



## **IPM News**

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### ***Disease Management Update***

***Yellowing of Golden Delicious Leaves*** - There is a report out of the Hudson Valley that Golden Delicious leaves are developing necrotic spots, yellowing, and dropping off the trees at an alarming rate. Golden Delicious trees are affected by a disorder called "Necrotic Leaf Blotch." The exact cause of the disorder is not known but it is thought to be physiological. Symptoms are usually most severe when extended cool, rainy periods precedes hot, sunny days. Within an orchard, symptoms can be very variable. If you have Golden Delicious trees and they turn yellow quickly, it may be this disorder. At this point, there is nothing that you can do.



Necrotic leaf blotch on Golden Delicious apple leaves.

[Source: <http://ohioline.osu.edu/hyg-fact/3000/3204.html>]

***Preventing Post-Harvest Apple Decays-*** Dr. David Rosenberger, Cornell University, has recently written two very informative articles on pre-harvest clean-up and options for post-harvest fungicide treatments to manage blue mold decay caused by *Penicillium expansum*. The following are those articles. They appeared in the August 17 and 24 issues of *Scaffolds Fruit Journal*, respectively:

Pre-Harvest Clean-up Options:

“*Penicillium expansum*, the fungus that causes blue mold decay in stored apples, continues to cause losses both during controlled atmosphere (CA) storage and during shipment of

packed apple fruit. Thiabendazole (Mertect 340F) and other benzimidazole fungicides provided excellent control of *P. expansum* for nearly 25 years. However, thiabendazole is no longer effective because the populations of *P. expansum* in most packinghouses have developed resistance to the benzimidazole fungicides. Captan, the only other alternative for postharvest application on apples, has never been very effective for controlling *P. expansum*.

#### Preharvest sanitation measures:

In the absence of effective fungicides, sanitation measures implemented by apple growers, storage operators, and packinghouses prior to harvest are essential for reducing losses to postharvest decays:

1. All decayed fruit mummies should be removed from field bins before bins are refilled. Decayed apples do not float, so they remain in bins as bins come out of the water flotation tanks on packing lines. Conscientious packinghouse operators will ensure that all of the decayed fruit is removed before the empty bins are bundled. These decayed fruits carry huge numbers of spores (sometimes more than a billion spores/bin) that will contaminate next year's crop if they are left in the bottoms of bins. Apple growers should inspect bins as the bins are unbundled in the field prior to harvest, and fruit mummies and decayed fruit debris that remain in the bins should be removed.
2. Sanitize packinghouse and storage walls and floors during summer by treating them with a quaternary ammonium sanitizer or another approved sanitizer. Quaternary ammonium compounds are registered for disinfesting storage rooms and can be purchased from your chemical supply dealer. Follow directions on the product labels. In addition to eliminating inoculum, quaternary ammonium sanitizers will also eliminate foul odors caused by non-pathogenic bacteria and fungi (molds) that sometimes persist on storage walls and floors. Alternatives to quaternary ammonia sanitizers include chlorine dioxide foam and a new product, Stor-Ox (hydrogen dioxide). Both chlorine dioxide and Stor-Ox require specialized application equipment whereas quaternary ammonium compounds can simply be sprayed on the walls and floors. Hypochlorite (bleach) solutions are not very effective for sanitizing storage floors and walls because solutions dry too quickly to allow effective sanitizing.
3. If possible, sanitize badly contaminated bins (i.e., bins that came out of storage containing many decayed fruits) with a quaternary ammonium wash. Quaternary ammonium sanitizers can reduce inoculum loads on bins by more than 99% if all of the decayed fruit and fruit residues are removed before the sanitizer is applied. Steam cleaning bins is also effective, but it may be less practical than a drenching system for applying quaternary ammonium sanitizers.
4. Cleaning bins and storages will be wasted effort if soil is brought into storage and drenchers via soil embedded in bin runners; Forklift operators must be trained to handle bins without pushing soil into the bin runners, or the bottoms of bins must be prewashed before the bins are run through drenchers. Putting one batch of dirty bins (or bins clogged with soil)

through the drencher will compromise the value of cleaning bins. Thus, for maximum effectiveness, sanitation must be integrated throughout the entire operation including all cooperating growers.

Factors affecting sanitizer activity:

Most biocides are oxidizers that kill spores via oxidative reactions. Bacteria are generally easier to kill with biocides than are spores of *P. expansum*. Effectiveness of biocides is dependent on the following factors and their interactions:

- o Biocide concentration: Higher concentrations are better, but excessively high concentrations can injure fruit in the water flumes or leave excessive residues on bins and other treated surfaces. (Read and follow product labels!).

- o Solution pH: For hypochlorite solutions, pH should be maintained between 6 and 7.5. With pH > 7.5, the effectiveness of the biocide is decreased and with pH < 6 chlorine off-gassing can create a disagreeable and potentially hazardous work environment. Hypochlorite solutions with pH < 6 are also more corrosive to equipment and nails in wooden bins.

- o Duration of exposure: Many fungal spores can survive brief exposure to biocides, especially at lower temperatures. Spores in water flumes generally receive long exposures (days) in the recirculating water whereas exposure for bins passing through a water dump is often a matter of minutes.

- o Solution temperature: Activity increases with temperature. At low temperatures, longer exposure times are needed to achieve effective sanitation.

- o Organic matter introduced into the biocide solutions can quickly deplete the oxidizing potential of the solution. Sanitizers cannot kill spores that are contained within organic debris (e.g., rotten apples) left in bins or on storage room floors. If water flumes contain organic matter, the solution will need regular recharging with a biocide.

- o Surfactants can affect biocide activity when biocides are intended to control pathogens like *P. expansum* that have very hydrophobic spore masses. However, using surfactants in flume water may also enhance penetration of *P. expansum* spores into fruit wounds, stems, and calices and therefore could conceivably enhance decay, especially if the concentration of biocide drops below critical levels.

Biocide Options:

The most common biocides available for use in apple packinghouses include the following:

- o Sodium hypochlorite is most commonly used for chlorinating water flumes.

- o Calcium hypochlorite is available in a system where water flowing through a dispenser

unit releases a constant supply of hypochlorite. Calcium hypochlorite is less corrosive than sodium hypochlorite.

o Hydrogen dioxide (Stor-Ox) was recently registered as an alternative for hypochlorite in water flumes, but we have no data to suggest that it is more cost-effective than hypochlorite solutions. According to company literature, hydrogen dioxide is very effective for disinfecting storage rooms when the product is introduced via cold-fogging. The advantage of cold-fogging is that exposure time can be extended by running the fogging equipment continuously for several hours.

o Ozone introduced into water with an ozone generator can substitute for hypochlorite solutions, but ozonation is used primarily in states where packinghouse operators have difficulty disposing of chlorinated water.

o Chlorine dioxide mixed into a foam is very effective for sanitizing bins, storage walls, and floors. However, as with ozone generation, equipment for generating chlorine dioxide can be relatively expensive and worker safety issues must be carefully addressed.

o Quaternary ammonia compounds, or "quats" (e.g., Deccosan) are not labeled for use in water flumes but are very effective for killing spores and microorganisms on bin surfaces and storage walls and floors."

#### Post-Harvest Fungicide Treatment Options

"Sanitation measures can reduce the incidence and severity of postharvest decays caused by *Penicillium expansum*, but fungicide treatments may still be needed to achieve acceptable control of postharvest decays. Sanitation reduces or eliminates inoculum that recycles from year to year on bins and in storages. However, sanitation alone will not eliminate inoculum that originates in the field.

Spores of postharvest decay fungi are often present on fruit before harvest because *P. expansum* and *Botrytis cinerea* are present in orchard soils and in organic debris on the orchard floor. These spores can be blown onto fruit prior to harvest, or they can be carried to fruit via soil on bin runners when bins are stacked on trucks or in storage. Spore concentrations on fruit at harvest vary from year to year, but we currently have no way of predicting "bad decay years." As a result, we cannot predict when postharvest treatments might be beneficial and when they will not be needed.

Because postharvest treatments (fungicides, diphenylamine, calcium chloride) are applied using recycling drenches, the treatment can worsen decay problems in the absence of effective fungicides because the treatment solution ensures uniform inoculation of all fruit wounds and stems. The combination of thiabendazole (Mertect 340F) plus diphenylamine (DPA) is still effective for controlling *B. cinerea*, but it no longer controls *P. expansum*. As a result, fruit that is moved into storage without any postharvest treatment may develop decays caused by *B. cinerea*, but decays caused by *P. expansum* cause minimal losses on

non-drenched fruit. The reverse is true for fruit given a postharvest treatment of thiabendazole plus DPA: *B. cinerea* will be controlled but *P. expansum* will be more prevalent than in non-drenched fruit. In most cases, losses to *P. expansum* are potentially greater than losses to *B. cinerea*. Therefore, postharvest treatments are usually omitted on apples that do not require DPA treatment.

Captan is registered for postharvest treatments and can be used either alone or in combinations with thiabendazole. Some packinghouse operators report that captan treatment helps to suppress postharvest decay, but captan has been inconsistent and only moderately effective in controlled research trials. If captan is used in postharvest treatments, it should be used at the full label rate because lower rates are unlikely to provide any control of *P. expansum*.

A new fungicide, pyrimethanil (trade name: PenBoTec) received a federal registration for postharvest use on apples on 13 August 2004. It is unlikely that this fungicide will receive a New York State registration in time for the 2004 harvest season, but New York State might approve PenBoTec by late winter at which time it could still be used as a line spray to prevent decay in packed fruit.

PenBoTec is very effective for controlling both *P. expansum* and *B. cinerea*, and it is fully compatible with other postharvest products such as DPA and calcium chloride. However, several factors may limit its usefulness, at least initially. One limitation is that many other countries (including Canada and most European countries) have not yet approved residue tolerances for this product, so treated fruit may not be acceptable for export. A second limitation for using the product in postharvest drenchers is that PenBoTec treatment will likely cost about three times more than Mertect 340F on a per-box basis. Each packinghouse operator will need to determine whether the risks of postharvest decay warrant that level of expenditure for postharvest treatment. The answer will vary depending on how well the packinghouse has been able to manage decays over the past few years without PenBoTec, how long the fruit will be stored, and the anticipated value of the fruit being stored. For example, after PenBoTec is approved in New York State, treatment may be warranted for Honeycrisp (a high-value cultivar prone to both stem punctures and decay) whereas treatment may not be warranted for Empire that will be stored for less than 6-8 months.

Guidelines for using fungicides in postharvest drenches: Storage operators opting to use postharvest fungicide treatments on apples should consider the following:

1. Keep drench solutions agitated: Without agitation, Mertect 340F and captan will settle to the bottom of the treatment reservoir when the system is shut down at night, and the settled product will be difficult to resuspend. Postharvest drenchers should be outfitted with an agitation system capable of resuspending any sediment that settles to the bottom of the tank during periods when the system is shut down. In the absence of a good agitation system, the fungicide concentration will quickly drop below effective levels.
2. Keep drench solutions clean: Soil introduced into the postharvest treatment tanks carries decay inoculum and makes it more difficult to keep postharvest chemicals in suspension. A

pre-wash with a high-volume stream of non-recycling water may be needed to remove soil from bins or equipment before they enter the postharvest drencher. Empty and clean tanks at least as frequently as is required on the DPA labels.

3. Keep drench solutions properly recharged: The drench solutions should be regularly recharged according to instructions included on the postharvest labels of the products being used.”



Blue mold caused by *Penicillium expansum*  
[Source: [http://www.caf.wvu.edu/kearneysville/disease\\_month/bluemold0199.html](http://www.caf.wvu.edu/kearneysville/disease_month/bluemold0199.html)]

### ***The Ugliest Apples at the UVM Hort. Res. Center ...***

Walking through the non-sprayed blocks at the UVM Hort. Res. Center (HRC) this morning I saw some ugly apples. It makes you pause and appreciate all the IPM tools we do have to manage the many diseases and insects that can attack apples. The following apples tied for first place for the ugliest apples at the HRC !!



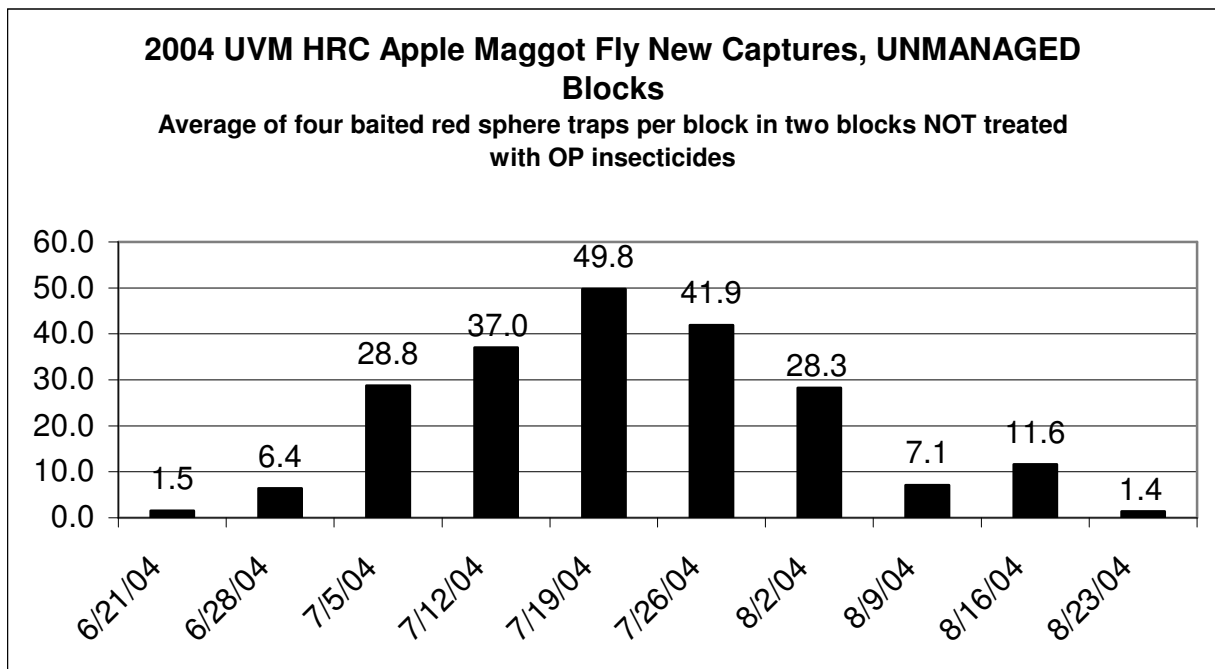
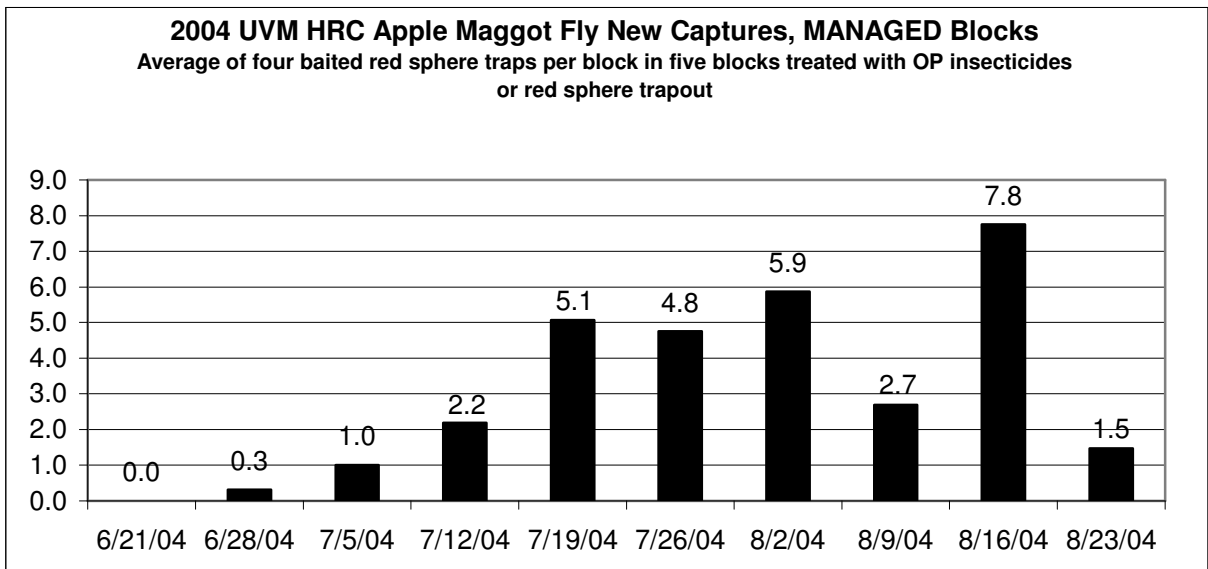
Apple Scab Damage



European Apple Sawfly Damage

## Arthropod Management Update

**Apple Maggot Fly (AMF) Captures** - Trap captures in both managed and unmanaged blocks decreased during the past week. Below are graphs of the weekly captures at the UVM HRC for 2004.



**Have A Little Apple With Your Maggots ?** Since everyone manages AMF populations well in commercial blocks, I thought you might be interested in seeing what the apples look like in a non-sprayed block at the UVM HRC which has a very high population of AMF....



Apple "riddled" by Apple Maggot Fly egg laying



Apple Maggot tunnels throughout apple

**Wrap-up of what to expect in the near future....**

The following two charts give where we are in terms of accumulated degree-days (base 50F) from Jan. 1 and what arthropod "events" should occur in the near future:

**2004 Estimated Degree-Day Accumulation (Base 50F, from Jan. 1) for Selected Vermont Sites<sup>1</sup>**

Date	So.Burlington	Shoreham	South Hero	Bennington	Dummerston
8/23/04	1686	1698	1670	1581	1763

<sup>1</sup>Degree Days received from Skybit E-Weather Service: <http://www.skybit.com/>

**Arthropod 'Events' Based on Degree-Day Accumulation<sup>1</sup>**

Pest/Phenology Event	Estimated DD Base 50 F for Event (from Jan 1)
OBLR - 1st catch, 2nd summer brood	1539-1847
STLM - 3rd gen. peak catch	1800-2138

<sup>1</sup> Source of Estimated DD (Base 50F) for arthropod pest events: Pest Management Guidelines for Commercial Tree-Fruit Production 2003. A Cornell Cooperative Extension Publication, Table 14: "Degree-day accumulations (from January 1) corresponding to selected fruit phenology and arthropod pest events." <http://www.nysaes.cornell.edu/ent/treefruit/>

## **Contact Information**

A Commitment to Excellence and Service:

If you have any questions or want to arrange for an orchard visit regarding your concerns, please call or write.

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Where trade names or commercial products are used for identification, no discrimination is intended and no endorsement is implied. Always read the label before using any pesticide. **The label is the legal document for the product use. Disregard any information in this newsletter if it is in conflict with the label.**

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