41. Yellows or Chlorosis

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Hosts

All green plants are susceptible to foliage yellowing or chlorosis.

Distribution

Seedling foliage chlorosis occurs throughout the temperate regions of the world.

Damage

The term yellows, or chlorosis, describes a generalized yellowing or bleaching of foliage due to a lack of chlorophyll. The destruction or reduced synthesis of chlorophyll may be caused by any number of biotic or abiotic agents. Chlorosis, for a brief period, may cause slight growth reductions. If chlorosis persists over an extended period of time, however, plant mortality may occur.

Diagnosis

Chlorosis of seedlings may be caused by one or a combination of biotic and abiotic factors, which requires a diagnostic procedure that involves a process of elimination. Look for standing water, insects, heat or cold injury, and fungal disease symptoms. Foliar and soil analysis will aid in pinpointing any nutritional deficiencies, excesses, and problems with soil pH or nematodes.

Biology

A number of factors cause the symptom called yellows or chlorosis. The following list includes some of the factors.

Most Common

1. Nutrient imbalance is a deficiency (or excess) of elements essential to plants such as iron, nitrogen, phosphorus, potassium, and calcium, along with minor elements such as magnesium, manganese, zinc, boron, copper, molybdenum, and sulfur. Nutrient deficiency is generally tied to either high or low soil pH (fig. 41.1). Probably the most common form of chlorosis is called iron chlorosis. Iron chlorosis results when seedlings are unable to obtain iron needed for the production of chlorophyll. In conifers, chlorosis is observed as an overall yellowing of needles. In mild cases, the younger needles are most affected. In more severe cases, the whole plant may become chlorotic. In hardwoods, the primary symptom is interveinal chlorosis (fig. 41.2)—observable as brown spots that develop between the main leaf veins. Iron chlorosis generally begins on the newer growth at the branch tips. If not corrected, the leaves may curl, dry up, and drop off.
2. Adverse environmental conditions or factors that can cause chlorosis include extreme temperatures and either excess or inadequate soil drainage. Cold temperatures, for example, are often associated with pigment synthesis other than chlorophyll, leading to red, purple, or yellow seedlings. Seedling color may return to a normal green when conditions improve as long as these are short-term environmental stresses.
3. Parasitic fungi, bacteria, and nematodes cause root, stem, or foliage disease. These pathogens are commonly associated with chlorotic seedlings. In most cases, roots are destroyed, thereby limiting the seedlings' ability to take up essential elements (fig. 41.3).

Figure 41.1—*Chlorosis caused by nutrient deficiency in a southern pine nursery.* Photo by David B. South, Auburn University.

Figure 41.2—*Interveinal chlorosis of red maple caused by iron deficiency.* Photo by John Ruter, University of Georgia, at http://www.bugwood.org.

Least Common

1. Toxic concentrations of herbicides, fungicides, nematicides, insecticides, and other compounds used in nurseries.
2. Feeding by insects and mites, such as red spider mites on coniferous seedlings.
3. Certain viruses and mycoplasmas that primarily affect hardwood tree species.
4. Genetic abnormalities, which result in the loss of ability to synthesize chlorophyll. Albinism is the most common genetic abnormality associated with chlorotic forest tree seedlings. These seedlings generally do not survive much past the germination phase.
5. Soils high in soluble salts.

Control

Cultural

Adjust soil pH to between 5.0 and 6.0 by either adding lime to raise the pH or ammonium sulfate (or other sulfur compounds) to lower the soil pH. Adjust nutrient deficiencies by applying the required mineral element(s) to the foliage or soil. Reduce the effects of air and soil temperatures by mulching, shading, and irrigating seedbeds. Ensure the nursery beds drain properly to eliminate excess soil water.

Chemical

Root diseases and nematodes can be controlled by soil fumigation prior to sowing. Use deep shank injection of soil fumigants to provide better control of persistent nematode problems. Foliage and stem pathogens can be controlled with fungicidal foliar sprays. Insects and mites can be controlled with insecticides.

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Figure 41.3—*Nematode-induced chlorosis in second year field (left side of photo) adjacent to first year methyl bromide fumigated field (right side of photo).* Photo by Tom Starkey, Auburn University.