



MOSES ORGANIC FACT SHEET

Managing Pests & Diseases in an Organic Apple Orchard



There are also many “minor” pests and diseases for apples that can, under the right conditions, cause economic damage.

Growing apples in the Midwest has always presented challenges. Apples are susceptible to many diseases and insect pests. Our humidity, rain and warmth can produce ideal conditions for fungi in particular, the single greatest threat to apple producers. Prior to the advent of Integrated Pest Management (IPM) techniques, apples were among the most heavily sprayed crops. Even after the widespread adoption of IPM, growers are challenged to produce blemish free apples without using chemical inputs. Conventionally produced apples are near the top of the Environmental Working Group’s “Dirty Dozen” list of foods found with pesticide residues.

Integrated Pest Management (IPM) is the science of combining cultural, biological and chemical pest control methods to reduce the reliance upon chemical inputs. Scouting for the presence of pests, and monitoring the conditions that contribute to their growth, are central techniques to IPM, since the use of chemicals should only be done if there is the potential of actual economic damage to the crop. Timing is everything—a little too early or too late and the effort (and money) is wasted. Before IPM, products were sprayed on a schedule, with minimal attention paid to the actual need for these applications.

Organic agriculture is indebted to many of these IPM strategies. The emphasis in an Organic System Plan is more on the mechanical, cultural and biological pest control options, but if needed, natural pesticide and

preventive inputs can be used to minimize economic loss. Organically approved pesticide inputs can be effective, but most are restricted use only, meaning that per the National Organic Standards, they can only be used when other pest control strategies (resistant varieties, biological and cultural controls) are not enough. Inputs that contain copper are restricted use in order to prevent soil contamination. In short, it is not enough to simply substitute organically approved inputs for conventional inputs. An organic orchardist can learn to control pests using a variety of IPM techniques. By doing so, the organic orchardist can meet the requirement of the organic rule, reduce input costs and minimize economic losses.

Your choice of pest control strategies will depend upon your goal as an apple producer. Blemish free, grocery store shelf quality fruit requires an understanding of the newest techniques. Fruit destined for your own table, or for processing (cider) does not need to be cosmetically perfect, so you may only need a minimalist approach. For grocery stores, farmers markets or roadside stands, however, you need #1 quality fruit grown using advanced monitoring and control programs.

Apple Scab

Apple scab is the number one pest of apples. It is caused by the fungus *Venturia inaequalis*. It causes more economic damage than any other pest. For that reason, it also requires the most monitoring and inputs. Susceptible varieties could require a rigorous spray schedule to produce grocery shelf quality fruit.

Disease Resistance

Disease control for organic apples begins with choos-

ing disease resistant varieties. Both modern and antique apple varieties have varying degrees of resistance to apple scab and may require a fungicide program in an average year. Many books and most catalogs list disease resistant varieties. Beginners, and those who want to minimize inputs, should choose apple scab resistant varieties or better yet, choose varieties that were bred for field immunity to apple scab. The following scab immune varieties have proven to be hardy and productive for the upper Midwest: Early August Harvest- "Pristine," a yellow apple with good quality but poor shipping traits. Late August Harvest- "Red-Free." Early September Harvest- "Prima", a tart apple similar to "Haralson." Resistant to apple scab but susceptible to cedar apple rust. Late September- "Liberty."

These varieties are "Field Immune" to apple scab, meaning that in a typical year you will not get apple scab even if these trees are not sprayed. Given ideal conditions even the most resistant trees will get apple scab. The apple scab fungus is also evolving and orchardists are starting to see strains of scab that can infect even the varieties bred for field immunity. The increasingly popular "Honeycrisp" variety is only slightly resistant to apple scab and can be a tough tree to grow for beginners. If you choose this variety, plan on having to manage apple scab to guarantee a sellable fruit. Avoid "Jersey Mac," "McIntosh," "Cortland" and any apple with McIntosh genetics as they are very susceptible to apple scab and will need high levels of inputs to produce a sellable fresh fruit.

IMPORTANT NOTE: always confirm with your certifier that any crop input is acceptable. Many of the generic and branded products listed in this document are "restricted use." Your certifier has the final say on input approvals based on the national organic standards and your organic system plan.

Terminology

Some organic growers may not be familiar with terms commonly used in commercial fruit production. Apple scab is a fungal disease that overwinters on leaves that were infected the previous season. Spore cases develop in these decaying leaves and then expel spores for a limited period of time during the spring. Primary scab refers to the lesions created by spores that came from the overwintered leaves. Secondary scab refers to the lesions that spread from the primary scab actively growing on the leaves and apples. Scab spores require a film of water to start growing and penetrate the tissue. The wetting period refers to the number of hours the leaf surface remains wet. An infection period refers to the number of hours that is needed for a scab spore to grow and penetrate a leaf or apple skin. The infection period is shorter with warm weather. As little as nine hours of wetness can be enough to cause

an infection in hot weather, while 36 hours or more may be needed in very cold weather.

The fungus can be controlled in one of two ways: a protectant fungicide coats the leaves and fruit and stops the spores from infecting the tissue; a post-infection fungicide penetrates the fruit or leaf and kills the fungus initiating the infection.

Controlling Primary Apple Scab

If your intent is to produce sellable organic fresh fruit, start with these important cultural activities:

- Remove wild apple trees, wild crabapple trees and any unwanted susceptible varieties of apple tree to reduce the level of fungal spores in the immediate area. Remove any unwanted trees within two hundred yards or more if possible. Spores can travel up to a mile from their source.
- Rake up and remove all fallen leaves as soon as possible. Fallen leaves are a major source of fungal spores. The more leaves that are removed, the less inoculum in the immediate area.
- Pruning is important. An open-structured tree with good airflow will have fewer problems with scab. A pruning course is recommended for beginners. When climatic conditions are optimal for apple scab, and cultural controls alone are not sufficient, you then might need to use organically approved materials.
- During a typical spring in the Midwest, it is recommended that a least a few sulfur sprays be applied as a protectant fungicide before every rainfall from bloom until mid-June. Use a NOP-allowed micronized wettable powder sulfur. Check with your certifier in addition to the OMRI Materials List for allowable options. Sulfur prevents the fungal spores from penetrating the leaf during periods of high humidity and moisture on the leaf, which are necessary for infection. Traditionally, orchardists have followed up with another spray of liquid lime sulfur as a post infection fungicide after each rain. Computer monitoring can determine which rains actually provided a long enough wetting period to allow infection. Only use the post-infection lime sulfur spray if the computer model indicates a need. This will allow you to drastically reduce the number of lime sulfur sprays. For the orchardist who cannot afford such monitors, plan to apply micronized sulfur before each rain event, and follow with a lime sulfur post infection spray. Following this spray program from bloom to mid-June should keep primary scab under control. With good early season control, good sanitation practices and a little luck with the weather, you should be able to reduce or eliminate spraying for secondary apple scab. This does have risks and in a wet year you will have problems from secondary scab, including the possibility of crop failure. If you need to maximize the quality and quantity of sellable fresh fruit, you need to consider a more comprehensive secondary apple scab control program.

Controlling Secondary Apple Scab

If infections are controlled during the primary scab season, fungicides can be greatly reduced during the summer because the overwintered spore cases will have expelled all of their spores. If protectant and post infection sprays are successful in controlling primary scab, an orchardist can get by with five or six properly timed post-infection sprays per season.

This reduction in total sprays is accomplished by using a weather data logger to track the temperature and leaf wetness in the orchard. This is a small fist sized unit that is placed in the tree canopy. Some models have to be brought in and downloaded to the PC. There are more expensive models that will send the data directly to the computer. The data from the logger is then entered into a disease modeling program that takes the weather data and figures out if the wetting period was long enough to cause an infection. If the modeling program indicates a need, plan to spray a protectant micronized sulfur in combination with a post infection lime sulfur product. Over time, monitoring equipment can help pay for itself by lessening your input costs and the labor needed to apply materials.

Tips for Managing Apple Scab

(For #1 Quality Fruit)

Reduce the amount or eliminate the varieties that are highly susceptible to scab. Phase out Jersey Mac, Cortland, and McIntosh. These varieties require higher rates and more applications per season to produce fruit that will grade out lower than the other varieties in an average season.

Treat every infection period, even if it is a very light infection according to the computer disease modeling programs. Spray the most scab susceptible varieties first, and then move to the more resistant ones.

Implement good horticultural practices. The post infection Lime Sulfur program will not control scab in high inoculum conditions. Remove blocks that are shaded or in a slow drying environment. Mow or remove leaf litter in the fall. Mow or flail again in the spring. Use a foliar spray of fish oil or neem oil to stimulate decay organisms and break down leaves. Keep the orchard well pruned.

Sooty Blotch and Fly Speck

Sooty blotch is caused by *Gloeodes pomigena* and fly speck by *Microthyriella rubi*. These are less damaging, but important fungal diseases of apples which are mainly a cosmetic issue and do not have a significant effect on production. Sooty blotch and fly speck are mid- to late-summer diseases, which are more of an issue in moderate temperature, humid conditions. Fog and heavy dew from cool night temperatures can be ideal conditions for infection. If you are producing ci-

der apples or fruit for personal use, do not worry about control. Spraying is very difficult to time correctly.

Remove wild brambles around the orchard, as they are a secondary host for the diseases and are often a source of infection.

Air movement through the orchard and the trees is very important. Any management practice that increases the rate of drying will be helpful. Keep trees well pruned, the orchard mowed or grazed and remove any barriers to wind flow. Maintain good tree spacing. These cultural practices alone can greatly reduce the infection rates of these diseases.

Fireblight

Fireblight is a bacterial disease caused by the bacterium *Erwinia amylovora* that attacks a tree through wounds in its bark. Overly fertilized trees with vigorous growth and young trees are more susceptible. Start your prevention program by sourcing resistant apple tree varieties when possible.

Susceptible varieties on susceptible rootstocks are a disaster waiting to happen. Fireblight can be translocated to the rootstock, which will kill the tree if you have susceptible rootstock. If the rootstock is resistant, even a severe infection will not kill the tree. There are several new rootstocks coming out of the Cornell University Geneva program. Cummins Nursery has made some of these rootstocks available for purchase. Dr. Cummins, who was an apple and root stock breeder at Cornell, owns the nursery. For a list of stocks that would be good for organic production, see www.cumminsnursery.com.

Cut out infected shoots, being careful to disinfect the pruners in between cuts with 70% alcohol or 10% bleach (alcohol requires a longer contact time to disinfect than bleach). It is best to prune on dry, sunny days. During dormant season pruning, look for lesions on infected branches and remove them.

Carefully apply fertilizers to avoid overly-vigorous trees. Use composted manure for slow release nitrogen which also stimulates the soil biology.

If fireblight was a problem the year before, or if you are dealing with susceptible varieties, you should use a preventative copper spray between green tip and loose cluster growth stages. If you have an active fireblight infection, it is currently allowed to spray with either streptomycin or tetracycline antibiotics. Leaf wetness and temperature data loggers can help you determine if there is a need to spray with greater accuracy. Please note that both streptomycin and tetracycline are only approved for this specific use until October, 2012 unless they are renewed by the National Organic Standards Board. Check with your certifier

Start trapping at petal fall and continue throughout the growing season. A “rough spraying plan” is to wait for two weeks (for the eggs to hatch) and then spray with *Bacillus thuringiensis* (Bt) or Pyganic™. The better way to time the spraying is by counting degree days. It takes 200 degree days to hatch out the eggs. The most effective treatment should therefore be applied 200 degree days between the threshold count and the application. Be aware that Pyganic™ is a broad spectrum organically approved pesticide. Application will kill beneficial insects as well as the codling moth, so use it sparingly.

Degree days are not difficult to calculate. Take the high and low temperatures for the day, add them together and divide by two then subtract 50. Codling moth eggs will not develop when the temperature is below 50. This is the number of degrees accumulated for that day. Track that until 200 is reached and spray for the best results. The MN Department of Agriculture has an excellent Apple IPM Manual that describes degree day calculations and IPM in general. It is available online: www.mda.state.mn.us/plants/pestmanagement/ipm/apple-manual.aspx.

If codling moth and other insects such as plum curculio are common problems, you should also consider using a kaolin clay product known as Surround™. Made of refined kaolin clay, Surround can be applied by backpack or other sprayer directly to the tree. The clay literally clogs up the insects orifices, making for a very inhospitable environment. It will even kill very small, newly hatched larvae of the codling moth. The trick is to get enough of the clay on the tree, and with enough coverage and thickness to discourage and/or kill insects. Many growers have found this environmentally benign input to be a very important tool in their organic orchard.

Apply Surround around the time the first generation codling moth begins to fly. While the Surround is not applied specifically for the codling moth, it will have some effect on the adult moths. Surround is not a “stand alone” control for codling moth, but it will irritate the moths. This may shorten their life by making them more agitated and forcing them to use more of their limited body fat before they lay all of their eggs or get a chance to breed. Surround will also repel some of the adult moths. It may also affect the larvae as they search for an apple to enter. The clay particles may make it harder for a larva to identify an apple, and it will most likely slow down the movement of this tiny newly hatched worm. The longer it searches for an apple the longer it is exposed to the elements, predators, and pathogens. Surround can also be applied in the summer to repel Apple Maggot Flies. This application often overlaps second generation CM and helps reduce damage. Some sources recommend three applications of clay before

you reach effective coverage. Surround™ can even be mixed with Bt or Pyganic™ to reduce labor.

Make sure to pick up dropped fruit throughout the growing season. Apple trees frequently will drop infested fruit. If you allow the codling moth to develop and emerge to become an adult, you are only adding to the problem. Remove and destroy dropped fruit as soon as possible. Infested fruit should be chopped up and composted or fed to livestock. Michigan State University has published interesting research on pest control in orchards using hogs, which rapidly and happily consume dropped apples. See www.michiganorganic.msu.edu/uploads/files/31/Koan%20Pig%20Research.pdf.

Plum Curculio

The plum curculio (*Conotrachelus nenuphar*) is a weevil (small beetle) that damages fruit in two ways. After mating, the female will look to lay eggs into a suitable developing fruit. She may make several attempts to do so and each spot will develop into a crescent shaped scar. Scarred fruit will not develop normally and will often have a warped appearance around each scar. When the female successfully deposits her egg, the larvae will also do internal damage, making the fruit unsellable.

Plum curculios overwinter in brush and woodlots near the apple trees. Keeping brush under control and the orchard clean will help. As with codling moth, apple trees often drop infested fruit. Prompt removal will kill many larvae before they can emerge as adults.

This is the toughest insect to control with organic methods. A combo of neem-derived products (Neemix and AzaDirect are two commercially available options) Surround™, and fish oil, sprayed from petal fall into early June will keep them under control. If you can live with a little damage here and there, Surround™ clay and cultural techniques such as cleaning up dropped fruit and removing overwintering habitat may be enough. If you want consistent #1 quality fruit, you will probably need to spray neem. Some orchardists will combine neem oil with fish emulsion or compost teas as a time and labor saver. Because neem is broad spectrum pesticide that will destroy beneficial organisms as well as the plum curculio, conscientious use is encouraged.

Apple Maggot

Apple maggot is a summer insect pest of apples. The apple maggot is the larval stage of an adult fly. Once mated, the female apple maggot fly will search for a developing fruit on which she will lay her eggs. She has a strong preference for large, red, strong smelling fruit, which can be used against her. You may have seen the red plastic spheres hanging in orchards. These are traps coated with Tanglefoot™ sticky glue

and an apple essence for smell. The combination is very attractive to the female fly which will land to lay eggs, become stuck and die. The traps, Tanglefoot™ and apple essence are readily available online.

Good control can be achieved by placing red sticky spheres every 15 feet around the perimeter of the orchard. Put at least two spheres per large tree. At least once a week they should be checked and cleaned since dust, dirt, leaves and dead insects will cover it quickly. Spheres need to be placed by July 15th and remain in the orchard until August 15th. This will control the majority of the AM flight in an average year in the upper Midwest.

Surround™ will help repel the female fly. It is possible to spray for the fly, but without proper monitoring equipment it is difficult to time the applications.

AM can be monitored by placing baited spheres in the orchard. If you are not using the trap out system, place three or four baited spheres around the orchard. The action threshold for conventional orchards is an average of five flies per sphere. The organic grower has to develop a threshold appropriate for his needs. For clean apples use the five fly average or lower given the fact that organic sprays are not as persistent as conventional sprays. Check the traps twice per week and treat as needed.

For a combination of the trap out system and organic pesticides put out three spheres for monitoring in late June. Check the traps twice a week. June flight rarely damages the small green highly acidic apples, but in an early bloom year, or on summer apples some damage could occur. If you start to trap several flies a day put out your border traps ASAP. Be sure to have a couple traps in the center of the orchard. If the center traps continue to catch AM even with the border traps in place, then you need to apply Surround or an organic insecticide to produce grocery store quality apples.

Other Pests and Diseases

There are also many “minor” pests and diseases for apples that can, under the right conditions, cause economic damage. It is highly recommended that you read as many resources as possible to prepare yourself for the common challenges in your area. Don't forget that your county's Extension Office can identify pests and diseases for you if you are unsure of what problem you are dealing with. Contact MOSES or reference the resources in this article for developing your own organic integrated pest management plan. Finally, remember to always check with your certifier to get approval on changes to your Organic System Plan and to verify that inputs are approved for use before you use them for the first time.

Sources for IPM Materials and Supplies

Planet Natural
1-800-289-6656 • www.planetnatural.com

Great Lakes IPM
1-800-235-0285 • www.greatlakesipm.com

Arbico Organics
1-800-827-2847 • www.arbico-organics.com

Useful Links

www.mosesorganic.org

Free resources including the Organic Resource Directory, Certification Guidebook, Organic Fact Sheets, and much more. The MOSES website is your source for farmer-oriented news.

organictreefruit.org

www.localharvest.org

www.rodaleinstitute.org

Includes a resource directory and Farm Locator™

www.organic-center.org

The latest news and research on why organic is better

www.nysipm.cornell.edu/organic_guide/apples.pdf

Grower's guide from Cornell University

www.canr.msu.edu/vanburen/organasp.htm

Michigan State Horticulture

www.groworganicapples.com

Holistic Orchard Network

www.uvm.edu/~organica

Resource for Organic Apple Production

attra.ncat.org/attra-pub/PDF/apple.pdf

ATTRA- Apples: Organic Production Guide

www.attra.org/attra-pub/kaolin-clay-apples.html

ATTRA- Insect IPM in Apples- Kaolin Clay

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The Midwest Organic and Sustainable Education Service (MOSES) provides a variety of resources for farmers interested in organic and sustainable farming. To learn more, please see:

www.mosesorganic.org