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RECOGNIZING TREE DISEASES AND STRESS FACTORS

Tree health problems in Connecticut are associated with a number of abiotic and biotic factors.

I. STEPS FOR DISEASE PREVENTION AND CONTROL:

A. *Diagnosis-*

knowing what you're trying to control; **accurate diagnosis is critical for successful disease control;**

B. *Assessing the Severity of the Problem-*

1. Nature of pest problem-

type of disease, i.e., root vs. foliar, systemic vs. localized

2. Level of disease-

loss threshold, i.e., amount of disease, number of years with problem; number of trees affected

C. *Control Options-*

1. Culture:

this includes cultural methods that modify the plant's growing conditions; maintaining optimum plant vigor by proper site selection, proper watering and fertilizing; avoiding mechanical injuries and soil compaction; appropriately timed pruning and transplanting, adequate spacing between plants, improving tilth and pH of the soil;

2. Sanitation:

this involves the use of vigorous, healthy, disease-free cuttings or plants, pruning of affected plant parts; raking and removing affected plant parts such as fallen leaves; disinfecting tools such as pruning shears and spades;

3. Resistance:

this involves the use of resistant/tolerant cultivars; plants with genetic resistance to specific diseases; refer to lists of cultivars with specific types of resistance;

4. Chemical:

this involves the use of pesticides which are registered for control of specific diseases; proper selection and timing of pesticide applications are *very* important; it is also very important to **thoroughly** read the pesticide label; the current status of many fungicides is unstable and labels are frequently being modified;

II. COMMON PLANT HEALTH PROBLEMS:

A. *Abiotic (caused by non-living agents)*

1. Culture

2. Environment

B. *Biotic (caused by living agents)*

1. Fungi
2. Bacteria, MLOs
3. Viruses
4. Nematodes

III. FACTORS TO CONSIDER IN PLANT SELECTION:

"The right plant for the right site!"

- A. Hardiness
- B. Site Requirements vs. Site Characteristics
- C. Structure/Size of Root System
- D. Aesthetic Qualities
- E. Sensitivities
- F. Common Disease Problems

IV. COMMON ABIOTIC PROBLEMS:

A. Winter Injury-

1. Symptoms:

dieback, foliar browning, sunscald and bark splitting

2. Causal Factors:

late spring frosts (after growth has started), cool summer followed by a warm fall and drop in temperature, excessive or late season nitrogen fertilization, dry soil or root injury, frost cracking, excessive temperature fluctuations and drying winds, lack of snowcover

3. Commonly Affected Plants:

wide range of plants including broadleaved evergreens (rhododendron and mountain laurel), narrowleaved evergreens (arborvitae, yew, juniper, pine, and hemlock), deciduous trees and shrubs (weeping cherry, rose), and ground covers (pachysandra and ivy)

4. Control Measures:

- a. select appropriate site for planting
- b. have sufficient moisture in root zone before soil freezes
- c. avoid late summer and early fall fertilization
- d. mulch to increase moisture retention in winter
- e. prune out dead branches or twigs in spring and fertilize to stimulate new growth
- f. use of anti-transpirants or anti-desiccants

B. Drought-

1. Symptoms:

loss of turgor in needles or leaves, drooping, wilting, yellowing, premature leaf or needle drop, dieback, poor growth, stunting, plant death; predisposes plant to secondary problems and cultural injuries; symptoms often not evident until the year after drought occurs

2. Causal Factors:

soil water becomes deficient and results in feeder root damage and death; plant unable to take up water

3. Commonly Affected Plants:

broad range of deciduous and evergreen trees and shrubs; effects are particularly severe on seedlings or recent transplants but established plants are also affected; especially affected this year were maple, ash, hemlock, juniper, dogwood, rhododendron

4. *Control Measures:*

- a. water in periods of low soil moisture
- b. select appropriate site and use proper planting practices
- c. select native plants adapted to local seasonal and annual variations in the water supply; drought sensitive (e.g., dogwood, many oaks, arborvitae, many *Viburnum*) vs drought tolerant species (e.g., most pines, many *Prunus*, eastern larch, some junipers)
- d. prune out dead branches or twigs in spring

C. Excess Water-

1. *Symptoms:*

highly variable, including epinasty (downward bending of petioles), stem swelling, chlorosis, edema, reduced and stunted growth, twig dieback, wilting, leaf drop, root and plant death

2. *Causal Factors:*

root damage in flooded or waterlogged soils associated with oxygen deficiency; damaged fibrous roots die, decay, and plants are unable to take up water; predisposed plants are subject to secondary invaders and opportunistic pests

3. *Commonly Affected Plants:*

seedlings and new transplants are more sensitive than established ones; dormant plants tolerate flooding longer than those in active growth; angiosperms are generally thought to be more tolerant than gymnosperms; particularly affected are yews, hemlocks, maples, rhododendrons

4. *Control Measures:*

- a. avoid plant stress by appropriate site selection and proper planting practices
- b. maintain vigor by fertilization to stimulate good growth
- c. select appropriate species for site and soil conditions, water tolerant species (e.g., red maple, eastern larch, forsythia, green ash) vs water intolerant species (e.g., gray and paper birch, crabapple, dogwood, eastern hemlock)
- d. prune dead or dying tissues to minimize problems from secondary invaders

D. Air Pollution-

1. *Symptoms:*

highly variable, depending upon type of pollutant and plant host; typically classified as **acute** or **chronic**; **acute injury** normally involves the death of cells and develops within a few hours or days following exposure to high levels of pollutants; symptoms include stippling or altered pigmentation, flecking, bleaching, chlorosis, interveinal and marginal necrosis, and tip necrosis; **chronic injury** typically develops more slowly, within days or weeks following exposure; this type of injury usually appears in response to long-term, low-concentration exposure; in some cases, visible symptoms are not present but exposure results in suppressed photosynthesis rates, stimulated respiration, and suppressed growth;

symptoms are often subtle and easily confused with other problems such as normal senescence, nutritional disorders or other environmental stresses

2. *Causal Factors:*

major classes of phytotoxic air pollutants, in descending order of direct damage are: oxidants (ozone O₃, PAN), sulfur dioxide (SO₂), and fluorides (hydrogen fluorides HF)

3. *Commonly Affected Plants:*

significant differences in sensitivity of plant species to specific pollutants occur; particularly sensitive tree species to specific pollutants are:

O₃- white ash, eastern white pine, black cherry, catalpa, honey locust

SO₂- larch, birch, American elm, eastern white pine

HF- young, expanding needles of pines and spruces, paulownia, Douglas fir, serviceberry

4. *Control Measures*

- a. plant resistant or tolerant species where pollutants are known problems
- b. maintain good plant vigor by proper cultural practices

V. COMMON BIOTIC PROBLEMS:

A. Leaf Spots and Anthracnoses-

1. *Symptoms:*

most prevalent plant diseases; leaf spots appear as dead areas scattered over the leaf surface; can develop in 3 phases including leaf spot, shoot blight, and cankering; often some defoliation; severe infections result in twig and branch dieback; most serious during wet springs

2. *Causal Agents:*

wide range of fungi and some bacteria including *Septoria*, *Colletotrichum*, *Discula*, *Gloeosporium*; most require water on the leaf surface for infection to occur

3. *Commonly Affected Plants:*

broad range of deciduous and broadleaved evergreen trees and shrubs and ground covers; common are anthracnose of sycamore, ash, maple, dogwood; scab of crabapple; oak leaf blister

4. *Control Measures:*

- a. maintain tree or shrub vigor by fertilization and watering during periods of drought
- b. rake and remove symptomatic fallen leaves in autumn
- c. prune out dead branches or twigs in spring
- d. use resistant cultivars when available; for example, scab- and rust-resistant crabapple
- e. most leaf spots are not serious enough to warrant chemical control; however, there are exceptions with regard to the value of the plant or tree, the specific host and type of leaf spot involved, the nature of the host-associated damage, and the timing of defoliation; most available fungicides are protectants and must be applied to developing foliage **before** symptoms appear; the number of sprays required for control will vary with weather conditions; check pesticide labels for plant host, pathogen, dosage rates, and safety precautions

B. Blights and Diebacks

1. Symptoms:

usually sudden and conspicuous leaf and growing tip damage, blackening or wilting of growing tips, death of shoots and growing tips; often more severe during wet weather or on plants which have been stressed by other factors

2. Causal Agents:

wide range of fungi and bacteria including *Botrytis*, *Phytophthora*, *Alternaria*, and *Erwinia*

3. Commonly Affected Plants:

broad range of deciduous and evergreen trees and shrubs; especially prevalent were *Botrytis* blight, fireblight of apple and pear, *Phytophthora* dieback of rhododendron and azalea, *Phomopsis* and *Kabatina* tip blight of juniper, *Diplodia* tip blight of pine

4. Control Measures:

- a. avoid plant stress and maintain good vigor by fertilization and watering during periods of drought
- b. protect plants from winter injury
- c. use resistant cultivars when available; for example, *Phomopsis* resistant *Chamaecyperis pisifera* and *Juniperus chinensis*
- d. prune, remove, and destroy diseased portions of plants, especially spent flowers and leaf debris
- e. fungicides are helpful in some host-pathogen combinations; many are protectants and need to be applied before symptoms appear; the effectiveness and number of sprays required for control will vary with weather conditions

C. Wilts-

1. Symptoms:

loss of rigidity, wilting, yellowing of foliage, drooping of plant parts; often followed by premature defoliation; gradual dieback may be evident; "flagging" may occur when one limb or branch becomes symptomatic at a time; infected trees will occasionally produce a heavy crop of seed and have leaves that are smaller than normal; infected branches may develop characteristic brown or greenish streaks in the sapwood

2. Causal Agents:

several genera of fungi; most commonly *Verticillium* (*Verticillium* wilt) and *Ophiostoma ulmi* (Dutch Elm Disease)

3. Commonly Affected Plants:

depending upon causal agent, **many** tree species; including maple, elm, mimosa, and oak; trees under drought, nutrient, or salt stress are generally more sensitive

4. Control Measures:

- a. prune and remove affected branches or limbs as soon as symptoms are evident
- b. plant resistant species where possible
- c. maintain overall plant health by proper fertilization and irrigation during drought
- d. avoid tree stress by appropriate site selection

D. Root Rots-

1. Symptoms:

non-specific symptoms; leaves turn yellow, wilt, and droop; twig and branch dieback; general decline, reduced or stunted growth, root and plant death

2. Causal Agents:

variety of fungi including *Phytophthora*, *Verticicladiella*, and *Ganoderma*

3. Commonly Affected Plants:

wide range of hardwoods and conifers including pine, spruce, oak, and maple; plants under stress are more susceptible

4. Control Measures:

- a. protect plants from drought or flooding
- b. maintain tree vigor by appropriate fertilization and cultural care
- c. remove and destroy affected trees; stump removal is often prudent and necessary
- d. plant resistant species, where possible

E. Cankers-

1. Symptoms:

infections may appear as definite areas that vary in color from the surrounding healthy bark; necrotic, often sunken or swollen lesions occur on twigs, branches, limbs or main trunk; when cankers girdle the twig or branch, leaves wilt, drop, and the distal portion of the branch dies; small fruiting structures of causal fungi may be evident in the canker

2. Causal Agents:

wide range of fungi and bacteria, including *Botryosphaeria*, *Nectria*, *Cytospora*, and *Sirococcus*

3. Commonly Affected Plants:

wide range of hardwoods and conifers including blue spruce, beech, maple, and butternut

4. Control Measures:

- a. prune and remove symptomatic branches or surgically trim and excise trunk cankers during dry weather
- b. fertilize to encourage good growth and overall vigor
- c. avoid wounds and pay careful attention to pruning techniques

VI. PROBLEMS OF UNDETERMINED CAUSE:

A. "Decline" Syndromes-

Tree decline is characterized by progressive deterioration due to loss of vigor and health. Trees can decline for **many** reasons and although one factor may be responsible, in most cases decline results from several factors. These factors, which are often both biotic and abiotic, can act singly or in combination. A key aspect of tree decline is that the causal factors are active **over a period of years**.

1. Symptoms:

highly variable, dependent upon cause(s) and tree species; slow growth, sparse canopy and undersized leaves, premature leaf drop and fall coloration, excessive fruit set, and dieback of twigs and branches

2. Causal Factors:

wide range of abiotic (e.g. extremes of heat or moisture, girdling roots, construction damage or injuries) and biotic (e.g. primary pathogens such as *Verticillium* and mycoplasma-like organisms; opportunistic pathogens such as *Phomopsis* and *Fusicoccum*; insects causing defoliation) factors

3. *Commonly Affected Plants:*

any tree or shrub can be affected by decline but some species are more frequently affected; in Connecticut these include ash, oak, and maple (Ash Decline, Oak Decline, Maple Decline,)

4. *Control Measures:*

- a. proper plant selection based on site characteristics
- b. good cultural practices that promote and maintain overall plant health and vigor
- c. deep watering during periods of drought
- d. avoid of physical, mechanical, and chemical injuries
- e. prune and remove any dead or dying branches or limbs

VII. TREE DISEASES THAT CAUSE HAZARDS:

Although many of the diseases associated with trees and shrubs result in loss of aesthetic qualities, certain diseases weaken tree structure and pose hazards which could result in injury to both property and persons. Therefore, it is **very** important to recognize and identify the symptoms and signs of such diseases. Many hazardous tree diseases can be traced back to injuries or wounds from mechanical and "human" causes since wounds provide sites for invasion for many of the fungi that are associated with these problems.

1. *Symptoms:*

highly variable and frequently non-specific; slowed growth, progressive and significant twig and branch dieback, undersized leaves or needles, premature fall coloration and leaf or needle drop, excessive seed or cone formation; presence of fungal fruiting structures such as mushrooms, conks, or shelf-like structures on limbs, trunks, butts, and root flares; the formation of these fruiting structures is the last step in a fairly long process that results in structural weakening of the tree- this process is typically incited by enzymes which degrade wood and result in extensive internal decay or various types of rot (e.g. heart rots, butt rots, white rots)

2. *Causal Agents:*

a number of fungi; common are *Armillaria*, *Fomes*, *Ganoderma*, and *Laetiporus*

3. *Commonly Affected Plants:*

wide range of deciduous and coniferous trees including oak, maple, sycamore, horsechestnut, elm, ash, hemlock, and spruce

4. *Control Measures:*

- a. in most cases, once a tree is infected, little can be done
- b. trees with fungal fruiting structures on several limbs, trunk, butt, or roots should be removed where property or personal injury could occur
- c. if a tree appears healthy and has only one or two branches with fruiting structures, the affected branches should be promptly remove and the tree monitored for additional signs

Table 1. Resistance of Selected Woody Ornamentals to Verticillium Wilt

Resistant		Susceptible
Apple (<i>Malus</i>)	Juniper (<i>Juniperus</i>)	Ash (<i>Fraxinus</i>)
Beech (<i>Fagus</i>)	Katsura tree (<i>Cercidiphyllum</i>)	Barberry (<i>Berberis</i>)
Birch (<i>Betula</i>)	Larch (<i>Larix</i>)	Black Locust (<i>Robinia</i>)
Boxwood (<i>Buxus</i>)	Linden (<i>Tilia</i>)	Box Elder (<i>Acer negundo</i>)
Crabapple (<i>Malus</i>)	Oak (<i>Quercus</i>)	Currant (<i>Ribes</i>)
Dogwood (<i>Cornus</i>)	Pear (<i>Pyrus</i>)	Maple (<i>Acer</i>)
Fir (<i>Abies</i>)	Pine (<i>Pinus</i>)	Redbud (<i>Cercis</i>)
Firethorn (<i>Pyracantha</i>)	Spruce (<i>Picea</i>)	Russian Olive (<i>Elaeagnus</i>)
Ginkgo (<i>Gingko</i>)	Sweet Gum (<i>Liquidambar</i>)	Viburnum (<i>Viburnum</i>)
Hawthorn (<i>Crataegus</i>)	Sycamore (<i>Platanus</i>)	Yellowwood (<i>Cladratis</i>)
Holly (<i>Ilex</i>)	Walnut (<i>Juglans</i>)	
Honey Locust (<i>Gleditsia</i>)	Willow (<i>Salix</i>)	
Hornbeam (<i>Carpinus</i>)	Yew (<i>Taxus</i>)	

Table 2. Resistance of Selected Woody Ornamentals to Crown Gall

Resistant		Susceptible
Bald Cypress (<i>Taxodium</i>)	Pine (<i>Pinus</i>)	Apple (<i>Malus</i>)
Barberry (<i>Berberis</i>)	Serviceberry (<i>Amelanchier</i>)	Birch (<i>Betula</i>)
Beech (<i>Fagus</i>)	Spruce (<i>Picea</i>)	Crabapple (<i>Malus</i>)
Boxwood (<i>Buxus</i>)	Tuliptree (<i>Liriodendron</i>)	Dogwood (<i>Cornus</i>)
Deutzia (<i>Deutzia</i>)	Yellowwood (<i>Cladratis</i>)	Elm (<i>Ulmus</i>)
Ginkgo (<i>Gingko</i>)	Yew, Japanese (<i>Taxus</i>)	Euonymus (<i>Euonymus</i>)
Goldenrain Tree (<i>Koelreuteria</i>)	Zelkova (<i>Zelkova</i>)	Honeysuckle (<i>Lonicera</i>)
Holly (<i>Ilex</i>)		Lilac (<i>Syringa</i>)
Hornbeam (<i>Carpinus</i>)		Plum, Peach, Cherry
(<i>Prunus</i>)		
Larch (<i>Larix</i>)		Rose (<i>Rosa</i>)
Littleleaf Linden (<i>Tilia</i>)		Walnut (<i>Juglans</i>)
Magnolia (<i>Magnolia</i>)		Willow (<i>Salix</i>)

Table 3. Common Diseases that can be Managed Using Resistant or Tolerant Species or Varieties*

Plant	Disease	Remarks
Azalea and Rhododendron	Phytophthora root rot	Hybrids with resistance include: Caroline, English Roseum, Professor Hugo de Vries; Species with resistance include: <i>R. shweliense</i> , <i>R. schlippenbachii</i> , <i>R. lapponicum</i> ; many others are available
Crabapple	Cedar-Apple Rust (C) Fire Blight (F) Scab (S)	Cultivars with resistance or tolerance: Adams (F,S), David (F,S), Ormiston Roy (C,F), Dolgo (F,S), Red Baron (C,F); many other cultivars and species are available
Dogwood	Anthracnose	Consider planting <i>Cornus kousa</i> as an alternative; <i>C. florida</i> x <i>C. kousa</i> hybrids are also now available with anthracnose resistance
Hawthorn	Cedar-Apple Rust (C) Fire Blight (F) Leaf Blight (B)	Resistant plants: Cockspur thorn, yellow-fruited thorn, <i>Crataegus intricata</i> , <i>C. pruinosa</i> (C); <i>C. phaenopyrum</i> , Washington Hawthorn (B); <i>C. viridis</i> , Winter King Hawthorn (C,B)
Juniper	Phomopsis Tip Blight (P) Kabatina Tip Blight (K) Rusts (including Cedar-Apple, C)	Many resistant cultivars and species, including: <i>Juniperus chinensis</i> , Pfitzeriana (P,K,C), Femina (P,C); <i>J. communis</i> , Suecica, Depressa; <i>J. virginiana</i> , Tripartita (P,C); <i>J. procumbens</i> , Nana, Variegata (K)
Spruce	Rhizosphaera Needlecast	Norway spruce is relatively resistant

* Detailed lists of resistant or tolerant species and varieties are available upon request.