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For Commercial Apple Producers



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Editor(s): John Gardner - Apple Specialist/OMAFRA
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Table of Contents

Orchard Management

- [Installing Drip Irrigation?](#)
- [Honeycrisp Leaf Complex](#)
- [How Densely Can We Plant Apples?](#)

Crop Protection

- [Pest Monitoring: Proper Use of Pheromone Traps](#)
- [Rotation and Resistance](#)
- [Using Casoron Herbicide for Apples](#)
- [Fire Blight Management Tips from Michigan: When to Prune](#)

Post Harvest

- [Control of Postharvest Blue Mold of Apple](#)
- [Postharvest Disorders....Photo Galleries - Check it Out](#)

| [Top of Page](#) |
| [OMAFRA Newsletters](#) |

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[HOME](#)[WHAT'S NEW](#)[CALENDAR](#)[PRODUCTS](#)[NEWS RELEASES](#)

Installing Drip Irrigation on Your Farm?

Author: Rebecca Shortt - Irrigation Specialist/OMAFRA
Creation Date: 01 December 2002
Last Reviewed: 01 December 2002

Our summers are getting hotter and drier and more and more growers are beginning to think about irrigating. Many have already invested in irrigation and the benefits in terms of yield and quality are making those farmers happy, particularly after a summer such as 2002 where rainfall deficits affected growth in many parts of the province.

If you're considering installation of irrigation on your farm, or considering upgrading your present system, why not look into a drip irrigation system. There are many benefits for apple growers.

With drip irrigation, only the root zone of the plant is supplied with water. Deep percolation and excessive evaporation from the soil surface are avoided. This leads to an overall reduction of water use decreasing both the required size of water storage and decreasing the required pumping rate. Field edge water losses and spray evaporation, which occur with sprinkler systems, are avoided with drip irrigation, leading to further reductions in water application demands. Runoff is minimized due to the low water application rate, making drip systems particularly well suited to steep fields where the tree rows run across the slope.

Labour requirements for drip irrigation systems can be low, once the system has been installed and systems can easily be automated. Fertilizing the trees directly using nutrients dissolved into the irrigation water allows for added efficiency. Drip irrigation provides the most uniform water application of any irrigation system, and is not subject to interference by wind.

There are some particular needs for drip irrigation systems that must be addressed for successful operation. Effective filtration equipment is needed to avoid clogging emitters. Filter selection will depend on the farm water source (well, pond etc.), and the quality of the water from that source. Emitters and system selection should be based on topography, soil and water source. Scheduling tools and techniques are important so that your drip irrigation system works for the maximum benefit of your crop.

| [Top of Page](#) |

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| [Home](#) | [What's New](#) | [Calendar](#) | [Products](#) | [News Releases](#) |



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[HOME](#)[WHAT'S NEW](#)[CALENDAR](#)[PRODUCTS](#)[NEWS RELEASES](#)

Honeycrisp Leaf Complex

Author: Dr. John Cline - Assistant Professor (Pomology)/ University of Guelph
Creation Date: 01 December 2002
Last Reviewed: 01 December 2002

This article was reviewed by the editor of *Orchard Network* for technical accuracy and appropriateness.

Honeycrisp (Figure 1) is a large, bicolored apple introduced by the University of Minnesota's apple breeding program in 1991.

Figure 1. Honeycrisp apples grown at the Horticultural Experiment Station, Simcoe.



It has an aromatic, sub-acid flavor with a good acid-sugar balance. One of its primary outstanding attributes is its

crispness and keeping quality - unusual traits for an apple that matures in early to mid September.

Another uniqueness of this cultivar is that it commonly develops a leaf complex indicated by interveinal chlorosis and leaf blotchiness - not very dissimilar to a nutrient disorder. It is not known what causes these symptoms, or whether it is of any physiological consequence to the tree or fruit. However, indications thus far seem to indicate that it is genetically based because it is so widespread wherever Honeycrisp is grown.

The leaf complex symptoms appear on extension shoot leaves early, worsen throughout the growing season and persist until leaf drop when leaves often become much browner in comparison with other cultivars (Figure 2). Its presence is more prevalent on trees with lighter crop loads and trees with less vigour (Figure 3). Although the symptoms resemble potato leafhopper damage, research in New York has ruled this out as a primary cause. Also, our lab has tested healthy and affected leaf tissue for macro or micro nutrient levels, and none appeared deficient. We have further screened trees from several Ontario and Nova Scotia orchards for viruses, and although some latent viruses were identified to be present, it is not clear whether they are explicitly contributing to the leaf complex. Dr.'s. Lailiang Cheng and Jim Schupp are postulating that the symptoms may be a result of excessive starch accumulation in the chloroplasts of leaves. This may be the result of impaired movement from the leaf to other parts of the plant such as fruit or roots. Regardless of the cause, orchardists growing Honeycrisp will soon discover these symptoms - and might initially be quite concerned. They can be assured that is common and at this point, does not appear to substantially affect tree health or productivity.

Figure 2. Close-up of leaves affected by leaf complex



Figure 3. Symptoms are more prevalent on younger terminal leaves and on trees with light crop loads



| [Top of Page](#) |

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How Densely Can We Plant Apples?

Author: John Gardner - Apple Specialist/OMAFRA

Creation Date: 01 December 2002

Last Reviewed: 01 December 2002

This is a question many have asked over the last decade or so. Many growers have thought about it and some in the Great Lakes Region have actually committed to plantings that are in the super spindle class. From a horticultural perspective, you can make a very tight planting work. Economically, there are limitations as to the amount we can invest in an acre of new orchard.

The costs of establishment can pile up quickly; with trees and components that are needed on a tree by tree basis being a major cost factor. However, density of planting does not have as great an effect on other major inputs such as irrigation and something like hail netting.

When you talk about spacings of 1.5 to 2 feet (super spindle) it translates into 45 cm to 60 cm in row spacing. The plant material alone for this density of planting could amount to several thousand dollars per acre or more (if it is sourced off the farm.)

In a recent discussion of super spindle and high-density systems at the Great Lakes Fruit Workers Conference in Michigan, New York researcher, Dr. Terrence Robinson summarized his findings on this type of system.

The tighter you plant, the faster you get returns. At some point, "the less densely planted orchards catch up to the super spindle with yields". With the super spindle, the owner should carry the planting for a minimum of 20 years to capture reasonable profits. In other words "you cannot grow super spindle for less than 10 years and expect to make money". Also the concept of super spindle is more attractive if you have the ability to produce your own nursery trees, since this can significantly reduce costs.

Another issue is light distribution within the high density planting. "The fruit colour disappears as the system matures" according to Terrence (if you are growing a cultivar with a colour requirement).

Terrence Robinson felt that a spacing of 4-5 feet in the row and 12 -13 feet between rows provides a good compromise. He emphasized that when you plant tightly you have to be very sure of the cultivar choice and growth habit.

In conclusion, an ideal cultivar for ultra high-density production should be grower friendly, have a high output of fruiting wood and provide good yield efficiency.

However, more importantly the variety must have consumer demand and pay well. The ultimate challenge is to get the best potential variety into the right system, at a manageable and affordable planting density.

| [Top of Page](#) |

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Pest Monitoring: Proper Use of Pheromone Traps

Author: Neil Carter - Tender Fruit and Grape IPM Specialist/OMAFRA; Hannah Fraser - Entomology Horticulture Program Lead/OMAFRA

Creation Date: 01 December 2002

Last Reviewed: 01 December 2002

Monitoring for pests and diseases is a fundamental first step in creating a proper integrated pest management (IPM) program. Targeting pests at the right time with the right product can save you money, make your pest control program more effective, and help preserve the beneficial organisms on your farm. There are many ways to monitor for insect pests in your orchards and vineyards and one popular method is pheromone traps. First of all, remember that pheromone traps are not the only method you should use to monitor for any pest. They are a useful tool but they are not a stand-alone method. Relying solely on pheromone traps for your monitoring information is hazardous to your crop! Having said that, pheromone traps are a useful tool but need to be used correctly. If you are in an area where there is a regional monitoring service and 'Agriphone' messages are available, you can rely on that for general guidelines, but you may want to monitor your own farm as well.

Pheromones are chemicals produced by some species of insects (probably in way more species than we now know) to communicate with members of the same species. Frequently, these are 'sex pheromones' which a female produces to attract a mate. Pheromones are most well known for Lepidoptera (moths and butterflies) and these chemical messengers can be commercially produced by synthesizing and blending the appropriate chemicals. For pheromone trap use, the pheromone chemicals are commonly forced into a rubber 'septa' (a small rubber cap), which can be placed in a sticky trap to attract male moths.

Storage and handling:

Pheromone 'caps' (lures) should be left in their sealed packages until a day before use in the field. "Pheromone blends are species-specific and insects are sensitive to minute quantities of pheromones. When handling pheromone lures (or any other pheromone product), wear disposable gloves to avoid cross-contamination with other products." (That quote is from the Pest Management chapter of OMAFRA Publication 360 -Fruit Production Recommendations. More information on this and other pest management topics can be found there.) Even if you are handling only one kind of lure, use disposable gloves or disposable forceps or you will contaminate the lure and it will be less effective than it should be.

Pheromone lures should be stored in their sealed packages in a fridge until use.

| [Top of Page](#) |

Placement in the field:

Sticky traps should be hung before the lures are placed in them. Put the traps at least 40m apart and if you are trapping

for more than one kind of insect, use separate traps for each kind of lure and keep them at least 40m from any traps set up for monitoring other species. Five traps placed in a line in your orchard should be sufficient for each kind of insect being monitored. Mark the location of the traps with bright flagging tape but keep the tape away from the trap so it doesn't become stuck in it. Use the jumbo-sized twist tie provided with the sticky traps to put the trap up firmly so it doesn't spin in the wind. Label your traps as well especially if you are monitoring for different insect species at the same site. Always use different traps for each insect type that you are monitoring - do not use more than one kind of lure per trap.

It's preferable if you can figure out a reliable way to suspend the lure in the trap without it touching the sticky surface. However, this practice can be both time consuming and frustrating. If the trap is firmly affixed to the tree, or wire, the lure can be placed in the bottom of the trap and will not roll around too much.

Some guidelines for placement of traps for commonly monitored pests:

Pest	# of traps	Separation	Height	Trap line placement
Oriental fruit moth	5	40 meters	1.2 - 1.5 m	From edge to interior
Grape berry moth	5	40 meters	On 2nd wire	Varies with site - 10m from likely source of infestation is a good start
Oblique-Banded Leafroller OBLR	2*	40meters	Mid Canopy	Wherever easily accessible in blocks with a history of damage

- With OBLR, you are monitoring for first catch, so fewer traps are needed. Established protocol says 2 traps, but we would suggest at least 3.

Replacement:

If traps get full of dirt, other insects or leaf bits, or if they sag from being wet for too long, they should be changed. Mass emergences of midges near large lakes often fill the sticky surface and cleaning them all off would remove all the sticky substance anyway. Transfer the pheromone lure to the new trap. Lures last for different lengths of time; if a replacement time is not printed on the package, assume that they last about 6 weeks. Pheromone lures definitely do not last all season! Try to replace the lures between generations of the monitored pest. It's best to take the lures out of their package for a day or two before putting them in the traps because lures tend to give off a large 'flush' of pheromones when packages are first opened. This can result in abnormally high numbers of moths being caught making interpretation of data difficult.

| [Top of Page](#) |

Monitoring the traps:

Traps should be checked twice a week on the same days each time. Once a week is not often enough because you will not get a good approximation of peak flights. Scrape out moths and other insects with a small spatula or scraper. Make sure you know what insect you are looking for and record the numbers you find every time. Do not rely on your memory!

If you are not sure exactly what your target insect looks like, find out. OMAFRA specialists, local entomologists and crop consultants can either identify your catches or direct you to good reference material for insect identification. The reason that this is so important is that even though pheromones are species specific, traps do sometimes catch other insects either passively (they're just flying through) or actively because of a close similarity in some species pheromones. A

pheromone is really a blend of chemicals and the major constituents may attract a non-target moth. The important point is that you want to be counting only the pest you are monitoring. Record your trap catches every time and graph the numbers if you can - it helps to visualize what the numbers mean.

Interpreting the numbers:

The numbers you record from pheromone trap catches tell you a couple of things about the pest but don't expect them to give you the whole picture. They do tell you when a particular pest is present in the adult form in your area. That's important for some pests as is 'biofix' or sustained first flight for other pests. By graphing the total numbers caught in your traps on each monitoring day, you can also see whether the numbers of adults is rising or falling. This can help you determine the best timing for control measures. The numbers caught in your traps do not always tell you enough information about the overall pest pressure to be used as thresholds for action. Timing of sprays is most accurate when information is gathered from a number of sites - regional monitoring programs are extremely useful in this regard.

Using the three pests from the previous table as examples, here is a rough idea of how to use the information from pheromone trap catches to time control sprays. (Note: if you are using mating disruption products for control of any pests, this information does not apply to you). Insecticide sprays are directed towards newly hatched larvae, not the adults. For GBM, decisions at some points are not based on pheromone trap data. Monitoring in other ways for all pests is a vital part of integrated pest management.

- For OFM, treatment should occur 3 to 6 days after peak flight depending on the weather (especially temperature - for first generation in the spring, the timing would usually be around 6 days after peak flight but only 3 days after peak for later generations).
- For OBLR in apples, the first spray is timed in the spring when larvae are found feeding in terminals. Pheromone traps are placed in the orchard after petal fall and the timing of treatments for the first summer generation (late June to early July) is just prior to first egg hatch. This occurs at 220 to 240 degree-days Celsius (base 6.1°C) after 'biofix' (first sustained flight). To calculate the degree days, use this calculation: $DDC = (Max. \text{ daily } ^\circ C + Min. \text{ daily } ^\circ C / 2) - 6.1^\circ C$ for each day and add the DDC until threshold is reached. In this case, the pheromone traps are used primarily to determine 'biofix'.

| [Top of Page](#) |

Don't worry if there are moths still being caught in your traps after a spray is used. Your spray for most moths is targeted at the new larvae as they emerge from their egg. Adult moths will still be flying from other locations and males will continue to be caught in your traps. That is not an indication that there was any problem with the effectiveness of your spray. When you do spray, post the information so any pest scouts can observe the appropriate re-entry period when they come to monitor your trap lines.

When you're not sure what the numbers mean, seek guidance from experienced crop consultants and pest management specialists.

Summary:

- Handle and store pheromone lures appropriately or they will not be effective.
- Replace traps and lures when needed and do not expect lures to work for a whole year.
- Place the traps so that they do not interfere with each other or with traps for other insects.
- Monitor faithfully and regularly and keep careful records.
- Be able to identify your target pest and find out what other common insects look like.
- Do not rely on trap catch numbers alone for pest management decisions.
- Attend pest scout training sessions, read 'Pub. 360' and find other information sources to learn more about pest monitoring.

Special note for growers using mating disruption products:

Pheromone traps have a very different use if you are treating your entire vineyard or orchard with pheromones for mating disruption (MD) of a particular pest. Full marks if you immediately said "but they won't work in a pheromone-treated site!". Of course they won't work - or at least they should not catch any moths in a pheromone treated area (a few are likely to be caught on field edges). The pheromone spray or 'twist-ties' fill the surrounding area with pheromones, making it hard for males to find females and also making it hard for males to find the lures. That is exactly why you should still use the traps - as an indirect measure that the MD is working! Do not rely on trap catches alone to be sure that MD is protecting your field! We cannot stress that point enough. Remember- the traps are for catching males, they tell you nothing about the number of mated females that may be flying in from elsewhere. Regular, careful monitoring for signs of crop damage is imperative to be sure your site is protected. Actually, that's good advice for everyone, not just those using MD products.

Related Links

- [Fruit Production Recommendations, OMAFRA Publication 360](#)

| [Top of Page](#) |

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Rotation Helps Prevent Resistance

Author: Neil Carter - Tender Fruit and Grape IPM Specialist/OMAFRA

Creation Date: 01 December 2002

Last Reviewed: 01 December 2002

Why is everyone involved in crop protection, from extension personnel to consultants to chemical company representatives, so fixated on product rotation? Why do pesticide labels suggest you use other products instead of one repeatedly? The answer to those questions is simple ('it helps prevent resistance') but requires some explanation.

Creating a resistant population

If I wanted to develop a local population of insects (or a disease) that was resistant to a particular chemical, I would spray the same product over and over again. I might increase the application rate and frequency as well, just to increase the likelihood of only resistant individuals surviving. Hopefully, that hasn't been your regular strategy for pest control.

A certain portion of any pest population will be resistant to the chemical you spray. Since they survive the first application, they will form a slightly higher percentage of the genetic heritage of the next generation (not the whole population - don't forget about immigration of pests from elsewhere and that not every individual is exposed to a particular spray). The next spray will kill the susceptible individuals and the now more numerous resistant ones will live to reproduce. Keep spraying the same product and gradually less control will be achieved as more resistant individuals survive and breed to create the next pest generation. However, if your goal was to create a resistant pest population, you're well on your way! This isn't always as simple as it sounds - it can take many years and many generations for resistance to develop to the point where the product no longer provides control. Also, some pest populations develop resistance faster than others.

Chemical families

Here's where things get a bit more confusing. Pesticides can be grouped into 'families' based on their active ingredient. I could change to a different product but if the new product is of the same chemical 'family' or group, the results will likely be the same as spraying the original product again if the pests have developed 'cross-resistance'. Cross-resistance allows a pest to survive exposure not only to the chemical that originally produced the resistance but also to related compounds. For example, if a pest is resistant to Cymbush (a pyrethroid), it might be cross-resistant to Decis (also a pyrethroid). To break this cycle, you need to rotate to a product that is in a different chemical family. A good place to determine the chemical family of a product is a chart called 'Pesticide Tables' in OMAFRA Publication 360 - Fruit Production Recommendations. Sometimes switching to a different chemical family or group still does not provide control of a pest population. This situation is called 'multiple resistance' and is the worst case scenario for resistant populations. Multiple resistance can extend to two or more classes of pesticides with different modes of action.

| [Top of Page](#) |

Case Study

In Niagara peach orchards, oriental fruit moth (OFM) (*Grapholita molesta*) reached epidemic proportions in 1992-93 resulting in significant crop losses (some blocks were not even worth picking). A common pest control program for at least 25 years, primarily of Imidan (phosmet, an organophosphate), led to widespread organophosphate-resistant populations. In response, a pesticide rotation strategy was developed by Dr. David Pree and others at AAFC and was widely adopted in the industry. Lorsban was recommended for first generation control and pyrethroids were recommended for subsequent generations. This rotational strategy has served the industry well for 9 years without serious outbreaks of OFM. However, this is ultimately an interim strategy and the industry must set its sights on preventing pyrethroid resistance from developing. New strategies of control such as mating disruption will help to lengthen the useful life of effective control products by reducing the exposure of pest populations to insecticides.

Other steps to help prevent development of resistant populations

Use insecticides and fungicides only when necessary rather than on a routine, calendar-determined basis. Many diseases require preventative rather than corrective sprays; even so, paying close attention to weather conditions and biological factors can help reduce the frequency of sprays and fine-tune their timing. Field monitoring and regional agriphone messages are key components of this strategy.

Using pesticides based on monitoring instead of a calendar will reduce the selection pressure on both the target pests and on secondary pests that can become major problems if they develop resistance.

Thorough monitoring will also tell you where treatments are necessary for relatively non-mobile pests when immigration of the pests from elsewhere is not a major factor. For these cases you can relieve the selection pressure on your entire acreage and give your beneficial insects and mites a break by only targeting areas that have damaging levels of pests.

Alternate products from different families before you have a resistance problem, and replace materials if control failures occur. Avoid extremely persistent pesticides. Apply all pesticides at label rates - resistance can develop with repeated exposure to sublethal doses. Calibrate your sprayer and ensure you are getting good coverage, especially on large trees.

| [Top of Page](#) |

How do you know if resistance is developing?

To test if a fungal disease is resistant to a particular chemical, pathologists take samples of the disease from the field and expose them to fungicides in the lab or in controlled greenhouse experiments. If the rate required to kill the fungus is higher than the level needed in the past or higher than needed to kill a known non-resistant strain, then the pathogen is resistant.

Determining if a population of insects is resistant can also be time-consuming and expensive; insects must be collected from the field and exposed to pesticides in the lab. Determining the correct doses and comparing mortality with known susceptible insects requires the efforts of skilled researchers using specialized equipment.

The bottom line is that without some careful tests, you cannot know if a control failure is due to resistance or some other reason.

Failure of a particular product is not proof that resistance has developed. Failure of a product can happen for many reasons. Don't jump to conclusions if an insect or disease appears to be getting out of control, but if you have not been following the recommendations for preventing resistance, start immediately. Make sure your timing is appropriate,

calibrate your sprayer, ensure good coverage, check your water quality, make sure that multiple spray products are compatible and that the product is registered for the target pest. If you think that you may have a resistant population, then that's all the more reason to begin best management practices to solve the problem.

In some cases, rotating to different products may be more expensive. New products and technologies, like mating disruption with pheromones, can also be more costly than existing insecticides. However, the costs of dealing with resistant populations of insects can be far greater. Finally, remember that it is easier and cheaper in the long run to work towards preventing resistance from developing rather than trying to manage it after it has developed.

Related Links

- [Pesticide Tables](#), OMAFRA Publication 360, Fruit Production Recommendations

| [Top of Page](#) |

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| [Home](#) | [What's New](#) | [Calendar](#) | [Products](#) | [News Releases](#) |



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Using Casoron Herbicide for Apples

Author: Leslie Huffman - Weed Management (Horticulture), Program Lead/OMAFRA
Creation Date: 01 December 2002
Last Reviewed: 01 December 2002

What it is:

Casoron is a granular herbicide that is registered for use on apples, other fruit trees and vineyards. It is also registered on raspberries, cranberries, blueberries, saskatoons, and woody nursery stock (both container and field grown. It controls a broad-spectrum of weeds, including many annual grasses and broadleaf weeds, plus some perennial weeds* like Canada thistle, quackgrass, bindweed, dandelion, horsetail, yellow nut sedge, sow thistle, and vetch. (*Perennial weeds usually require higher rates and late fall applications).

How it works:

When Casoron is applied to cool moist soil, the active ingredient, dichlobenil, is released as a vapour, and is absorbed in the top 5 centimeters of soil. A herbicidal barrier forms in the top layer of soil, and kills the growing points of roots and shoots that try to grow through it. Annual weeds are killed as they germinate. Some perennial weeds are killed as they emerge. Crop safety is achieved when the crop roots grow below the vapour barrier.

When to apply:

Casoron is very volatile. It should be applied when air temperatures are below 10C, when soil is moist, but before it is frozen or snow covered. The ideal timing is usually sometime between November 15 and December 15, although occasionally ideal conditions in orchards may occur in March or early April . If Casoron is applied when soil or air is warm, much of the herbicide can be lost through volatilization.

Casoron can also be applied 4 weeks after new plantings, but you must consider if soil conditions are cool and moist enough. In all cases, Casoron should be applied to weed-free soil or, in the fall, before annuals germinate. Casoron will not control germinated weeds.

How much to use:

The recommended rate of Casoron refers to the area actually treated with herbicide. Remember that only a portion of your orchard (weed-free strips under the tree) will be treated with Casoron, which often makes the treatment more cost effective.

A range of rates is recommended on the label. The higher rate is for perennial weeds, and for higher organic matter

soils. If irrigation is used shortly after application (eg. if soil conditions are dry, or for new plantings in early summer), use the lower rates to avoid crop injury.

How to apply:

Uniform application of the Casoron granules is important. There are a number of herbicide applicators available for spreading granular products. These can range in price from \$15 to a few thousand dollars.

For a small acreage, growers can choose a hand-held applicator that is gravity fed. A Webfoot applicator holds about 3 kilograms, and retails for \$15-20. Application rates of 0.1-0.2 hectares/hour are possible.

There are some backpack granular applicators with motorized fans available for slightly larger fields. They hold 4 to 6 kilograms of product, and require the operator to hold the hose that directs the granules under the plants. These applicators retail for about \$300-400.

The challenge has been to find larger equipment that can efficiently and uniformly apply Casoron for larger fields. Granular products like Casoron are generally applied with either side or rear-mounted applicators like Herd or Gandy spreaders.

One custom applicator in southwestern Ontario has mounted a modified Gandy applicator on an all-terrain vehicle. His innovation has been using a fan to spread the granules under the plants. After doing custom work for several years, he has found that the best pattern was achieved by driving on each side of the row, applying half of the recommended rate each time. Custom rates with his applicator costs \$35-40/hour. They are able to treat about 10 to 12 acres/day, covering a 4 foot band on 12 foot rows.

How much does it cost:

The recommended retail cost of Casoron is about \$810-1285/ treated hectare (about \$325-515/treated acre). Although this is more expensive than other herbicides, Casoron has a proven track record when applied under the correct conditions. As well, regular use of Casoron suppresses many perennial weeds that tend to creep into orchards as they mature. The cost of hand weeding or lost cropping due to the competition of weed escapes should be considered when comparing Casoron to other options.

| [Top of Page](#) |

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Fire Blight Management Tips From Michigan: When to Prune or Not to Prune

Author: Michael Celetti - Plant Pathologist (Horticulture Crops) Program Lead/OMAFRA

Creation Date: 01 December 2002

Last Reviewed: 01 December 2002

The question of pruning out fire blight strikes during the growing season, leaving them until the winter or using the "ugly Stub method" has long been debated. The answer to this question may depend upon the number of strikes and the weather conditions suitable for infection.

During the 2000 season, a warm, humid spring and a long bloom period resulted in a severe outbreak of fire blight in Michigan apples. To complicate the situation further, a severe storm brought 2 ½ inches of rain and hail to the region in mid May resulting in severe trauma blight several weeks later. After two years, fire blight is still a concern for many Michigan apple growers.

What did Michigan researchers, extension agents and farmers learn about managing fire blight in 2000? Proper timing and application of Streptomycin is very important for the management of this disease. During the 2000 fire blight epidemic in Michigan, weather conditions at bloom allowed bacteria populations to rise to very high levels. When rains came late in bloom, growers did not have time for streptomycin applications in all their orchards and only sprayed the most susceptible varieties. Consequently, blossom blight developed on the unsprayed rows in many orchards and a trauma event in May spread the disease throughout the orchards in the region. Many Michigan apple growers immediately pruned out fire blight infections. While other growers did not prune fire blight strikes until winter. Regardless of when they pruned, growers found some fire blight in their orchards the following season. Dr. Mark Longstroth, an extension agent with Michigan State University, suggested that under dry conditions when only a few strikes occur, immediately pruning down to non-infected 3-year-old wood would reduce the potential of the disease spreading. Prunings that have dried out on the orchard floor do not present a danger to spreading the disease. Longstroth stresses that if warm, wet weather persists, the risk of spreading the disease during pruning would be great and it may be better to leave the fire blight strikes in the orchard until a period of dry weather occurs. Unfortunately, leaving the disease in the orchard may serve as a source of inoculum should a severe storm roll through that could result in a "trauma blight" event. There is some uncertainty of whether the "ugly stub" method works better than leaving the diseased strikes in the orchard until winter. A comparison of the two methods under Michigan climate and situation is required.

"We had a lot of orchards where the grower walked away from older trees and the blight killed all the young wood less than 3 or 4 years old" says Dr. Longstroth, "by late July the trees had grown new shoots and you could hardly tell they were infected from the road." Some Michigan growers pruned out all the fire blight affected wood the following winter and others waited a year and did their pruning after the tree's growth had settled down. "Both strategies seem to work well and I think waiting a year was cheaper," says Longstroth, "but you do have a much-increased risk the following spring if you leave it in for a year."

Dr. Longstroth suggested trees that show symptoms of fire blight for two years in row should be removed and burned. This continuous infection is an indication that the fire blight bacteria is systemic in that tree and it will continue to express symptoms each year and serve as an infection source inoculating the orchard each year. Continuous pruning of the same infected trees year after year is not sustainable, since the trees would probably become unproductive due to the infection and pruning.

Also the infected trees will continue to act as a source of inoculum for the rest of the orchard.

Longstroth suggests that pruning out strikes during years when fire blight is not a major problem allows growers to reduce the amount of bacteria that will be present in the orchard in the years when bloom conditions are right for the spread of the disease. "I tell my growers to scout and prune out strikes when the weather is dry.

| [Top of Page](#) |

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Control of Postharvest Blue Mold of Apple

Author: Deena Errampalli - Agriculture and Agri-Food Canada/SCPFRC

Creation Date: 01 December 2002

Last Reviewed: 01 December 2002

This article was reviewed by the editor of *Orchard Network* for technical accuracy and appropriateness.

Postharvest decay in apple is caused by two diseases, blue mold (causal agent, *Penicillium expansum*) and gray mold (causal agent, *Botrytis cinerea*). Blue mold is more damaging than the gray mold. To determine the cause of this increase in post harvest decay a study has been initiated to identify if the *P. expansum* has developed resistance to MERTECT (thiabendazole; TBZ) and diphenylamine (DPA). (Figure 1)

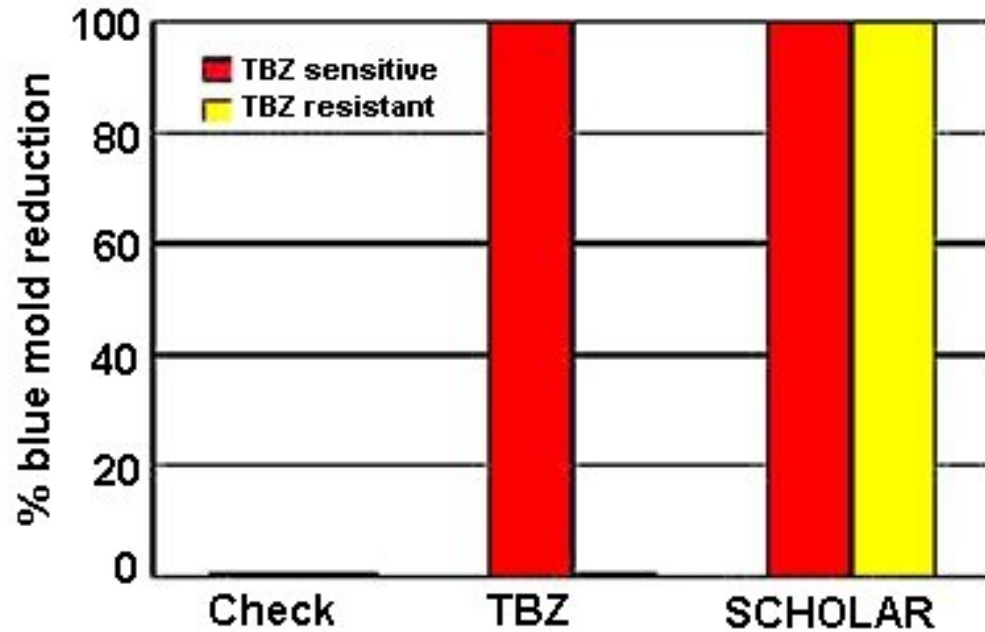
Figure 1. Untreated control (left) versus apple treated with Scholar fungicide (right). Treatment applied within one day after wounding.



It was observed that some of the isolates collected from the apple storages were TBZ-resistant. To overcome the fungicide resistance problems, during 2001- 2002, a low risk phenylpyrrole fungicide, SCHOLAR (active ingredient, fludioxonil), was tested for efficacy against blue mold on "Empire" and "Red Delicious" apples. Surface disinfected apple cvs. Empire and Red Delicious, were wounded and co-treated with recommended concentrations of TBZ, and four to six different concentrations of SCHOLAR fungicide and with 1×10^4 conidia/ml of *P. expansum* inoculum by dip or drench methods. Treated apples were incubated for 3 months under controlled atmosphere storage and also 4 °C for 2 months. Results have shown that SCHOLAR reduced blue mold by 100% at a concentration of 200, 300 and 600 ppm ai of fludioxonil/ml as compared to the untreated controls. The treatments were effective if the fungicide was applied within a day of wounding. TBZ which gave excellent control (100%) on blue mold caused by TBZ-sensitive *Penicillium*, but it reduced blue mold caused by TBZ-resistant *Penicillium* by only 35% and 4% at 4°C and 20°C, respectively (Figure 2).

The treatments were also tested with DPA and all the concentrations gave 100% of control indicating that there was no negative reaction between SCHOLAR and DPA. In summary the SCHOLAR gave good control of blue mold of apple during storage under CA and also cold storage conditions. In these experiments, the fungicide, SCHOLAR was used experimentally, and is not registered for post harvest treatment on apples in Canada and cannot be used commercially.

Figure 2. Control of TBZ sensitive & TBZ resistant *Penicillium* by SCHOLAR & MERTECT.



[| Top of Page |](#)

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Postharvest Disorders...Photo Galleries

Author: John Gardner - Apple Specialist/OMAFRA
Creation Date: 01 December 2002
Last Reviewed: 01 December 2002

One of the most well documented and researched areas of horticulture remains the discipline of postharvest physiology. Included in this documentation are all those responses of various cultivars to disease organism infections and various physical factors including different types of CA gases, freezing injury and the like. The web is resource rich in photo Gallery shots of various disorders. Some are cultivar specific. We often get asked about what caused the wrinkle in the skin or the decay or breakdown of a specific apple variety. A lot of the answers can be found by exploring web resources.

Related Links

- [Physiological and Abiotic Disorders of Apple Fruit in the Pacific Northwest](#)
- [Washington State University - Postharvest Information Network](#)
- [Chilling Injury of Horticultural Crops](#)
- [Postharvest disorders of apples and pears](#)

[| Top of Page |](#)

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