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IDENTIFICATION AND MANAGEMENT OF DISEASES OF PERENNIALS IN THE LANDSCAPE

Use of perennials in the landscape continues to increase dramatically, particularly here in the Northeast. The demand for perennials has been estimated to be growing at a rate of 8-15% per year, especially as long as producers continue to make new plants available. As a group, perennials are fortunately relatively problem free in the landscape. In part, this is attributed to the diversity of plant species in perennial gardens which helps to minimize chances for widespread disease outbreaks. However, we still need to be able to accurately identify disease problems when they do occur. Some diseases tend to be fairly host specific and are limited to plants within a genus or family whereas other diseases can be widespread and have broad ranges of hosts. It is also important to recognize which diseases are aesthetic rather than life-threatening so appropriate control strategies can be implemented.

The focus of this fact sheet is recognition and management of diseases of perennials in the landscape. Since it isn't feasible to know all of the specific diseases on all perennials (a daunting task considering the number of plants and diseases out in the landscape) learning to recognize and manage **key diseases** will allow you to make informed decisions for effective control of most problems that are encountered. Before

discussing the key diseases, it is important to consider **disease prevention**, a fundamental component of management and one of the most effective ways to deal with diseases in the landscape.

I. DISEASE PREVENTION:

By following a few basic measures, many diseases of perennials can be avoided or minimized in the landscape.

1. Planting Practices

- *Spacing*--use the correct spacing since crowded plants don't do well and too-close spacing can promote disease by inhibiting drying and air circulation.
- *Planting Depth*--plant at depth recommended for each species; this is especially important for winter hardiness and in some cases, for flowering.

2. Cultural Care

- *Fertilizing*—appropriate applications based on soil tests to maintain plant growth and vigor and to avoid plant stress due to deficiencies or toxicities.
- *Mulching*--properly applied mulch helps with weed control, soil temperature moderation, and soil moisture retention; summer mulches should not be applied too thick or too close to the stem or crowns of plants.

- *Watering*-- maintain adequate soil moisture for the plant species; this usually translates to approximately one inch of water per week; in the absence of natural rainfall, irrigation should be used and depending upon soil type, this is best delivered as a deep soaking; avoid overhead irrigation or water plants early in the day to allow foliage to dry before nighttime.
 - *Winter Protection*--winter mulches can be effective to protect plants from heaving during freeze-thaw cycles; mulches should be applied AFTER the ground has frozen and removed BEFORE or WHEN new growth starts in the spring.

3. Plant Selection

- *Hardiness*--often an overlooked aspect of disease prevention; most of Connecticut is in USDA Zone 6 (some Zone 5); usually not a problem with most perennials but a factor for consideration when trying new species.
- *Plant Requirements vs. Site Characteristics*--match these as closely as possible; special attention to soil type and pH, drainage, and light level.
- *Genetic Resistance*--if resistant or tolerant cultivars or species are available, they should be selected for use.
- *Plant Health*--purchase healthy, vigorous, pathogen-free plants and carefully inspect the root systems before planting.

4. Sanitation

- *Remove Infected Plants and Debris*--symptomatic plants or infected plant parts should be removed promptly to minimize disease spread; after tops are killed by frost in autumn, all plant debris should be removed to reduce or minimize overwintering inoculum.
- *Groom Plants*--remove spent flowers and leaf debris during the growing

season to minimize inoculum buildup and spread.

II. KEY DISEASES

Key diseases are diseases that are problems on many types of plants each year. These are best categorized by the part of the plant that is affected. This section provides a brief description of the symptoms, causal agents, and additional strategies for disease management and control which are necessary when preventative methods are not effective. Examples of available pesticides are given for each key disease although the lists are not all-inclusive. Pesticide regulations vary from state to state and many pesticides are not labeled for use on perennials or may only be labeled for use on specific plants. Although many companies have recently broadened their fungicide labels for use on perennials, care should be taken when using a product for the first time on a particular species to avoid phytotoxicity problems. Additionally, it is also important to carefully read the pesticide label since some compounds may have labels for greenhouse and/or nursery use but not landscape use.

A. FOLIAR DISEASES:

1. Leaf Spots

- Leaf spots are the most prevalent of all plant diseases. They appear as dead areas scattered over the leaf surface and often have defined margins. Since the fungi and bacteria which cause these diseases tend to be fairly host specific, widespread outbreaks on different species of plants usually don't occur. Most fungi associated with leaf spot diseases require free water on leaf surfaces in order to infect so these diseases are often most serious during wet, humid weather.
- Fungicide applications can supplement preventative control measures. Among the compounds registered for use are

biologicals (Rhapsody, Plantshield), chlorothalonil, thiophanate-methyl, copper compounds, strobilurins, and mancozeb. Most of these fungicides are protectants and must be applied to developing foliage **before** symptoms appear. The effectiveness and the number of sprays required for control will vary with weather conditions.

Key Hosts: *Aster, Phlox, Veronica, Coreopsis, Rudbeckia, Heuchera, Hosta, Iris, Hemerocallis*

Key Pathogens: Fungi (*Septoria, Cercospora, Didymella, Phyllosticta*), Bacteria (*Pseudomonas, Xanthomonas*)



Mycosphaerella leaf spot of iris.



Septoria leaf spot of phlox.

2. Blights

- Blights are characterized by sudden and conspicuous leaf and growing tip symptoms which are more severe than leaf spots since entire leaves, stems, and

flowers may be killed. Infected tissues may also appear blackened or wilted. Blights are often more severe during wet weather or on plants which have been stressed by other factors. Although a wide range of fungi and bacteria are known to cause blights, one of the most notorious and ubiquitous is *Botrytis*. *Botrytis cinerea* and several other related species commonly infect a very broad range of perennials.

- Fungicides are helpful in some host-pathogen combinations but many are protectants and therefore need to be applied before symptoms appear. The effectiveness and number of sprays required for control will vary with weather conditions. Among the compounds registered for use are biologicals (Rhapsody, Plantshield, Messenger), chlorothalonil, copper compounds, mancozeb, thiophanate-methyl, and iprodione.

Key Hosts: *Paeonia, Geranium, Dahlia, Iris, Rudbeckia, Salvia*

Key Pathogens: Fungi (*Alternaria, Botrytis, Rhizoctonia*), Bacteria (*Erwinia, Xanthomonas*)



Bacterial blight of peony



Southern blight of pachysandra.

3. Rusts

- Early symptoms of rust infections appear as pale spots on the upper surface of the leaf. More diagnostic symptoms are present on the undersurface of the leaf as blisters or pustules which break open to reveal the rusty, orange to brown spores that give these diseases their name. Rusts are specialized fungi that are host specific and do not casually spread from species to species in the landscape. They typically infect only one or several closely related hosts. However, there are also rusts that require more than one type of host in order to complete their life cycles.
- Fungicide applications can supplement preventative measures for control. Among the compounds registered are

chlorothalonil, mancozeb, strobilurins, myclobutanil, and triadimefon.

Key Hosts: *Alcea*, *Potentilla*, *Coreopsis*, *Aconitum*, *Delphinium*, *Iris*

Key Pathogens: Fungi (*Puccinia*, *Coleosporium*, *Phragmidium*, *Uromyces*)



Rust of daylily.



Rust of New England aster.

4. Powdery Mildews

- By far one of the most common diseases of perennials in the landscape, powdery mildews are recognized by their distinctive symptoms which are similar on essentially all hosts. Symptoms first appear as chlorotic or pale green irregular patches on the upper leaf surface which gradually develop into diagnostic white to gray, powdery patches. Symptoms are usually most evident on the upper surface of the leaf and often first appear on the lower foliage where humidity levels stay higher for longer periods of time. In

some cases, severely infected leaves quickly turn brown and drop. Although the disease looks the same on every host, in reality the fungi are fairly host-specific. For example, the powdery mildew fungus that infects aster is not able to infect lupine and *vice versa*.

- While preventative measures often keep these diseases at manageable levels in the landscape, fungicides can be important for control in areas of high visibility. However, in most cases they need to be applied when disease is first detected since powdery mildew is difficult to effectively control once it is severe or has reached epidemic status. Among the compounds available are biologicals (Rhapsody), horticultural oils, neem oil, mancozeb, potassium bicarbonates, triadimefon, thiophanate methyl, and sulfur.

Key Hosts: *Aster, Coreopsis, Dahlia, Monarda, Phlox, Delphinium, Rudbeckia, Lupinus, Veronica*

Key Pathogens: Fungi (*Erysiphe, Phyllactinia, Podosphaera*)



Powdery mildew of peony.

5. Downy Mildews

- Downy mildews can be troublesome in the landscape and are often misdiagnosed or overlooked because of the symptoms that they produce. Pale green or yellow areas appear on the

upper surface of leaves during the early stages of infection. Diagnostic symptoms gradually develop on the undersurface as the fungus grows out of the infected leaf and appears as a fuzzy, white to gray-purple growth. These symptoms often go unnoticed until the infection is severe and heavily infected leaves turn brown and shrivel, often in a very short period of time.

- Fungicides can help to keep the disease in check as long as severely infected plants are removed from the planting bed. Among those available are fosetyl-Al, phosphorous acids, strobilurins, coppers, mancozeb, and mancozeb plus thiophanate-methyl.

Key Hosts: *Aster, Veronica, Artemisia, Geum, Coreopsis, Potentilla, Rudbeckia*

Key Pathogens: Oomycetes (*Peronospora, Plasmopara*)



Downy mildew of lamium.



Downy mildew of rudbeckia.

B. ROOT AND STEM DISEASES:

1. Root, Stem, and Crown Rots

- These rots often produce fairly non-specific above-ground symptoms and plants turn yellow, wilt, and droop. Infected plants can also appear stunted and have poor vigor. In some cases stems and roots are discolored, soft, and mushy. In others, sunken, discolored areas or cankers develop along the stem or on individual shoots which can result in dieback. In extreme cases entire plants die. Plants which are under stress (especially in sites with poor drainage) are most susceptible. A number of fungi and bacteria are associated with root and crown rots. The majority of these pathogens are soil contaminants that are capable of infecting an extremely broad range of plants.
- Fungicides can be effective in supplementing preventative strategies. However, accurate diagnosis of the pathogen is necessary in order to select the appropriate fungicide since they vary in their efficacy. Among those available are biologicals (Rhapsody, Plantshield), etridiazole, etridiazole plus thiophanate-methyl, fosetyl-Al, iprodione, mefenoxam, metalaxyl, and PCNB.

Key Hosts: most perennials (*Chrysanthemum*, *Dianthus*, *Papaver*)

Key Pathogens: Fungi (*Rhizoctonia*, *Sclerotium*, *Thielaviopsis*), Oomycetes (*Pythium*, *Phytophthora*), Bacteria (*Erwinia*)



Thielaviopsis root rot (left) and healthy root (right).



Pythium root rot.

2. Vascular Wilts

- Symptoms of vascular wilts include loss of rigidity, wilting, yellowing of foliage, drooping, gradual dieback, and in extreme cases, plant death. In many cases the symptoms are very similar to those caused by root rots. All of these symptoms indicate water stress since the fungi and bacteria that cause these diseases systemically invade the plant's vascular system (most commonly the xylem, but occasionally the phloem). A diagnostic symptom can sometimes be seen if the stem is cut to reveal a discoloration or browning of the

vascular system. Since the infection is systemic and the entire plant is involved, little can be done once a plant is infected. Several fungi (and a bacterium in warmer areas) are responsible for vascular wilts. They are soil-borne and have extremely broad host ranges.

- Fungicides are not usually effective for control. Use of resistant species or varieties and rotation are often the only effective means for control.

Key Hosts: *Aster, Coreopsis, Chrysanthemum, Dahlia, Dicentra, Callistephus, Dianthus, Phlox, Paeonia*

Key Pathogens: Fungi (*Fusarium, Verticillium*), Bacteria (southern states: *Pseudomonas*)

C. MISCELLANEOUS DISEASES:

1. Viral Diseases

- Although symptoms of virus infection are often distinctly different from those caused by other types of pathogens, they can also be very difficult to diagnose or detect. Among the distinctive symptoms are mosaics, mottles, ringspots, and distorted growth habits. These can develop on leaves or shoots. More subtle symptoms involve the entire plant and include stunting and poor vigor. Virus infections are often systemic in the plant and once infected, little can be done. Most viruses that are encountered in the landscape have very broad host ranges although there are some that can be fairly host specific. Viruses are most often spread through vegetative propagation or by insect vectors (including whiteflies, aphids, thrips, and leafhoppers).
- Pesticides are ineffective for control once infection has occurred. However, insecticides aimed at the vectors can reduce the spread of the disease in the landscape. Symptomatic plants should be promptly removed to eliminate sources of the pathogen.

Key Hosts: *Aquilegia, Aster, Delphinium, Gaillardia, Dicentra, Dahlia, Paeonia*

Key Pathogens: Cucumber mosaic virus, Impatiens necrotic spot virus, Peony ringspot



Hosta X virus of hosta.



Impatiens necrotic ringspot (INSV) virus of wild ginger.

2. Phytoplasmal Diseases

- Symptoms of phytoplasmal infection can be quite variable and include yellowing of foliage, greening of flowers (called virescence), distortion of growth, witches-brooming, and stunting. Aster yellows is by far the most common and widespread disease caused by this category of pathogens. Phytoplasmas are typically spread by vegetative propagation or by insect vectors (most often leafhoppers). As with viral

infections, phytoplasmal infections are usually systemic in the host and cannot be eliminated once infection has occurred.

- Pesticides are ineffective for control once infection has occurred. However, insecticides aimed at insect vectors can reduce spread of disease. Symptomatic plants should be promptly removed to eliminate sources of the pathogen.

Key Hosts: *Delphinium*, *Dahlia*, *Gaillardia*, *Salvia*, *Rudbeckia*, *Campanula*, *Coreopsis*

Key Pathogens: ‘*Candidatus* Phytoplasma asteris’

3. Nematode Diseases

Foliar Nematodes

- Several species of nematodes infect the foliage and shoots of a wide range of perennials. The foliar nematode, *Aphelenchoides* spp., is very common on many perennials.
- Symptoms include foliar discoloration, twisting and curling of leaves, necrosis, and blighting of affected leaves by mid to late summer. Lesions are often delineated by the venation pattern of the leaf so they have an angular appearance.

Key Hosts: *Hosta*, *Baptisia*, *Hypericum*, *Phlox*, *Heuchera*, *Geranium*



Foliar nematode of salvia. (J. A. LaMondia)

Root-Knot Nematode

- The northern root-knot nematode, *Meloidogyne hapla*, has a wide range of perennial hosts.
- This nematode infects roots and causes small galls to develop on feeder roots. The galls interfere with root function.
- Symptoms of infected plants include stunting, poor vigor, and poor color.

Key Hosts: *Achillea*, *Chelone*, *Liatris*, *Phlox*, *Rudbeckia*, *Monarda*



Root knot nematode of hosta. (J. A. LaMondia)

D. PLANT DISEASES LOOK-ALIKES:

1. **Insect Problems** (cyclamen mite, broad mite, four-lined plant bug)
2. **Nutritional Deficiencies and Toxicities**
3. **Misapplied Pesticides and Phytotoxicity**

QUICK REFERENCE FOR DIAGNOSING KEY DISEASES OF PERENNIALS

PLANT PART AFFECTED	SYMPTOMS	POSSIBLE DISEASES or CAUSES
<i>Foliage</i>	round, dead spots on leaves	leaf spots, spray injury
	angular dead spots on leaves; leaves and shoots brown or blacken and die;	leaf spots, blights, foliar nematodes
	white powdery growth on leaves, usually upper surface	powdery mildews
	grayish purple powdery growth on leaves, usually on lower surface	downy mildews
	distorted growth	phytoplasmal or viral diseases, misapplied pesticides, usually herbicides
	mosaic, mottle, cupping, or ringspot pattern on leaves	viral diseases
<i>Whole Plant</i>	stunting	root rots, nematodes, nutritional or soil problems
	yellowing	root rots, nutritional problems
	abnormal leaves and flowers	phytoplasmal or viral diseases, misapplied pesticides
	wilting	vascular diseases, root rots, stem rots
	blackened appearance; growing tips and flowers shrivel and die	blights
	stunting, galls at crown and on roots	crown gall
	wilting of leaves or collapse of one or more shoots associated with discolored, sunken areas on stems	cankers, stem rots

BOOKS AND GUIDES FOR DIAGNOSING DISEASES OF PERENNIALS

Ball Pest & Disease Manual, 2nd Edition. 1997. Powell, C. C. and R. L. Lingquist. Ball Publishing, Batavia, IL. 226p.
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ISBN 0-87563-810-4

Herbaceous Perennials Production: A Guide from Propagation to Marketing. 1998. Perry, L. P. Northeast Regional Agricultural Engineering Service (NRAES) Ithaca, NY. 208p.
Publication # NRAES -93.
ISBN 0-935817-29-8

Manual of Herbaceous Ornamental Plants, 4th Edition. 1994. Still, S. M. Stipes Publishing Company, Champaign, IL. 814p.
ISBN 0-87563-433-8

Pests & Diseases of Herbaceous Perennials: A Biological Approach, 2nd Edition. 2006. Gill, S., R. A. Cloyd, J. R. Baker, D. L. Clement, and E. Dutky. Ball Publishing, Batavia, IL. 422p.
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The Organic Gardener's Handbook of Natural Insect and Disease Control. 1996. Ellis, B.W. and F. M. Bradley, eds. Rodale Press, Emmaus, PA. 534p.
ISBN 0-87596-753-1

Westcott's Plant Disease Handbook, 6th Edition. 2001. Westcott, C., rev. by R. K. Horst. Kluwer Academic Publishers, Boston, MA. 1008p.
ISBN 0-7923-8663-9 (~\$255.00)

April 2008 (revised)