

Is It Drought, Nutrient Deficiency or Air Pollution? Diagnosing Plant Symptoms

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Plant Disease is described as:

Any malfunctioning of host cells and tissues that result from continuous irritation by a pathogenic agent or environmental factor and leads to development of symptoms (Agrios 2005).

Inoculum: a pathogen or its parts, capable of causing infection when transferred to a favorable host.

Biotic pathogens (fungi, bacteria, viruses, nematodes and parasitic seed plants)

- Parasitize nutrients that the plant needs for growth and maintenance
- Secrete biochemicals that kill or disrupt plant cells
- Block the transport of water and nutrients within the infected plant

Abiotic agents (pollution, flooding, wind, fire, compaction, mechanical injury, herbicides)

- Create growing conditions that plants cannot survive in
- Wound and damage vital plant parts
- Expose plants to toxic chemicals that disrupt normal plant processes or kill plant tissues

Biotic and abiotic diseases interfere with normal plant processes, some examples:

- Discolored/spotted/blighted leaves reduce photosynthesis
- Rotted roots reduce water and mineral absorption
- Damaged branch and stem xylem sapwood/vascular cambium disrupts water and mineral transport
- Dead flowers and spotted/rotted fruit diminish appearance of ornamental plants

Parasitic organisms (*pathogens*) cause infectious or biotic diseases

- A **parasite** acquires nutrients and water from another *living* organism
- A **saprophyte** obtains nutrients and water by decomposing *dead* organic matter

Plant Disease Symptoms and Signs

Symptoms – the plant's responses to adverse growing conditions as well as disease infection

1. Wilting foliage and branches
2. Chlorosis or browning of foliage
3. Dieback of branches and stems
4. Sap/resin flow on branches and main trunk
5. Excessive seed production
6. Cankers or sunken lesions

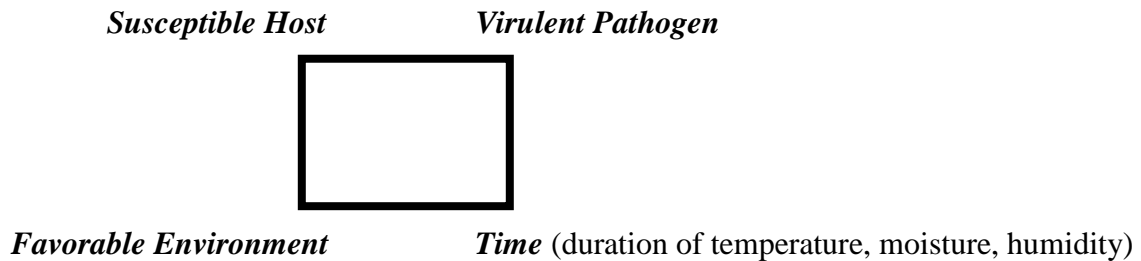
Signs – the pathogen or its parts on or within the plant

1. Fruiting structures (mushrooms, conks)
2. Mycelia/hyphae of a fungus (vegetative body of the fungus)
3. Bacterial ooze
4. Parasitic plant parts (mistletoe, dodder)
5. Nematodes

Disease Square

In order for plant disease to occur, the following conditions must occur at the same time. These conditions collective make up what is known as the “disease square” and include:

1. Virulent pathogen
2. Susceptible host
3. Proper environmental conditions
4. Time



Environmental Conditions Necessary for Disease Development

1. Moisture
Free moisture on plant surfaces or high relative humidity
Free moisture usually required for bacteria and fungi to invade plant parts
Wetness typically determines whether infection will occur and how severe it will be
Saturated soil often aid root disease fungi and bacteria
Splashing water commonly spreads disease organisms
2. Temperature
Optimal for most pathogens: 60-75° F (15-24° C)
Pathogen growth is significantly slowed if not stopped, below 40° F (4° C)
3. Air movement/wind
Aids drying of wet plant surfaces, which prevents infections
Damages plants, which aids infection
Spread plant pathogens
4. Plant nutrition
Vigorous plant better protects itself from new infections + limits established infections
High nitrogen can increase succulent growth and prolong period of susceptibility

Important Abiotic Stresses in New England

1. Drought & heat-stress: very common forms of stress creating symptoms such as scorch, wilt and dieback. Drought-stress often predisposes plants to attack by insects and pathogens.
2. Air pollutants (ozone): created through a photochemical reaction between nitrogen oxides (NO_x) and sunlight. Damage is often more severe near urban areas during periods of hot, sunny weather. Acute and chronic symptoms typically appear as browning and dieback of foliage, buds and young stems/twigs and stunted growth.
3. Road salts (root inundation and spray): buds and young stems/twigs are most affected along with foliage on coniferous hosts. Damage is caused by a buildup of chloride ions, which are toxic to plant cells at high levels
4. Misapplied pesticides: damage is often caused through non-target application or errors in the application rate. Symptoms vary widely depending on the chemical used but often appear as scorch, chlorosis, dieback, stunting and abnormal growth.
5. Flooding or waterlogging: when roots are inundated by water, even after 24 hours, anaerobic respiration occurs leading to the production of ethanol and other toxic products. Subsequent root death leads to wilt, chlorosis, browning and dieback of upper canopy plant parts. Symptoms may appear slowly over time or in the immediate aftermath of the predisposing event. Younger plants are more susceptible due to a smaller root volume.

Managing Infectious Diseases

1. Identification of plant and disease agent (biotic and abiotic).
2. Cultural control: reduce **inoculum** and improve vitality of the plant.
3. Chemical control: proper chemical that is toxic or inhibits growth of pathogen.
4. Biological control: suppress pathogens through parasitism or competition from other microbes.
5. Regulatory: awareness of regulated plant pathogens and their hosts.

Define the problem: Case History

1. Identify the plant: know what the plant normally looks like when healthy.
2. Examine the plant closely: what **symptoms** and **signs** are present?
3. Soil conditions at the site: pH, nutrients, and drainage/compaction.
4. Neighboring plants: Are they diseased? Are they potential hosts for the same disease?
5. Additional site conditions: sun, shade and wind exposure? Recent construction/landscaping?
6. Status of roots: are the symptoms a manifestation of a root problem? Excavation, if possible.

Define the problem:

Abiotic Agents

1. Age of the plant, condition and resistance/susceptibility.
2. Climate: temperature (extremes), precipitation, wind, winter drying.
3. Soil pH, drainage, compaction (foot traffic, heavy equipment on root zone).
4. Chemical damage from deicing salt (run-off, spray drift), herbicide, natural gas, air pollution, cement, nutrient disorder (deficiency, over-fertilization).
5. Transplanting stress associated with depth, girdling wires, mulch against trunk, transplant shock.
6. Physical damage from mower/string trimmer injury, severed/smashed roots.

Biotic Agents

1. Pathogens (fungi, bacteria, viruses, nematodes, phytoplasmas, parasitic higher plants)
2. Insects (defoliating, wood-boring, piercing/sucking, benign)
3. Animal damage (squirrels, bear, deer, porcupine, moose, etc)