

Diseases of Landscape Trees

Mary Ann Hansen, Extension Plant Pathologist, Virginia Tech

Many landscape tree diseases can be managed effectively by cultural control methods and/or with fungicides or other chemicals. Trees should be maintained in the best possible vigor by a regular fertilization and watering program as needed to help prevent disease from occurring. (See Additional Comments 1 and 2 at the end of this section.) Fungicides should be used only when a destructive disease is a known threat. Few diseases require regular spray schedules on a yearly basis. For example, anthracnose control should be elected during prolonged damp weather in late winter and early spring. Most fungicides are designed primarily to be protective; that is, they must be applied before the fungus is deposited on the plant surface to prevent infection. They are ineffective when applied to established lesions. Fungicides should be re-applied when washed off by rain following their application. The addition of a spreader (surfactant)-sticker to the fungicide suspension often enhances disease control.

Pruning may be used either as a horticultural practice or for removing diseased or dead plant tissues. The disinfecting of tools used in these activities cannot be overemphasized. Many disease organisms are spread by careless workers who do not use disinfectants. Pruning tools should be dipped between cuts in rubbing alcohol or in a household bleach solution made by combining 1 part of bleach and 9 parts of water; the solution is more effective when a little soap is added as a wetting agent. A wound paint or spray, preferably one fortified with a disinfecting agent, may then be applied. Recent research indicates that wound paint preparations may not be effective in excluding wood-rotting organisms (see Additional Comment 3 at the end of this section); they may, however, be helpful in preventing infection by certain canker-causing organisms. In all cases, diseased tree parts of all kinds (whole trees, limbs, leaves, etc.) should be removed and, if possible, burned or buried. This eliminates or reduces the source of inoculum.

Many decline problems are attributable directly to 1) chemical exposure (spillage of toxicants near roots or growth of roots into soil treated with soil-sterilant herbicides, de-icing salts, excessive rates of turf herbicides, excessive rates of fertilizer, etc.); 2) mechanical injury (building, sidewalk or driveway construction, lawnmower injury at tree base, etc.); 3) poor cultural practices (deep planting, pruning, or mulching method; inadequate or excessive soil moisture or fertilizer; lack of winter protection; etc.); and 4) girdling roots. Girdling roots, especially ones that partially girdle the trunks, have been recognized as a major cause of landscape tree decline. Often the problem with an abnormally shaped root system starts in the nursery and is magnified over time after the tree is transplanted to the landscape. Trees purchased from nurseries should be carefully examined for depth of flare roots and for encircling roots before transplanting. Trees that were already planted too deeply in the nursery should have excess soil removed and/or be planted higher in the planting hole. Encircling roots should be loosened or severed to prevent continued circular growth after transplanting.

Trees weakened by the above stresses are predisposed to attack by pathogens that normally are of little or no consequence. Insect attack is also commonly observed in declining landscape trees, and some species serve as vectors or carriers of important pathogens. Therefore, in the control of landscape tree diseases, one should seriously consider a total maintenance program.

Many problems of landscape trees can be prevented by proper selection of planting materials. Competent horticultural counsel should be sought and considered at the planning stage; resistance to diseases, pests, and other stresses should be involved in all decision-making during the landscape design planning process. It is often wise to use as many native trees as possible, since native species often have more resistance to endemic pathogens than exotic species. Refer to electronic fact sheets on problem-free trees and shrubs for Virginia at the following websites: <http://www.ext.vt.edu/pubs/plantdiseasefs/450-237/450-237.html> and <http://www.ext.vt.edu/pubs/plantdiseasefs/450-236/450-236.html>.

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Table 4.2 - Fungicide Use

Tree And Disease	Fungicide, Rate, and Remarks
Ash (<i>Fraxinus</i>) Anthracnose (<i>Gloeosporium</i>)	Apply fungicide sprays at label rates, beginning at budbreak or first sign of disease. Collect and either burn or bury fallen leaves to reduce overwintering of inoculum. Fungicide options include: <ul style="list-style-type: none"> • Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide): repeat at 7- to 14-day intervals. • Chlorothalonil + thiophanate methyl (Spectro 90 WDG): repeat at 7- to 21-day intervals. • Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, or Protect T/O): repeat at 7- to 10-day intervals. • Thiophanate methyl (Cleary 3336, Fertilome Halt): repeat applications at 7- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. • Thiophanate methyl + mancozeb (Zyban WSB): repeat at 7-day intervals.
Ash Rust (<i>Puccinia</i>)	By the time symptoms are noticed, control is generally not warranted. However, if fungicide control is desired, application of the following fungicides at label rates can be made in early spring: <ul style="list-style-type: none"> • Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, or Protect T/O): repeat at 7- to 10-day intervals. • Myclobutanil (Eagle 40WP, Eagle 20EW, Systhane WSP): repeat applications at 10- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. • Thiophanate methyl (Cleary 3336, Fertilome Halt): repeat applications at 7- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population.
Beech (<i>Fagus</i>) and Birch (<i>Betula</i>) Anthracnose	Follow directions for anthracnose of ash.
Canker (various fungi)	Prune affected branches below the canker and destroy cankered branches by burning or burying.
Buckeye (<i>Aesculus</i>) Leaf Spot and Blotch (<i>Guignardia</i>)	Same as for control of anthracnose of ash.
Catalpa (<i>Catalpa</i>) Verticillium Wilt (<i>Verticillium</i>)	Verticillium wilt on this and other tree species is normally not manageable with fungicides. Some research has shown that high-nitrogen applications will aid in recovery; specific recommendations cannot be made, and personal discretion must be followed. Replace trees that have died from this disease with immune species. See comments for Verticillium wilt of maple.
Cherry (<i>Prunus</i>) Cankers (various fungi)	Ornamental cherries are susceptible to a variety of fungal canker diseases and, for that reason, may not be the best choice for landscape plantings. Symptoms include swollen, sunken, or cracked areas on the bark. Dieback occurs above the canker. Fungicides are generally not effective for control of canker diseases. Pruning out affected branches below cankers back to healthy wood is the only recommended control. If cankers occur on the trunk, trees cannot be saved.
Chestnut (<i>Castanea</i>) Canker (<i>Cryphonectria</i>)	Excise cankers at least 1 inch beyond visibly stained bark tissues. A fungicide-amended wound dressing applied to the wound may be helpful in disease control. See Additional Comment 3 at the end of this section.

Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
Crabapple (<i>Malus</i>)¹ Cedar-apple Rust (<i>Gymnosporangium juniperi-virginianae</i>)	Apply fungicides at label rates, beginning at budbreak or first sign of disease. Fungicide options include: <ul style="list-style-type: none"> · Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, or Protect T/O): repeat at 7- to 10-day intervals. · Myclobutanil (Eagle 40WP, Eagle 20EW, Systhane WSP): repeat applications at 10- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. · Thiophanate methyl (Cleary 3336, Fertilome Halt): repeat applications at 7- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. · Thiophanate methyl + mancozeb (Zyban WSB): repeat applications at 14-day intervals. · Trifloxystrobin (Compass): repeat applications at 7- to 14-day intervals. · Bacillus subtilis (Serenade, Rhapsody): repeat applications at 3- to 7-day intervals.
Fire Blight (<i>Erwinia</i>)	Prune out affected branches at least 6 inches below discolored wood and destroy or bury. It is best to prune in late summer when bacteria are no longer active. Disinfest pruning tools with rubbing alcohol or a solution of 1 part bleach to 9 parts water between cuts. Spray a registered copper product at label rates; use only one spray before budbreak. Alternatively, spray streptomycin (Agrimycin 17 or Fertilome Fire Blight Spray) at label rates, using no more than 5 applications, starting at 20% to 30% bloom, every 10 to 14 days. Serenade or Rhapsody can also be used for fire blight control. See instructions under cedar-apple rust.
Powdery Mildew (<i>Podosphaera</i>)	Apply fungicides at label rates, beginning at budbreak or first sign of disease. Fungicide options include: <ul style="list-style-type: none"> · Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide): repeat applications at 7- to 14-day intervals. Applications made during bloom may damage flowers. · Jojoba oil (E-Rase): make repeated applications when new mildew infections are observed. · Myclobutanil (Eagle 40WP, Eagle 20EW, Systhane WSP): repeat applications at 10- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. · Neem oil (Garden-Safe Fungicide): repeat applications at 7- to 14-day intervals. · Potassium bicarbonate (First Step, Remedy): repeat applications at 7- to 10-day intervals. · Sulfur (Lilly Miller Sulfur Dust, Sulfur Dust, Sulfur Plant Fungicide): repeat at 5 to 10-day intervals. · Thiophanate methyl (Cleary 3336, Fertilome Halt): repeat applications at 7- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. · Thiophanate methyl + mancozeb (Zyban WSB): repeat applications at 7-day intervals. · Trifloxystrobin (Compass): repeat applications at 7- to 14-day intervals. · Bacillus subtilis (Serenade, Rhapsody): repeat applications at 3- to 7-day intervals through second cover.
Scab (<i>Venturia</i>)	Apply fungicides at label rates, beginning at budbreak or first sign of disease. Fungicide options include: <ul style="list-style-type: none"> · Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, or Protect T/O): repeat at 7 to 10-day intervals. · Myclobutanil (Eagle 40WP, Eagle 20EW, Systhane WSP): repeat applications at 10- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. · Thiophanate methyl (Cleary 3336, Fertilome Halt): repeat applications at 7- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. · Thiophanate methyl + mancozeb (Zyban WSB): repeat applications at 7-day intervals. · Bacillus subtilis (Serenade, Rhapsody): repeat applications at 7- to 10-day intervals.

¹ Many cultivars of crabapple are available, and many have resistance to one or more of the diseases listed here. When planting new cultivars, choose ones with resistance to as many of these diseases as possible.

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Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
Conifers Needle Casts (various fungi)	<p>Collect and either bury or burn fallen twigs and needles in autumn. Needle casts are caused by many different fungi. Generally, a broad-spectrum fungicide, applied at label rates in a series of applications as needles are emerging in the spring, will adequately control needle-cast fungi.</p> <ul style="list-style-type: none"> • Calcium hydroxide + copper sulfate (Bordeaux mixture): apply when new growth starts, as needles emerge from the sheath, and when needles are 2/3 mature length. • Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide): for most needle cast diseases, an application at budbreak, followed by applications at 3- to 4-week intervals until needles are fully elongated, will control the disease. • Copper hydroxide (Cupro 2005 T/N/O, Kocide 2000 T/N/O): apply at first sign of disease and repeat at 7- to 14-day intervals. Copper hydroxide should NOT be tank mixed with Aliette or phytotoxicity may occur. The spray solution should also have a pH of >6.5 to avoid phytotoxicity. • Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, or Protect T/O): begin applications in spring or early summer and repeat after heavy rains and at 2-week intervals.
Dawn Redwood <i>(Metasequoia)</i> Dothiorella Canker <i>(Dothiorella)</i>	<p>Prune affected branches below the canker and destroy cankered branches by burning or burying.</p>
Dogwood <i>(Cornus)</i> Bacterial Wetwood (various bacteria)	<p>See elm section.</p>
Discula Anthracnose <i>(Discula destructiva)</i>	<p>This disease develops rapidly and may kill the tree. It is especially serious at cool temperatures, high moisture, higher elevations, and near water sources. Understory trees are more prone to attack. Plant landscape trees in full sun. Trees should be maintained carefully, employing the best management procedures: mulching, watering, fertilizing with a balanced NPK formulation, removing suckers (water sprouts), and avoiding lawnmower injuries, etc. Fungicide applications appear to be essential in high-hazard areas. (See options below.) Propiconazole (Banner Maxx) fungicide is the preferred fungicide. Breeding efforts are ongoing, but to date only one cultivar with resistance to Discula anthracnose has been developed ('Appalachian Spring'). This cultivar does NOT have resistance to another serious disease of dogwood, powdery mildew. The kousa dogwood (<i>Cornus kousa</i> = Korean, Chinese, or Japanese) is resistant but not immune to Discula anthracnose; however, it may harbor fungal inoculum that can perpetuate the disease cycle on flowering dogwoods. Hybrids of kousa and flowering dogwood with varying levels of resistance to both Discula anthracnose and powdery mildew are also available ('Stellar' series).</p> <p>Apply fungicides at label rates, beginning at budbreak or first sign of disease. Fungicide options include:</p> <ul style="list-style-type: none"> • Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide): repeat applications at 7- to 14-day intervals. • Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, Protect T/O): repeat applications at 7- to 10-day intervals. • Neem oil (Garden Safe Fungicide): repeat applications at 7- to 14-day intervals. • Propiconazole (Banner Maxx, Fertilome Liquid Systemic Fungicide, Fungonil Lawn & Garden Disease Control): repeat applications at 14- to 28-day intervals.
Powdery Mildew <i>(Oidium)</i>	<p>Although powdery mildew diseases of many plant species are primarily a cosmetic problem, powdery mildew of dogwood can severely stunt the tree. Cultivars of both flowering dogwood and kousa dogwood with resistance to powdery mildew are available. For fungicide control, see the fungicide list under powdery mildew of crabapple.</p>

Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
<p>Septoria Leaf Spot (<i>Septoria</i>)</p>	<p>Septoria leaf spot generally occurs in late summer and control is usually not warranted. If the disease occurs earlier in the season, the following fungicides can be used for control, beginning at the first sign of disease:</p> <ul style="list-style-type: none"> • Azoxystrobin (Heritage): repeat applications at 7- to 28-day intervals. Follow label instructions on the total number of sprays allowed per season to avoid fungicide resistance in the pathogen population. • Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide): repeat at 7- to 14-day intervals. • Copper hydroxide (Kocide 2000 T/N/O, Cupro 2005 T/N/O): repeat applications at 7- to 14-day intervals. See notes about phytotoxicity under needle casts of conifers. • Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, Protect T/O): repeat at 7- to 10-day intervals. • Myclobutanil (Eagle 40WP, Eagle 20EW, Systhane WSP): repeat applications at 10- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. • Thiophanate methyl (Cleary 3336, Fertilome Halt): repeat applications at 7- to 14-day intervals. Rotation with other products is recommended to prevent resistance development in the pathogen population. • Thiophanate methyl + mancozeb (Zyban WSB): repeat at 7-day intervals.
<p>Spot Anthracnose (<i>Elsinoe corni</i>)</p>	<p>This disease is a distinct disease from <i>Discula</i> anthracnose. Spot anthracnose is not fatal to the tree. It is present to some degree every year, but is more severe in wet springs. Spots are tiny and don't enlarge. The fungus attacks leaves and "flowers" (bracts) but not branches. Sanitation, i.e. removal of fallen leaves, may help if the tree is isolated. Fungicides can also be used for control. Apply one of the following fungicides at label rates beginning when buds begin to open. Repeat three times: when bracts have fallen, four weeks after bract fall, and in late summer after flower buds form.</p> <ul style="list-style-type: none"> • Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide) • Mancozeb (Dithane DF Rainshield, Mancozeb DG, Dithane T/O Rainshield, Pentathlon LF, Protect T/O) • Thiophanate methyl + mancozeb (Zyban WSB)
<p>Douglasfir (<i>Pseudotsuga</i>)</p>	<p>See control recommendations for needle casts of conifers.</p>
<p>Swiss Needle Cast (<i>Phaeocryptopus</i>)</p>	<p>See control recommendations for needle casts of conifers.</p>
<p>Elm (<i>Ulmus</i>) Bacterial Leaf Scorch (<i>Xylella</i>)</p>	<p>A bacterial disease limited to the xylem (wood), causes leaf scorch, a slow decline, and ultimately tree death. Means of spread and disease control are currently under investigation. Leafhoppers and treehoppers are known vectors; however, insecticides have not proven effective in control. Preliminary research has indicated that micro-injections of OTC (oxytetracycline) are helpful in symptom remission; however, OTC does not cure the tree of the bacteria and is generally not a practical control measure for most homeowners. Pruning out affected branches on trees that are not yet severely affected may help slow disease progression. Branches should be pruned back as far as possible. The bacterium has a wide host range, but some trees not known to be affected include linden, black gum, buckeye, zelkova, willow oak (other oaks are very susceptible), hackberry, tulip tree, and maples other than red maple. These species can be considered as replacement trees.</p>

Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
Bacterial Wetwood (Slime Flux) (various bacteria)	Bacterial wetwood is a condition that typically does not cause serious harm to the tree. Many tree species, including elm, oak, dogwood, and probably most other hardwood species, can be affected; conifers are sometimes affected. Often a rancid or stinky odor emanates from affected tissue due to fatty acids produced by a complex of microorganisms. Generally, the external signs on bark include vertical light or dark streaks with seeping liquids, wet or dried when observed. The word "wetwood" is derived from the wet appearance of cross-sections of affected wood. This disease really has no practical management either preventively or therapeutically, although some have drilled holes at oblique angles with or without insertion of copper pipes to allow alleviation of built-up pressure and drainage of the flux away from the bark in affected areas. Stinging insects or other pests that are sometimes attracted to the fluxing sites may need to be controlled. Fluxing in oak trees may become more severe in trees that have undergone high stress situations (climatic extremes) and may disappear when such stressors are gone. Note: In oaks, bacterial wetwood is sometimes confused with Ramorum blight, which is not currently known to occur in Virginia. See section on OAK.
Black Leaf Spot (<i>Gnomonia</i>)	Collect and either burn or bury fallen leaves. Mancozeb (=Dithane T/O Rainshield, Dithane DF Rainshield, or Mancozeb DG) at label rates may be applied at budbreak and 1 to 2 times thereafter at 10- to 14-day intervals.
Dutch Elm Disease (DED) (<i>Ophiostoma novo-ulmi</i>)	<p>An integrated program for susceptible elms is strongly recommended in American elm trees for maximum protection against DED. PREVENTION is the critical key to disease management. This integrated program consists of (1) sanitation—prompt removal and destruction of diseased trees by burning or burial, (2) chemical or mechanical severance of root graft unions between diseased and healthy trees, and (3) prompt removal at the trunk of individual branches with new and restricted (5% or less of crown involvement) beetle-transmitted infections. Systemic fungicides have undergone preliminary trials for prevention and cure of DED. Even though promising results have been reported following applications in preventive (before contraction of disease) and curative (after contraction of disease) situations, research has not adequately revealed the (1) degree and completeness of disease control, (2) extent of translocation within the sapwood and therefore extent of internal protection of therapy, (3) residual life, (4) optimum dosage per individual trees of varying sizes and configurations, and related information. In high hazard situations where fungicide injection is the only recourse available for disease management, injection is elected for use. Injections are made in flare roots. When administered to symptomatic elms, systemic fungicides should be applied in American elm trees before the removal of diseased branches (radical surgery as a supplemental component). Treatment administered after crown involvement exceeds 5% may not be effective. Virginia Cooperative Extension recommends the administration only of scientifically proven systemics as a component part of its integrated DED control package, as outlined herein, but not as a substitute for it. These compounds are to be used by trained arborists or others acquainted with the identification of DED and injection techniques.</p> <p>1. 3-Year Treatment For Preventive and Therapeutic Management of DED: Inject 12.0 fl oz thiabendazole (Arbotect 20-S) in 6.0 gal of water for each 5 inches of trunk diameter. Inject into any exposed root flares, as near to the ground as possible, once every 3 years. The maximum diameter of the injection holes should be about 1/4 inch. 1-1/2 to 2 injection holes (ports) per inch of trunk diameter are recommended. Do not use this treatment if trees are less than 10 inches in diameter. When a tree shows more than 5% crown symptoms, treatment may not be effective. Treatment should be used in conjunction with an insect control and sanitation program (pruning of diseased limbs) in order to obtain best results. Be sure to flush injection holes with water following fungicide injection; several liters are desirable. This promotes faster and better wound closure.</p> <p>2. Propiconazole (Alamo), also registered for use on Dutch elm disease, has shown remarkable preventive and curative properties. For macroinjection or infusion, Alamo should be used preventively at the rate of 6-10 ml/ DBH inch or curatively at the rate of 10-20 ml/DBH inch or whatever is indicated on the current label. Label dosages for prevention and therapy should be followed. Dilution in water can be variable.</p>

Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
Dutch Elm Disease (DED) (<i>Ophiostoma novo-ulmi</i>) (cont.)	<p>Frequency of Alamo treatment required is not clearly known at this time, but research indicates that the 6-ml rate should protect trees for 24 months; the 10-ml rate for 36 months. Curative treatments should be repeated every 12-36 months. Also, we emphasize that preventive injection is much preferable to therapeutic (curable) injection; extent of disease can often be misinterpreted or underestimated on the basis of percentage of crown symptoms. Severely affected trees may not respond to treatment. Alamo is also registered for use in microinjectors. Injectors are placed on flare roots. Injection holes should be flushed with water as previously mentioned for Arbotect or any other injectant.</p> <p>Please Note: New products, including EPA-registered fungicides, for the control of Dutch elm disease appear occasionally on the market. Many of them have not been tested objectively and scientifically in reputable laboratories where rigid standards of evaluation are employed. Beware of products not tested or recommended by Virginia Cooperative Extension. It is important to inquire if doubts arise.</p>
<p>Hawthorn (<i>Crataegus</i>) Cedar-quince Rust (<i>Gymnosporangium clavip</i>)</p>	<p>Spray with chlorothalonil (Daconil Weather Stik, Daconil Ultrex), azoxystrobin (Heritage), or chlorothalonil + thiophanate methyl (Spectro 90 WDG) at label rates at pre-bloom stage. Sprays applied after bloom are not effective for this disease.</p>
<p>Hickory (<i>Carya</i>) Leaf Spot (<i>Microstroma</i>)</p>	<p>Collect and either burn or bury diseased leaves. Fungicides generally are not warranted.</p>
<p>Honeylocust (<i>Gleditsia</i>) Cercospora Leaf Spot (<i>Cercospora</i>)</p>	<p>See fungicide recommendations for Septoria leaf spot of dogwood.</p>
<p>Horse Chestnut and Buckeye (<i>Aesculus</i>) Leaf Blotch and Other Leaf Spots (<i>various fungi</i>)</p>	<p>Same as for control of anthracnose of ash.</p>
<p>Leyland Cypress (<i>x Cupressocyparis leylandii</i>) Canker (<i>Seiridium</i>, <i>Botryosphaeria</i>)</p>	<p>Trees are predisposed to these diseases by drought stress. In some cases, decline can be reversed in the early stages of disease by alleviating water stress with adequate irrigation. Prune out affected branches below cankers (look for cracked, swollen or sunken bark with resin droplets) and remove or destroy them by burning or burying. Dip pruning tools in rubbing alcohol or a solution of 1 part bleach to 9 parts water between cuts to avoid spreading the pathogen. Fungicides are generally NOT effective for control of these diseases in landscape trees.</p>
<p>Magnolia (<i>Magnolia</i>) Leaf Scorch, Winter Injury</p>	<p>Apply foliar anti-transpirant such as Moisturin, Wilt Pruf, or other according to manufacturer's recommendations.</p>
<p>Sooty Mold (<i>various fungi</i>)</p>	<p>Sooty mold fungi appear as a black coating on the leaf surface on several different trees and shrubs, including magnolia and holly. Sooty molds do not parasitize the leaves; they simply grow on the honeydew substance secreted by certain insects, such as aphids and scales. To prevent the growth of sooty mold, treat for the insect that is secreting the honeydew. For magnolia, refer to the section on control of magnolia scale in the "Insects of Trees and Shrubs" section.</p>
<p>Maple (<i>Acer</i>) Anthracnose (<i>Kabatella</i>, <i>others</i>)</p>	<p>This disease is common in spring, but is generally harmless except in very wet springs. When weather is conducive to disease development, the fungicides recommended for anthracnose of ash can be used for control.</p>

Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
Maple (Acer) (cont.) Scorch	Scorch, the “burning” of leaf margins, occurs commonly in early spring or summer due to moisture stress. Supplemental watering and mulching often alleviate or prevent the problem. Anti-transpirants have proven helpful. Bacterial leaf scorch has also been found to cause leaf scorch in red maple. See bacterial leaf scorch of elm section for details.
Verticillium Wilt (<i>Verticillium</i>)	Some research indicates that a vigorous nitrogen (ammonium sulfate) fertilization, above that which the tree and/or turf might ordinarily receive in a standard maintenance program, may enhance recovery. We cannot offer a specific recommendation; the consumer must choose a regimen at his/her discretion. Avoid replanting susceptible species in infested soil. Refer to Additional Comment 4 for a list of tree species immune to Verticillium wilt.
Zonate Leaf Spot (<i>Cristulariella</i>)	Collect and either burn or bury diseased leaves. If zonate leaf spot appears early in the season, which is sometimes seen in Norway or red maple, a broad-spectrum fungicide, such as mancozeb (Mancozeb DG, Dithane T/O Rainshield, or Dithane DF Rainshield), can be used at label rates, starting at the first sign of disease. Usually this disease appears later in the season and does not warrant control.
Mimosa (<i>Albizia</i>) Mimosa Wilt (<i>Fusarium</i>)	This disease is a vascular wilt disease for which there are no chemical controls. The fungal pathogen has a very narrow host range. Replace trees that have died from this disease with species other than mimosa.
Mountain Ash (<i>Sorbus</i>)	
Cytospora Canker (<i>Cytospora</i>)	Remove and destroy cankered branches by burning or burying.
Oak (<i>Quercus</i>) Anthracnose (<i>Apiognomonina</i>)	Normally, this disease is not deemed serious enough to recommend fungicidal treatment. However, if fungicide control is desired, refer to recommendations for anthracnose of ash.
Bacterial Leaf Scorch (<i>Xylella</i>)	The same organism that causes elm leaf scorch causes bacterial leaf scorch in oak. Refer to comments for bacterial leaf scorch of elm.
Bacterial Wetwood	See elm section.
Chlorosis	Chlorosis (yellowing) is a common problem in the Virginia highlands on pin oak (<i>Quercus palustris</i>) and in other oak species in other areas of the state. It should be noted that ANY macro- or micro-element in short supply might interfere with chlorophyll synthesis, leading to chlorosis. Commonly, however, on pin oak, the problem is elevated soil pH (in the neutral, pH 7.0, or higher (alkaline) range due to limestone or other alkalifying agent). To control this problem, soil pH must be lowered (soil must be acidified) by some agent, such as an acid-producing fertilizer, addition of sulfur, aluminum sulfate or other acidic compound. For exact dosage, report the soil pH to an extension soil scientist. On sites where soil is difficult to amend, some have achieved success with foliar applications of iron chelate. Trunk implantation devices (capsules, “Medicaps,” etc.) have been successful in some situations also. The best result, however, is to adjust soil pH. Consult an Extension soil scientist for specific recommendations. Note that chlorosis may also result from root abnormalities, such as girdling roots, or from poor drainage. For example, willow oaks or other oak species planted in parking lot islands in heavy clay soil may show severe chlorosis even when the soil pH is correct.
Endothia Canker (<i>Endothia</i>)	Endothia gyrosa, causal agent of pin oak blight, may also be pathogenic to other species of oak. Remove cankered branches at the trunk or at the major adjoining branch and destroy by burning or burying. Avoid wounding of any kind, especially lawnmower injuries and trimming of lateral branches of the pin oak. Keep pin oaks well watered. Provide nutrients on a regular basis as needed.
Leaf Blister (<i>Taphrina</i>)	This disease rarely causes significant stress to trees. Preventive spray is generally not needed. The pathogen infects leaves early in the spring and repeat infections do not occur. By the time symptoms are noticed, it is too late for effective control.
Powdery Mildew (<i>Sphaerotheca</i>)	This disease rarely causes significant stress to oak trees; preventive sprays are generally not needed.

Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
Ramorum Blight (Sudden Oak Death) (<i>Phytophthora ramorum</i>)	This disease is not known to occur on oaks in Virginia at this time. If symptoms of bleeding areas are seen on oak bark, the problem is most likely bacterial wetwood. Refer to the description of bacterial wetwood in the elm section.
Tubakia Leaf Spot (<i>Tubakia</i>)	This disease rarely causes significant stress to trees; preventive sprays are generally not needed.
Pear (<i>Pyrus</i>)	A special note on Bradford (Callery) pear: This species is prone to breakage during wind or ice storms. Although it has resistance to fire blight, dieback due to this disease may occur in severe fire blight years. Pruning out affected branches 6 inches below obvious cankers usually provides adequate control. Dip pruning tools in rubbing alcohol or a solution of 1 part bleach to 9 parts water between cuts. Bradford pear is also very sensitive to deep planting and poor drainage. The tree responds to these conditions by turning black (foliage and branches) throughout the tree. These symptoms could be confused with fire blight, but fire blight generally affects only a few individual branches at a time on this species.
Pine (<i>Pinus</i>) Diplodia Tip Blight (<i>Diplodia</i>)	Clubbed shoot tips, which serve as a source of fungal inoculum, should be pruned back to healthy wood. Austrian and other 2-needled pines are especially susceptible to this disease. In some cases, cankers form on branches. Such branches should be pruned back to healthy wood. On highly susceptible species, such as Austrian pine, the disease may progress to kill the whole tree in the absence of early intervention. Fungicide options include: <ul style="list-style-type: none"> • Calcium hydroxide + copper sulfate (Bordeaux mixture): apply when new growth starts, as needles emerge from the sheath, and when needles are 2/3 mature length. • Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide): apply at budswell and repeat at 10- to 14-day intervals. • Thiophanate methyl (Cleary 3336, Fertilome Halt): begin applications in spring when new growth starts. Make a second application just before needles emerge from the sheath and a third application 7 days later. Thorough coverage is necessary for optimal disease control.
Eastern White Pine (various disorders)	Eastern white pine (<i>Pinus strobus</i>), known commonly as “white pine,” is a tree that is particularly sensitive to a wide array of stresses. It is easily injured by insufficient or excess soil moisture, and many trees do not adapt to landscapes where soil profiles have been disturbed, where the soil is heavy and/or compacted, or where other soil problems exist. White pine is also sensitive to chemical toxicants, such as certain herbicides, deicing salt, and air pollutants. Most of these stresses result in overall browning, yellowing, and/or stunting of the needles. Individual cases must be examined to be diagnosed.
Needle Casts (various fungi)	See Conifers section.
Needle Rust (<i>Coleosporium</i>)	This disease rarely causes significant stress to trees; preventive sprays are generally not needed.
Pine Wilt (Japanese Black Pine, esp.) (<i>Bursaphelenchus</i>)	Symptoms include sudden wilting and death of entire trees. It is believed that trees in decline attract beetles that carry a nematode which colonizes the water-conducting system. Remove affected trees. No chemical controls are available.
Seasonal Needle Drop	Conifers are often referred to as “evergreens”, however, conifers are not really “evergreen” because they regularly lose the oldest needles when those needles are 2 or more years old. Many conifers lose their oldest needles gradually and the discoloration and loss of these needles goes unnoticed. White pines, however, are especially prone to losing the oldest needles all at once in the fall. The innermost needles turn yellow all over the tree and may remain on the tree for some time before they drop, resulting in a striking inner yellowing of the tree. This phenomenon often leads homeowners to believe the trees are dying. Seasonal needle drop is a normal occurrence in pines and other conifers. It may be more noticeable some years than others, but it is no cause for concern.

4-20 Home Ornamentals: Diseases of Landscape Trees

Table 4.2 - Fungicide Use (cont.)

Tree And Disease	Fungicide, Rate, and Remarks
White Pine Root Decline (Procerum Root Disease) (<i>Leptographium</i>)	The fungus, <i>Leptographium (Verticicladiella) procerum</i> , is the suspected causal agent, but may not be the sole contributory stress factor. Pales weevils are believed to introduce the fungus to the tree or provide entry ports for the fungus. These weevils breed in stressed trees or in the stumps of trees that have been cut down. Therefore, complete removal and burning of dying trees, including stumps, is recommended. If stumps are not removed, insecticide treatment of stumps is recommended. Refer to information on stump control of pales weevil in the "Insects of Trees and Shrubs" section of this guide. White pine should NOT be used as a replacement plant.
Plane-tree	See sycamore.
Plum (<i>Prunus</i>) Black Knot (<i>Dibotryon</i>)	Galls turn black in the second year after infection when the fungus produces fruiting bodies and spores on the bark surface. Prune out galled branches and remove or destroy them while they are still the color of the bark and before spores have formed. Avoid planting ornamental plums near stands of wild cherries, which are very susceptible to the disease.
Poplar (<i>Populus</i>) Canker (various fungi)	Remove and destroy cankered branches by burning or burying. Avoid the use of Lombardy or other susceptible species and cultivars.
Redbud (<i>Cercis</i>) Botryosphaeria Dieback (<i>Botryosphaeria</i>)	This disease causes sections of the tree to die back. Prune out affected branches back to healthy wood (where entire cut surface appears creamy white). Dip pruning tools in rubbing alcohol or a solution of 1 part bleach to 9 parts water between cuts. Botryosphaeria infections often follow drought stress. Water trees deeply during drought.
Spruce (<i>Picea</i>) Cytospora Canker (<i>Cytospora</i>) Rhizosphaera Needle Cast (<i>Rhizosphaera</i>)	Remove and destroy cankered branches by burning or burying. Prevent drought or other stresses, which predispose trees to this disease. Fungicide options include: <ul style="list-style-type: none"> • Calcium hydroxide + copper sulfate (Bordeaux mixture): apply when new needles are 1/2 to 1 inch long. Repeat when needles are full length. • Chlorothalonil (Daconil Weather Stik, Daconil Ultrex, Fertilome Landscape & Garden Fungicide): make first application in spring when new growth is 1/2 to 2 inches in length. Repeat applications at 3- to 4-week intervals until conditions no longer favor disease.
Sweetgum (<i>Liquidambar</i>) Bleeding Canker (<i>Botryosphaeria</i>)	This disease appears as small bleeding lesions on the bark. Stress, especially drought stress, predisposes trees to the disease. Removing stress factors by watering during drought, etc., can allow trees to recover. There are no chemical controls.
Sycamore (<i>Platanus</i>) Anthracnose (<i>Apiognomonina</i>)	Anthracnose can be severely disfiguring and possibly debilitating to this species during repeated long, moist, cool springs. Follow fungicide recommendations for anthracnose of ash. If sprays are undesirable because of the tree's location or size, Arbotect 20S injections done in late summer are highly effective; see the 3X rate used in elm for management of Dutch elm disease, or follow the label dosage. Anthracnose must not be confused with bacterial leaf scorch caused by the bacterium, <i>Xylella fastidiosa</i> . Anthracnose lesions tend to follow leaf veins, whereas symptoms of bacterial scorch appear along leaf margins.
Bacterial Leaf Scorch (<i>Xylella</i>)	See elm section.
Walnut (<i>Juglans</i>) Anthracnose (<i>Gnomonia</i>)	Follow directions for control of anthracnose of ash.
Willow (<i>Salix</i>) Crown Gall (<i>Agrobacterium</i>)	If desired for cosmetic purposes, galls on larger trees may be removed surgically, and a wound paint applied to the wound. Disinfect tools between cuts. Galls should be removed during late fall or mid-summer when sap flow is minimal.
Fungal Cankers (various fungi)	Willows are susceptible to a variety of fungal canker diseases. Symptoms appear as discolored or cracked bark with dieback above the canker. Fungicides are generally not effective for control. Prune out cankered branches back to healthy wood and destroy them by or burying.

Additional Comments

1. The vigor of unthrifty and undernourished trees, commonly susceptible to various environmental stresses, often can be greatly improved by periodic applications of nutrients. Soil tests are always recommended prior to fertilizer application, especially if a soil fertilization program has already been in effect. In general, a 10-10-10 (NPK) fertilizer at the rate of 2.0 to 4.0 pounds per inch of tree diameter at waist height (DBH) can be applied in holes evenly distributed in the ground beneath the tree. Alternatively, one can apply about 1.0 to 2.0 pounds actual nitrogen per 1000 square feet by surface-broadcasting during the dormant season; ammonium nitrate or nitrate of soda are acceptable compounds. Consult your local Extension agent for specific recommendations.
2. Lack of water is one of the most widespread and destructive abiotic stress of the landscape tree; when possible, this stress should always be prevented or alleviated. Research at Virginia Tech has shown that when dry conditions prevail, irrigating deeply twice a week for the first year after transplanting helps prevent stress to the tree. It should be remembered that moisture stress can also occur in winter. Watering trees in the fall before the ground freezes can help to prevent winter desiccation.
3. For the exclusion of certain pathogenic fungi, any of the following compounds may be applied thinly and evenly over freshly-cut surfaces and wounds: 1.0% thiram, 3.3% to 10.0% copper naphthenate, or 2.0% sodium-o-phenylphenate in an asphalt or other non-fortified tree wound preparation.
4. Tree or shrub species that appear to be immune or resistant to Verticillium wilt include:

<i>Abies spp.</i> (fir)	<i>Liquidambar styraciflua</i> (sweet gum)
<i>Amelanchier spp.</i> (serviceberry)	<i>Malus spp.</i> (apple, crabapple)
<i>Betula spp.</i> (birch)	<i>Morus spp.</i> (mulberry)
<i>Buxus spp.</i> (boxwood)	<i>Nerium oleander</i> (oleander)
<i>Carpinus spp.</i> (ironwood)	<i>Picea spp.</i> (spruce)
<i>Castanea mollissima</i> (Chinese chestnut)	<i>Pinus spp.</i> (pine)
<i>Ceanothus spp.</i> (red-root)	<i>Platanus spp.</i> (sycamore)
<i>Celtis spp.</i> (hackberry)	<i>Pyracantha spp.</i> (fire-thorn)
<i>Cercidiphyllum japonicum</i> (katsura-tree)	<i>Pyrus spp.</i> (pear)
<i>Cornus spp.</i> (dogwood)	<i>Quercus alba</i> (white oak)
<i>Crataegus spp.</i> (hawthorn)	<i>Q. falcata</i> (southern red oak)
<i>Fagus spp.</i> (Beech)	<i>Q. phellos</i> (willow oak)
<i>Ficus carica</i> (fig)	<i>Q. virginiana</i> (live oak)
<i>Ginkgo biloba</i> (maidenhair tree)	<i>Salix spp.</i> (willow)
<i>Gleditsia spp.</i> (honey locust)	<i>Sorbus aucuparia</i> (European mountain-ash)
<i>Ilex spp.</i> (holly)	<i>Taxus spp.</i> (yew)
<i>Juglans spp.</i> (walnut)	<i>Zelkova serrata</i> (zelkova)
<i>Juniperus spp.</i> (juniper)	
<i>Larix spp.</i> (larch)	

