paradigm shift or change in the apparent value of the apple crop as evidenced by what consumers are paying for quality fruit. Not only are consumers paying more for apples but they are buying more at higher prices. This is good news for the industry and growers in general as average bin returns for different cultivars has been better than expected. This response is in part resulting from the changes in the ways in which apples are grown, the product being offered and the supporting technologies that the industry now employs. Our OFVC Apple Program this year is largely a reflection of these changes in concept from the selection of cultivars to plant, the way our orchards are managed and how product is handled after harvest to maintain its value.

We are featuring talks on crop protection, postharvest technologies and their application, orchard design for labour efficiency as well as presenting an expert panel on scab management in the orchard. Michael Celetti will cover findings on management of black rot disease as it relates to our thinning practices in Gala plantings. Dr. Julia Reekie, researcher from AAFC, Nova Scotia is going to discuss GF 120, a biopesticide with potential for the management of apple maggot. Our panel on scab management features Dr. David Rosenberger from Cornell University's Hudson Valley Lab of New York, Cathy McKay, grower/consultant, The Apple Doctor Ltd., consultant Dr. Wendy McFadden Smith, McSmith Agricultural Services. Dr. Terence Robinson of Cornell University will address the topics of tall spindle training and efficient management of high density orchards. Dr. Jennifer DeEll, Fresh Market Quality Program Lead with OMAFRA will review the advances in our understanding of how to hold product quality in the postharvest period. Jennifer will be joined by Jim Schaefer of Storage Control Systems Inc., in Sparta, Michigan. There should be plenty of time for discussion and questions. Check out the Thursday program that includes a fireblight workshop led by some of the top fruit tree pathologists in North Eastern North America.

Apple Program as Part of OFVC

Apple Program as part of the OFVC, Wed., February 20th, 2008, Walker Complex, Brock Univ.

AM

- **Black Rot in Royal Gala Apples in Response to Chemical Thinning** –Michael Celetti, Plant Pathology Program lead, Horticulture Technology, OMAFRA
- **GF-120 NF Naturalyte Fruit Fly Bait for Apple Maggot Control in Organic Orchards** – Dr. Julia Reekie, AAFC, Kentville, Nova Scotia
- **Expert Panel on Scab Control** – Dr. David Rosenberger, Cornell University, Hudson Valley Lab, N.Y.; Dr. Wendy McFadden Smith, McSmith Agricultural Services; Cathy McKay, grower/consultant, The Apple Doctor Ltd.

PM

- **The Tall Spindle** – Dr. Terence Robinson, Cornell University, Ithaca, New York

- **Improving Apple Quality** – Dr. Jennifer DeEll, Fresh Market Quality Program Lead, OMAFRA, Simcoe
- **Storage Techniques Far and Wide** – Jim Schaefer, Storage Control Systems Inc., Sparta, Michigan
- **Efficient Management of High Density Orchards** – Dr. Terence Robinson, Cornell University, Ithaca, New York

Fire Blight Workshop Agenda

“Fight the Blight”

February 21, 2008, 1:00 pm – 4:00 pm
Ontario Fruit and Vegetable Convention,
Room 201, Walker Complex,
Brock University, St. Catharines

Fire blight caused by the plant pathogenic bacteria *Erwinia amylovora* is a serious disease of pear and apple. Up until 2007, the antibiotic streptomycin was the only effective management tool registered in Ontario for control of fire blight in apples and pears. Reliance on streptomycin for fire blight management may lead to the development of resistant strains of *E. amylovora*. Recently, new biological based products such as Bloom Time, Blight Ban and Serenade have been registered in Canada to help manage fire blight and possibly reduce the risk of resistance development. The effectiveness of these new products requires precise application and timing. Participants at this workshop will learn how to use and interpret the simple fire blight prediction and decision support based model Cougar Blight to aid in the timely application of products to manage fire blight. Participants will learn about the differences between prediction models and how they can be used in a fire blight management system. Fire blight resistance management, the effectiveness of the biological based products and the latest research on resistant root stocks will also be discussed.

1:00 pm Michael Celetti, OMAFRA Plant Pathologist - "Cougar Blight: A Simple, User-Friendly Fire Blight Predictive Model".

Hands on step by step instructions will be provided to growers on how to input information into the Cougar blight model to determine the risk of Fire blight in their orchards.

1:30 pm Dave Rosenberger, Cornell University - "A Time-Line for Fire Blight Management with Action Cues from Prediction Models"

Timing of critical activities for controlling fire

blight will be discussed for the period from bud break through mid-June. Benefits and practical limitations of Cougar Blight will be reviewed along with other cues that can assist with timing of blossom blight sprays.

- 2:00 pm Megan Dewdney, Cornell University- "A Comparison of Fire Blight Forecasters: What Are the Differences?"

The presentation will compare and contrast the two commonly used blossom blight forecasters, Cougarblight and MARYBLTY. There will be discussion of forecaster accuracy, the circumstances when forecasters can be inaccurate and future research areas.

- 2:30 pm Nicole Russo, Cornell University – "Evaluation of Apple Rootstocks for Resistance to Fire Blight"

Fire blight caused by *Erwinia amylovora* is a continual threat to apple production in the Great Lakes Region. The rootstock phase of fire blight, known as rootstock blight, has become an increasing problem in high-density systems due to industry reliance on fire blight susceptible rootstocks, particularly Malling 9 (M.9). Field evaluations have shown that fire blight resistant rootstocks can outperform industry standard Malling stocks while greatly enhancing the survival of young trees.

- 3:00 pm George Sundin, Michigan State University - "Streptomycin Resistance: What is it? Where is it? and How to Avoid It".

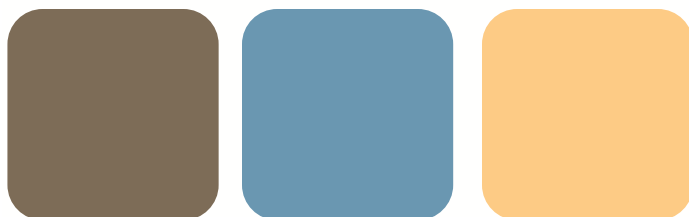
Michigan apple growers have been dealing with streptomycin resistance to the fire blight pathogen for many years. The lessons learned on how resistance develops in orchards, the loss of the best blossom blight control material available, and the efficacy of various streptomycin alternatives will be specifically discussed.

- 3:30 pm Antonet Svircev, AAFC, Vineland - "The Use and effectiveness of Biopesticides for Fire Blight Management."

Successes and problems will be openly discussed using the data from the 2007 Canadian Demonstration Trials in BC, ON and Quebec. The key message will be: biopesticide application and use requires a new strategy from the growers. Their efficacy is highly weather dependant and last minute applications will not work. The goal is to integrate the biopesticides into the current streptomycin program and reduce the number of strep applications.

Wind Meter Sources

Green Lea Ag Center	800-661-5019
Graham Agriservices	905 786-2934
Halltech Environmental	866-425-5832
HJV Equipment Limited	866 476-2424
Hoskins Scientific	905 333-5510
Phillips Farm Supplies	800 811-6238
CFE Industries Inc.	877-233-2255
Forestry Suppliers Inc.	800 647-5368



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

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