Disease Management in Home Apple Plantings

DEPARTMENT OF PLANT PATHOLOGY

Introduction

There is probably nothing more frustrating for a home gardener than to see the fruits of his or her labors lost to diseases and other pests. Diseases occur when environmental conditions are suitable for pathogens to attack the host plant. Some pathogens attack a wide variety of plants, whereas others attack only specific plants. Additionally, some pathogens can attack all plant parts, whereas others attack only selected tissues (i.e. flowers, fruit, roots etc.).

Many types of organisms cause infectious diseases of plants, but the five major groups of plant pathogens are the fungi, water molds, bacteria, viruses and nematodes. Adverse environmental conditions also can cause disease-like symptoms on plants; referred to as disorders. These include improper soil pH, nutrient deficiencies and toxicities, soil compaction, excess water, herbicide damage and more. Plants weakened by adverse environmental conditions may be further predisposed to attack by pathogens.

Successful disease management begins with accurate identification of the cause of the problem. Knowing the common diseases of individual crops aids greatly in disease identification and management. Many diseases are readily identified based on characteristic signs (observation of the pathogen itself) and symptoms (observation of damage to the plant) of disease. The identification of other diseases requires microscopic examination of diseased tissues or even more sophisticated laboratory techniques, which are available through the C. Wayne Ellett Plant & Pest Diagnostic Clinic, Columbus OH.

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Disease Management

Prevention is the key to disease management in the home garden. There are several disease management options for the home apple grower that have minimal impact on the growing environment yet help to maintain a healthy crop. Creating an optimal growing environment for apples will minimize plant stress, which in turn will reduce plant disease susceptibility and ultimately improve crop yield and the aesthetics of the planting.

Several synthetic chemicals and natural products (also called biopesticides) are available to aid in the management of plant diseases, but they should always be used in conjunction with cultural practices intended to modify the environment to make it less conducive to disease development.

Site Selection and Preparation. The most important management decision is selecting where to plant your apple trees. Pre-existing pathogens (fungi, bacteria, virus, and nematodes) can infect new trees, causing replant disease (gradual tree decline and lack of vigor). Before planting new trees into a site previously planted with apples, remove as many of the old roots as possible. Some crabapple, juniper, and cedar varieties are a source of important fungi that cause disease in apples. When selecting a location for your apple trees consider planting the trees up wind of any crabapple, juniper or cedar trees that you may have in your yard.

Choose a sunny (6 to 8 hours of sunlight per day), well-drained location with a slight southern facing slope. Soil is the foundation for healthy and productive trees. Soil temperature, moisture, pH and fertility all influence a soil pathogen's ability to survive and colonize plants. Apples will grow in a wide range of soil types but grow best in sandy loam, loam, or silt loam soils. Ideal soil pH for apples is 6.0-7.0. Have your soil tested annually to determine the pH, salts, nutrients and organic matter levels, and water holding capacity.

Variety Selection. In addition to the consideration of dwarf versus standard varieties, harvest time, or taste, disease resistance to important diseases in Ohio should be considered. Four diseases that commonly attack apple trees in Ohio are fire blight, apple scab, cedar apple rust and powdery mildew. While very few varieties have resistance to all four diseases, selecting varieties with resistance to apple scab, which is the most troublesome disease of apple in Ohio, and fire blight is recommended (see Table 1). Planting disease resistant varieties can reduce the need for fungicide and bactericide applications.

Pruning. Annual pruning of apple trees is necessary to maintain tree health, vigor and productivity. Pruning prevents the tree canopy from getting too dense and promotes good air circulation, which is very important for preventing most diseases. Well pruned trees are also easier to spray with pesticides.

Sanitation. Sanitation includes various physical practices intended to reduce pathogen populations and prevent their spread. Many pathogens survive year to year in the tree, on fallen leaves around the tree and rotting fruit. At the end of the season remove diseased fruit from the tree and ground. Leaves and pruning debris should be raked and bagged. Diseased branches should be pruned and removed during the dormant season. Diseased plant material should not be composted.

Synthetic Chemicals. The home gardener has several options for chemical control. Most of the available products for home gardeners work on contact and must be applied before the disease occurs or as soon as disease symptoms are observed. The most common fungicides for home garden use contain sulfur, copper, captan or mancozeb. Organic gardeners can use sulfur or copper to manage apple diseases. Before applying a pesticide, always read the product label carefully. A list of synthetic chemicals available for homeowners is provided in Table 2. Before applying a fungicide always read the product label carefully.

Biopesticides. Many home gardeners prefer to use organic products that are more "environmentally or earth friendly" than traditional synthetic chemicals. Biopesticides are derived from natural materials such as plants, animals, minerals, and fungi or bacteria, and are most effective when used in conjunction with cultural methods. A list of biopesticides available for homeowners is provided in Table 3.

Table 1. Apple Varieties for Home Plantings
Resistance to diseases other than apple scab has not been fully evaluated and may or may not differ in some locations from that reported here. All apples require cross-pollination by a different variety. Winesap cannot serve as a pollinizer because it has sterile pollen.

	Resistance To				
Variety	**AS**	**CR**	**FB**	**PM**	**Other Traits**
Crimson Crisp	VR	M R	S	S	red, harvest mid-September
Dayton	VR	R	MR	R	bright medium red, harvest mid-August, good for southern Ohio climate
Enterprise	VR	VR	MR	R	light to medium red, mid-October, good for southern Ohio climate
Freedom	VR	R	VR	R	bright red, harvest late September
Golden Delicious	S	S	S	VS	yellow, harvest late September
GoldRush	VR	S	MR	S	deep yellow with red blush, harvest mid-October, good for southern Ohio climate
Jonafree	VR	S	S	R	red stripes, harvest early September, good for southern Ohio climate
Liberty	VR	R	R	R	red stripes on green yellow, harvest late August
Macfree	VR	VR	MR	S	medium red over green yellow, harvest mid-September
Nova Easygro	VR	VR	R	S	80% dark red on green yellow, harvest early September
Pixie Crunch	VR	—	—	—	Deep red, harvest early September
Priscilla	VR	VR	VR	R	70-90% dark red blush over yellow green, harvest mid-September
Sundance	VR	VR	VR	VR	Yellow, occasionally russets in stem cavity, harvest mid-October, good for southern Ohio climate
William's Pride	VR	VR	R	R	dark red, harvest late July or early August
Winesap	VS	R	S	R	Deep red, harvest mid-October

AS = apple scab, CR = cedar apple rust, FB = fire blight, PM = powdery mildew. VR = very resistant, R = resistant, MR = moderately resistant, S = susceptible, — = insufficient information

Common Diseases of Home Apple Plantings in Ohio

Apple scab. Apple scab is the most important fungal disease in Ohio and is most severe in wet springs. The fungus causes circular, olive brown to black colored spots on the leaves, fruit and young stems of the tree. Fruit lesions are generally superficial and do not alter the taste of the fruit. Heavily diseased trees will prematurely lose their leaves and apples. The fungus overwinters on fallen leaves. Disease is best controlled by planting resistant varieties. Raking and destroying leaves and fruit that have fallen will help to prevent scab the following spring. Leaves, stems and fruit can be protected with synthetic chemicals applied beginning at green tip (buds begin to show green tissue) and continuing throughout the summer.

Fire blight. Fire blight is a bacterial disease that can eventually kill a tree if the disease is not controlled. Fortunately, this disease is sporadic and only an occasional problem for backyard growers. The disease affects all parts of the tree including the flowers, leaves, shoots, fruit and trunk. Infected tissues are characterized by their blackened, burned appearance, hence the name fire blight. Infected shoots often have a crook-shape appearance. During warm and wet weather diseased tissue may ooze with bacteria. Varieties vary considerably in their susceptibility to fire blight but planting varieties (and rootstocks) that are resistant to fire blight is the most effective way to prevent the disease. MM.111 and M.7 EMLA rootstocks are resistant to fire blight. If trees show symptoms of fire blight, infected branches or twigs should be cut back to healthy wood during the dormant season. Disease can also be minimized by avoiding heavy applications of nitrogen in the spring as this promotes vigorous shoot growth. Fungicides will not effectively control fire blight. The antibiotic streptomycin can be applied during bloom to prevent new infections.

Powdery mildew. Powdery mildew is a fungal disease that is generally not a problem in Ohio. The fungus prefers hot and fairly dry summers, which is not typical of most summers in Ohio. Signs of infection appear as white powdery growth on the shoots, leaves, blossom buds, and immature twigs of apple. In cases of severe infection, the skin of the fruit will be light brown in color and rough to the touch, which is called russetting. During the dormant season, the tips of diseased twigs will have a frosty white appearance. The disease is effectively controlled by planting resistant varieties. Pruning and destroying diseased twigs during the dormant season will help to reduce new infections in the spring. Fungicides and biopesticides can also be used beginning before the blossoms start showing a pink color and repeated throughout the summer.

Apple Scab
Melanie Lewis Ivey, The Ohio State University

Powdery Mildew
Sasha Marine, Virginia Polytechnic Institute and State University

Fire Blight
Marcus McCartney, The Ohio State University Extension

Summer Fruit Rot
Melanie Lewis Ivey, The Ohio State University

Summer fruit rots. There are three fungal fruit rots (Black rot, White rot and Bitter rot) that can cause apple fruit to rot while still on the tree. The black rot fungus can infect fruit during warm rains anytime from petal fall to harvest but symptoms don't show up on the fruit until it begins to ripen. Large, tan to black colored lesions that form on the calyx end of the fruit are firm and dry are typical of black rot. In contrast, white rot lesions are soft with an apple sauce consistency. Fruit with white rot often

Table 2. Fungicides for Use in Home Apple Plantings

Fungicide	Trade Names	Diseases Controlled	Recommended Rate (Per Gallon of Water)
calcium chloride*	Calcium-25 ferti-lome Yield Booster Tetra Cor-Clear Dry Calcium	Bitter pit Cork spot	1.5 tablespoons
captan	Hi-Yield Captan 50W Fungicide	Apple scab Fly speck Fruit rots Sooty blotch	1-1.5 tablespoons
copper	Liqui-Cop Copper Fungicidal spray	Fire blight	4-6 teaspoons (silver to ½ inch green tip only)
mancozeb	Bonide Mancozeb Flowable with Zinc	Apple scab Juniper rusts	5 teaspoons
myclobutanil	Spectracide Immunox Multi-purpose Fungicide	Apple scab Cedar apple rust Powdery mildew	4 teaspoons
sulfur	Bonide Sulfur Plant Fungicide Sulfur Safer Brand Garden Fungicide II	Fruit rots Cedar apple rust Powdery mildew Sooty blotch	1-2½ tablespoons

* Do not apply calcium chloride sprays when temperature is above 85 degrees F and rinse sprayer well after use because calcium chloride is corrosive.

Table 3. Biopesticides for Use in Home Apple Plantings

Biopesticide	Diseases Controlled	Recommended Rate (Per Gallon of Water)
Bayer Advanced Serenade Garden Disease Control	Fire blight	4-8 tablespoons
GreenCure Foliar Fungicide	Apple scab Fly speck Powdery mildew	1-2 tablespoons
SafeGro Mildew Cure	Powdery mildew	3 tablespoons
Neem Oils (many brands)	Powdery mildew	Refer to product labels
BioWorks MilStop	Powdery mildew	1 tablespoons
BioSafe Disease Control	Powdery mildew	1.5 tablespoons
Organocide Plant Doctor	Apple scab	3-4 teaspoons

have a sour smell when you cut them open. White rot infections primarily occur during the heat of the summer. Bitter rot is favored by hot and humid weather during mid to late summer. Symptoms of bitter rot include circular lesions that are slightly sunken. In damp weather, masses of orange spores form in the center of bitter rot lesions. Fungicide applied beginning at petal fall and continuing through harvest will provide good control of fruit rots. There are no effective biopesticides for fruit rot control. To prevent fruit rots from being a yearly problem diseased fruit on the trees and ground should be removed and destroyed.

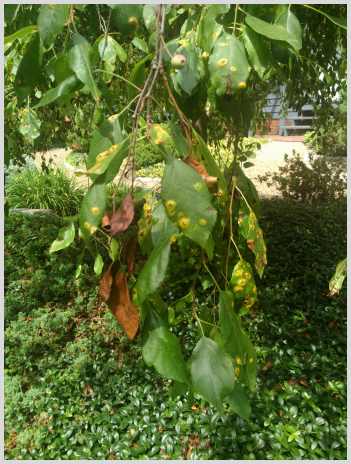
Flyspeck and sooty blotch. Flyspeck and sooty blotch are two different diseases, caused by different fungi but they commonly occur together on the same fruit. Both diseases are most common during years with cool wet springs, rains in late summer, and low temperatures in early fall. Although all apple varieties are susceptible to infection by both fungi, symptoms are most severe on yellow or light-colored varieties. Sooty blotch appears as dull black to grey colored blotches on the fruit. Fly speck appears as small groups of black shiny round dots that may or may not form within sooty blotch patches. Sooty blotch and flyspeck symptoms are superficial on the fruit and can be removed by washing or rubbing the fruit. Annual pruning of trees to promote good air flow through the canopy and rapid fruit drying is a very effective management strategy. Fungicides and biopesticides can be used to control both diseases, however because the diseases don't affect fruit quality and the symptoms can be rubbed off, fungicides and biopesticides are not recommended for home plantings.

Cedar apple rust. Cedar apple rust is caused by a rust fungus and is a problem when apple and certain species of juniper and red cedar grow in close proximity. The cedar apple rust fungus causes bright yellow-orange or reddish spots on apple leaves. Occasionally lesions will also appear on the calyx end of fruit. Resistant varieties should be planted in yards that have junipers or red cedars nearby (up to a mile). For homeowners who want juniper and red cedar trees in their yard, they should consider planting rust resistant varieties (see OSU Extension Factsheet HYG-3055-08 for a list of juniper and cedar varieties with resistance to cedar apple rust). Fungicides applied beginning at tight cluster (blossom buds that are mostly exposed and tightly grouped) can protect apple trees from rust infections. There are no effective biopesticides for cedar apple rust.

Flyspeck and Sooty Blotch
Janna Beckerman, Purdue University

Common Injuries of Home Apple Plantings in Ohio

Necrotic leaf blotch. Necrotic leaf blotch is a common but minor problem that appears to be restricted to the Golden Delicious cultivar of apples. The cause of the problem is not known. Necrotic leaf blotch usually appears in late June or early July and mature leaves on rapid-growing shoots are usually the only part of the tree that shows symptoms. Symptoms begin as blotching on the leaves, followed by yellowing and defoliation. Trees that have a biennial bearing habit or a light fruit crop are more prone to necrotic leaf blotch than an annual moderate crop of fruit. Trees pruned to have a central leader tend to have less necrotic leaf scorch than those that are pruned to an open center. Fungicides and biopesticides are not recommended.



Cedar Apple Rust on Crabapple
Rachel Medina, The Ohio State University

Cedar Apple Rust on Red Cedar
David Taylor, USDA Forest Service

Bitter pit and cork spot. Bitter pit and cork spot are physiological disorders that affect fruit quality. They are caused by low levels of calcium in the fruit. Low soil pH, excessive nitrogen, rapid shoot growth, and large fruit from trees with light crops are associated with increased incidence of these disorders. Cork spot appears anywhere on the fruit as green dimples or depressions. When the fruit is pealed a corky brown spot is under the dimple or depression. Bitter pit appears as sight depressions generally on the calyx end of the fruit. However, in some instances the symptoms may not be apparent on the fruit surface but appear under the skin. Under the skin there will be dry, brown spongy spots. Apples with bitter pit often have a bitter taste. Symptoms of both diseases can be difficult to distinguish from damage caused by insects. For long term control of bitter rot and cork spot, soil liming at planting and three to five year intervals after planting is suggested. A soil test should be conducted to determine the amount of limestone to add to the soil. Foliar application of calcium chloride beginning two weeks after full bloom and continuing at 10 to 14 day intervals thereafter may help reduce corks spot and bitter pit in established trees.

Necrotic Leaf Blotch
Mark Longstroth, Michigan State University

Bitter Pit
Poliana Francescatto, Cornell University

Cork Spot
Mike Ellis, The Ohio State University

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