The Plant Doctor's LANDSCAPE TIPS

By David L. Roberts, Ph.D, *Michigan State University*

Photo 1: These crabapple leaves and fruit are infected with the scab fungus, Venturia inaequalis. Infections the following spring will originate from this foliage and fruit unless they are removed from the landscape.

Photo 2: Tar spot lesions are still visible on this Maple foliage after leaves were shed from trees in the fall. Even though leaves will partly decompose over the winter, the tar spot fungus will survive and infect maple trees the following spring. Gathering the leaves and composting them will minimize fungal survival.

Photo 3: Similar to deciduous trees, the survival and spread of conifer diseases, such as Rhizosphaera needlecast, depends on undisturbed foliage, either on or beneath the trees.

Photo 4: Dothistroma needle blight on pines remains on the trees during the winter, rather than being cast from trees. This attribute makes Dothistroma possibly less amenable to IDM techniques.

MANAGING THE OVERWINTERING SURVIVAL OF DISEASES: AN IDM APPROACH

INTRODUCTION:

Plant diseases may be caused by a variety of agents, also known as pathogens. These pathogens include bacteria, fungi, nematodes, viruses, viroids, and phytoplasmas. Traditional management of plant diseases incorporates applications of chemical sprays at various times during the disease cycle when management by those chemicals is most efficacious. Usually, the most appropriate time for application of chemicals is during the growing seasons (spring and summer) when plants become active and are most susceptible to infection and subsequent disease development. While these "spray and pray" tactics have offered variable control, there are serious deficiencies with this approach. The timing of the chemical application is critical; a too-late or too-early application of the chemical can result in less than desirable control of the disease. Also, the public is becoming more concerned with chemical contamination of our environment; more and more human health concerns are being attributed to exposure from agricultural and industrial chemicals. Some Integrated Disease Management (IDM) efforts have been directed toward reducing our use of chemicals while implementing alternative management practices. The targeted disease pathogens have developed various mechanisms for survival during the dormant season, when both plants and pathogens are overwintering. The dormant period can offer Plant Health Care Providers a unique opportunity to help manage diseases via environmentally friendly ways.

OVERWINTERING AND THE DISEASE CYCLE:

Disease pathogens may survive by various mechanisms on various plant parts. In general, pathogens may be killed by cold weather and other adverse conditions. Even though many propagules (fungal spores, bacterial cells, etc.) of the pathogens may be killed during the overwintering cycle, the pathogens produce such copious numbers of propagules (billions) that their survival is easily accomplished. The number of surviving propagules is one factor that can determine how serious the disease is on particular plants during the following season. Understanding how and where pathogen propagules survive the winter and infect the following season can help us reduce their numbers so that fewer chemical inputs are needed the following season.

Deciduous Foliage: Because of the nature of deciduous plants, many foliar disease pathogens survive on the foliage that has fallen from the tree or shrub during the fall season. Some examples are anthracnose of trees and shrubs, scab on crabapple/apple/pear (Photo 1), and tar spot of maple (Photo 2), etc. While the tissues of foliage may break down somewhat during the overwintering season, pathogen propagules usually survive in plant refuse just fine. Removal of this pathogen-infested foliage from the vicinity of trees and shrubs can reduce the numbers of propagules available for infection on those plants the following spring and summer.

Evergreen Foliage: Many foliar diseases of conifers are known as needlecast diseases, meaning that needles are cast from trees after infection. The casting of infected needles may occur the same season or in succeeding seasons. Pathogen propagules generally mature in various fungal fructifications the following season when spores are released (often ejected) to foliage on the branches. Examples include Rhizosphaera needles cast of spruce (Photo 3), Rhabdocline needlecast of Douglas Fir, Lophodermium and Cyclaneusma needlecasts of Scotts Pine. A slight exception to the needlecast diseases is Dothistroma needle blight of pines; most recently emerged and infected needles remain attached to branches on the tree (Photo 4), where spores are spread from maturing overwintering structures to infect newly emerging needles the following spring.

Twigs/Branches: Many pathogens that attack the woody portions of trees and shrubs remain associated with infection areas or cankers on branches of trees for the entire year, even during the overwintering season. Some examples include Nectria canker of various trees and shrubs, Cytospora canker of spruce and other trees and shrubs, fire blight of rosaceous plants (crabapple, firethorn, hawthorn, pear, etc.) and some anthracnose diseases (Photo 5, next page).

Root/Stems: Most diseases that affect the roots and lower stems/trunks (root collar) of herbaceous and woody plants can survive very well in the soil. Examples of these pathogens include Phytophthora, Rhizoctonia, Pythium and Armillaria (Photo 6). As soil inhabitants, they have evolved mechanisms that enable them to compete and survive very well amidst the very harsh and competitive soil environment.

MANAGEMENT OF OVERWINTERING DISEASE AGENTS:

Plant disease pathogens have developed various schemes to survive over winter. Some pathogens survive on plant refuse (foliage, twigs) shed from plants during the fall season. Other pathogens survive on the plant, where they may release propagules the following spring to "re-infect" its host plant and possibly spread to others. With an understanding of these survival mechanisms, we can implement various IDM practices that may be helpful in managing these diseases.

Removal: Because many foliar pathogens survive from year to year on plant refuse, simply removing that refuse from the landscape should theoretically reduce the potential for infection the following season. The problem with this practice is that pathogen propagules can travel by wind for great distances (Photo 7). Hence, removal of infested plant refuse can be helpful if the practice is extended well beyond the specific landscape. This practice is especially effective when composting is involved.

For many root and lower stem pathogens, removal may be helpful but offer limited control because many of these soil-borne pathogens already exist naturally in the soil. However, removal of the infected roots and stems may reduce the pathogen population.

Because viruses, viroids and phytoplasmas tend to be systemically distributed through infected plants, the entire plant may have to be destroyed to prevent spread and further infection. For serious diseases caused by these pathogens, accurate diagnosis is strongly recommended before removal and destruction of the entire plant is performed.

Pruning: Pruning out cankers that harbor fungi (e.g., Nectria) and bacteria (e.g., Erwinia fireblight) can be a highly effective practice for reducing these diseases in succeeding seasons. For this type of disease, pruning may be far more efficacious than removal techniques for foliar diseases. Prunings should be destroyed by chipping and composting, burying, or burning (incineration).

Composting: There are several efficient ways to process pathogen-infected plant wastes. Burying or burning the refuse, whether it is composed of foliage, branches or stems and roots, is very effective in destroying pathogens. However, burying and burning are not always practical solutions in many communities. Composting (Photo 8), if performed properly, is a highly effective procedure for destroying or reducing pathogen propagules. Proper composting involves occasional turning and mixing, and, possibly, the addition of water and nutrients. Proper composting stimulates the rapid breakdown of pathogen-infested plant refuse by numerous species of microorganisms, which cause the demise of pathogen propagules. Improper composting will probably result in the survival of many pathogens. Proper composting of chipped branches and lower trunk/roots can also be highly effective.

Implementation of these IDM procedures can provide alternative and highly effective methods for reducing the impacts of diseases on plants in our landscapes. As consumers evolve and become less tolerant of chemical applications to their environment, innovative arborists and landscape companies can promote these alternative IDM practices to fulfill an important and upcoming niche for plant health care. IDM also offers extended business opportunities during traditionally non-busy periods of the year. These IDM practices will be far more effective if implemented neighborhood- or community-wide.

For more information, please feel free to email me at robertsd@msu.edu or contact a professional plant health-care provider. The author, MSU and MGIA do not endorse any particular products. If using pesticides, be sure to read and follow label directions.

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Photo 5: Improper pruning can result in the infection of wounds by canker fungi such as Cytospora, Nectria and Hypoxylon. Winter pruning is the best time to manage many of these diseases.

Photo 6: Similar to many root and stem/trunk rot pathogens, Phytophthora, a soil-borne fungus and the cause of stem and root rot of Rhododendron, is marginally managed by removal and composting techniques. Other cultural practices, such as avoiding excess irrigation, providing good drainage and avoiding excess fertilizers, may help to minimize soil-borne diseases.

Photo 7: Implementation of IDM techniques should be as wide ranging as possible, encompassing communities and neighborhoods. Pathogen propagules, such as these spores, may spread extensive distances by the wind.

Photo 8: In addition to recycling plant refuse and providing natural fertilizers, proper composting is a highly effective way to reduce the survival of pathogen propagules in diseased plant material.