Colorado State University Extension

Colorado Master Gardener℠ Program

CMG GardenNotes #112

Diagnosing Tree Disorders

Outline:

Skills Essential to the Diagnostic Process

Judiciously examine the tree – Many homeowners have a difficult time describing their plants and plant problems. For example, the description "leaves are yellow" is so generic that nothing can be diagnosed without more details. When it comes to insects, a typical home gardener says they have "black bugs". What do they mean by "bug"? Are they saying they have a black insect? This is so generic that no diagnosis is possible without additional details.

Read – Part of the diagnostic process is to read, comparing the symptoms and signs of the problems with details in references. Do not simply work from memory.

Referring to multiple books on the same topic gives a better understanding of a pest's description and management situation. In diagnostic work, read for the details rather than general concepts.

Ask questions – Diagnosis requires extensive two-way conversations. Often the horticulturist trying to diagnose the problem has not been on site and has to totally rely on the descriptions of someone else. In this situation, diagnosis is difficult to impossible. Even with good samples or when

visiting the site, questions about the care of the plant, history of the site, and progression of symptoms are needed in the diagnostic process.

Practice – Diagnostics is far more than applying knowledge that can be read in a book. The diagnostic process requires the integration of years of gardening wisdom and knowledge. It is learned by practice.

Patience – Diagnosing plant disorders is a process, not a simple answer to a question. It takes time and patience to work the process. Never jump at an answer just because it seems easy. Never guess. Rather take the time to work the process, asking lots of questions.

In pest management, first diagnose the problem and then discuss management options. Home gardeners often jump to management questions without diagnosing the problem. Because management options are very pest specific, correct diagnosis of the problems must be completed before management can be discussed.

Asking Questions, Gathering Information

Ask questions that create dialogue. For example, *"Tell me how you watered the plant."* Avoid accusatory type questions, (e.g., *"Did you over water the plant?"*)

Some disorders cannot be diagnosed. – We can only complete a diagnosis when detailed information is available. Generic descriptions, like "yellow leaves" or "poor growth" are inadequate descriptions for a diagnosis.

Diagnosis must be done in the context of the tree's environment. – For example, is the tree in a routinely irrigated lawn or in a site with limited irrigation? Does the site have an open area for root spread or is the root system limited by poor soils or hardscape features?

For example, a client called with concerns that her tree looked wilted. Should she water more? After asking questions, it was discovered that the tree is located in a construction site and had most of the root system cut. Understanding the context of the root damage is essential to addressing the watering issue.

Questions asked may not reflect the real issues. – Home gardeners frequently do not know what questions to ask. In the diagnostic process, Colorado Master Gardener volunteers must often help frame questions as well as provide answers. For example, in the previous situation with the tree in the construction site, an important question is the stability of the tree with respect to wind as most of the roots have been cut.

A useful tool in diagnosing trees is visualizing the tree, that is painting a mental picture of the tree and its surroundings. As you paint the picture, ask questions about details. Every detail must be verified. For example, do not paint a nice green lawn in your mental picture until it's verified by asking questions. Painting creates a long list of questions to help discover details needed for diagnosis. Explaining to the client that you are trying to paint a mental picture of their tree encourages them to more patiently provide the needed information.

In working with clients, repeat back in your own words their descriptions. This helps clear up miscommunications about symptoms.

In working with clients, verbally explain how you rule out possible causes. This helps the client move on with you and may clarify miscommunication about symptoms.

As previously stated, diagnosis is not possible when generic symptoms are all we have to work with. Keep in mind that multiple problems will have similar symptoms.

Management should only be addressed AFTER the diagnosis is complete. Because disorders generally arise from a combination of factors, management must look at predisposing factors and inciting factors in the management discussion. For details on predisposing, inciting and contributing factors (the *PIC Cycle*) refer to CMG GardenNotes #101, ***Plant Health Care***).

Steps in the Diagnostic Process

Diagnosis

1. Identify the plant.
2. Identify the problem(s).
   a. LOOK – Define the problem by describing the signs and symptoms.
   b. READ – Refer to reference materials describing similar signs and symptoms.
   c. COMPARE – Determine probable cause(s) through comparison and elimination.

Management

3. Evaluate if management efforts are warranted.
   a. What type of damage/stress does this disorder/pest cause?
   b. Under what situations would management efforts be warranted?
   c. Are management efforts warranted for this situation?
4. Evaluate management options effective for this disorder/pest and when they are applied.

Step 1 – Identify the Plant

There are hundreds of insects and diseases that attack landscape plants any geographic region. Once the plant has been correctly identified, the list of potential insects and diseases that attack the specific plant drops to just a few. Additionally, insects and diseases account for only 20% of landscape plant problems. When working with abiotic disorders, plant identification will be helpful but will not shorten the list of potential possibilities as significantly.

Many gardeners are not familiar with plant materials and need help to correctly identify trees. Identification of a tree is not practical over the phone. The novice gardener cannot give adequate description over the phone for identification. Rather a small branch sample with leaves should be brought to the Extension office.

Step 2 – Identify the Problem(s)

Step 2a – LOOK – Define the Problem by Describing the *Signs* and *Symptoms*.

Take a close look at the plant and surroundings. A detailed description of the problem is essential for diagnosis. In situations where the description is limited or generic in symptoms, diagnosis will be impossible. Many landscape problems cannot be diagnosed! When diagnosing abiotic disorders, systematically evaluating the tree will help organize questions in a discovery process.

Symptoms are changes in the plant's growth or appearance in response to causal factors.

Signs are the presence of the actual organism or direct evidence of the casual factors.

Time development – Knowing the time frame for the development of signs and symptoms is a helpful tool. Did it occur suddenly or over a period of time? Keep in mind that the gardener may not actually know as he or she may not have observed the early development. Symptoms that occur suddenly and do not progress are typical of abiotic disorders. Symptoms that progressively develop are typical of living factors (insects and diseases).

Keep in mind that **multiple problems have similar symptoms**. Let the symptoms lead you to the diagnosis rather than trying to make a diagnosis fit a group of symptoms. Treatment without correct diagnosis is malpractice!

Terminology used to describe common <u>symptoms</u> includes:

- **Blight** – A rapid discoloration and death of twigs, foliage or flowers.
- **Canker** – Dead area on bark or stem, often sunken or raised.
- **Chlorosis** – Yellowing – Chlorosis is so generic that without additional details diagnosis is impossible.
- **Decline** – Progressive decrease in plant vigor.
- **Dieback** – Progressive death of shoot, branch or root starting at the tip.
- **Gall** or **gall-like** – Abnormal localized swelling or enlargement of plant part. It could be caused by insects, mites, diseases, or abiotic disorders.
- **Gummosis** – Exudation of gum or sap.
- **Leaf distortion** – The leaf could be twisted, cupped, rolled, or otherwise deformed.
- **Leaf scorch** – Burning along the leaf margin and into the leaf from the margin.
- **Leaf spot** – A spot or lesion on the leaf.
- **Necrosis** – Dead tissue – Necrotic areas are also so generic that without additional details diagnosis is impossible.
- **Wilt** – General wilting of the plant or plant part.
- **Witches broom** – Abnormal broom-like growth of many weak shoots.

Terminology used to describe <u>signs</u> includes:

- **Fruiting bodies** – Reproductive structures of fungi; could be in the form of mushrooms, puffballs, pycnidia, rusts or conks.
- **Insects** and **mites** are common signs.

- **Mycelium** – A mass of fungal threads (hyphae) on the plant surface.
- **Rhizomorphs** – Shoestring-like fungal threads found under the bark of stressed and dying trees caused by the *Armillaria* fungi. They may glow!
- **Slime flux** or **ooze** – A bacterial discharge that oozes out of the plant tissues, may be gooey or a dried mass.

Examples of abiotic signs includes the following:

- Girdling roots (caused by planting too deep), leads to root starvation.
- Lack of a root flare (sign that the tree was planted too deep with a high potential to develop girdling roots).
- Measuring soil compaction with a penetrometer.
- Bark damage on a trunk from lawn mowers and weed eaters.
- Standing water over rooting zone.
- Plugged drip irrigation system emitters.
- Record of spring time freezing temperatures or severe winter temperatures.
- Hardscape over tree rooting area.
- Soil tests indicating high soil salts.

Define What's Normal Versus Abnormal

It is common for the home gardener to suddenly observe normal characteristics of a tree and mistakenly attribute it to an insect or disease. For example, on evergreens:

- Needle problems and dieback of the new needles at the branch tip are abnormal.
- Yellowing and dropping of older needles from the inside of the tree are normal. The number of years that needles are retained is a factor of plant genetics and stress. Under stress, needles may drop sooner.

Other examples of "normal" occurrences often confused as problems include:

- Fuzz on underside of leaves.
- Male pollen cones on pine or spruce mistaken for insects or disease.
- Less conspicuous fruit, such as juniper berries.
- Mushrooms.
- Bluegrass going to seed.
- Spores on the underside of fern fronds.
- Flowers and fruit on potatoes (potato fruit look like cherry tomatoes).
- Tomatoes dropping blossoms after a cool night.
- Male squash blossoms not producing fruit.
- June drop of apples and other fruit.
- Aerial roots on tomatoes and corn
- Seed stalk on rhubarb and onions.

Step 2b – READ – Refer to Reference Materials Describing Similar Signs and Symptoms.

The reading will often send you back to the tree to look for more details.

A key in the back of the CSU Extension publication ***Insects and Diseases of Woody Plants*** makes this step easy for diagnosing insects and diseases of landscape trees and shrubs. The key is very good for most insects and fair for diseases (diseases are hard to describe in a few words). It does NOT include abiotic disorders.

Step 2c – COMPARE – Determine Probable Cause(s) Through Comparison and Elimination.

When the description of the disorder matches the details in the reference materials, diagnosis is complete. It requires careful reading of fine details. When things do not match up, backup. Is the plant correctly identified? Work through the process again paying attention to details missed.

Keep in mind that multiple problems have similar symptoms. Let the process guide you through the diagnosis rather than trying to match symptoms to fit a diagnosis.

Insects on trees are fairly easy to diagnose with the book *Insects and Diseases of Woody Plants.* Diseases are more difficult; and only a few tree diseases are common in Colorado. This book does not include abiotic disorders.

Abiotic disorders are generally difficult, if not impossible, to diagnose. A systematic evaluation of the tree will be helpful for diagnosing abiotic disorders. Abiotic disorders occur in 80% of the samples diagnosed by CSU Extension and often predispose the tree to insects and diseases.

Step 3 – Evaluate If Management Efforts Are Warranted?

Step 3a – What Type of Damage/Stress Does This Disorder/Pest Cause?

The primary question here is to determine if the disorder/pest is only cosmetic, if it adds stress to the tree or if it is potentially life threatening. This may depend, in part, on the general health of the tree before the disorder/pest started.

Step 3b – Under What Situations Would Management Efforts be Warranted?

On healthy stress free trees, most insect and disease problems are only cosmetic. However, trees under stress are much less tolerant of additional stress factors.

For example, aphids on shade trees are generally only cosmetic and normally do not warrant management efforts, unless they become a nuisance (like dripping honeydew on the car or patio table). However, under a water stress situation (due to drought, non-irrigated site, limited rooting spread or non-established newly planted tree) aphid feeding adds to the water needs of the tree creating a potentially serious stress issue. With water stress, mechanical (hosing off the tree with water), bionaturals (adding beneficials to feed on the aphids) or insecticidal management efforts would be warranted to protect the tree.

As a rule-of-thumb for leaf chewing insects, healthy trees can tolerate the loss of 1/3 of the total leaving surface before stress becomes a management issue. Tolerance is much less for trees with growth limiting factors such as poor soil tilth, limited rooting space, dry non-irrigated sites, previous defoliation, etc.

Predicting the potential population for caterpillars or sawfly larvae is difficult to impossible. Generally speaking, populations rarely remove more than 1/3 of the leafing area. However, outbreaks of some pests could leave the tree leafless.

Evergreens are much less tolerant because the needles last for multiple years. For example, a sawfly larva outbreak that takes off all the new needles would have an influence over multiple years; this would bring a healthy tree to a threshold where management would be warranted.

Step 3c – Are Management Efforts Warranted For This Situation?

The bottom line in Step 3 is to determine if management efforts are warranted for this situation. In other word, does the gardener need to do something about this situation? The answer needs to be focused on the specifics of this situation rather than generic considerations.

Step 4 – Evaluate Management Options Effective for This Disorder/Pest.

Management options may take many forms or directions. For example, on some insect pests, hosing off the tree with a strong force of water may be an effective mechanical option. In other situations an insecticide may be needed.

Management efforts may take the approach of dealing with soil issues, such as lawn aeration to reduce soil compaction around a tree.

Other management efforts may go in the direction of irrigating a dry site during hot dry weather or reducing the over-watering with better irrigation system design and management.

Management options include far more than just spraying an organic insecticide. On landscape trees, only four percent of the insect problems warrant insecticides.

Timing of management efforts is another important consideration. Often the effective spray window is past before the pest is observed.

Pesticide Use Questions

Note: The term “pesticide” is a generic term that includes *insecticides* (used for insect management), *fungicides* and *bactericides* (used for disease management), *herbicides* (used to control weeds), etc.

When pesticides are a management option, answer these important questions to guide pesticide application.

1. What pesticides are effective on this pest? (Refer to Extension fact sheets.)
2. Which have minimal health risks? (Refer to the pesticide label.)

3. Which have minimal environmental risks for the site? (Refer to the pesticide label.)
4. When are they applied to be effective? (Refer to Extension fact sheets.)
5. How are they applied to minimize health and environmental hazards? (Refer to the pesticide label.)
6. What is the re-entry period and the application-to-harvest interval following application? (Refer to the pesticide label.)

Answers to these questions often indicate that a pesticide is not warranted at the point in time. Only 4% of landscape pest problems warrant the use of pesticides.

Steps to Systematically Evaluate a Tree

In diagnostics, it is often important to systematically evaluate the entire tree as part of the diagnostic process (Step 2a). Professional arborists use a formal process in tree evaluation.

1. **Macro-look at tree –** Walk completely around the tree looking for things that stand out. These may be clues for other steps. For example, decline from the top down is typical of root problems and/or drought. Give extra attention to the soil and roots in step 3.

2. **Macro-look at surroundings** – Insects and diseases are often host specific. If symptoms are found on a variety of plants, it suggests abiotic disorders. Abiotic problems (like soil compaction) may also affect surrounding plants. How is the lawn under the tree doing? It shares the same soil problems.

3. **Soil and rooting area** – Soil problems contribute to 80% of the problems in the landscape. While we cannot see the root system, other clues will help evaluate the root system. For additional details on diagnosing soil/rooting problems of trees, refer to CMG GardenNotes #113, *Diagnosing Root and Soil Disorders of Landscape Trees*. Examples of things to look for include the following::

    - How is the lawn doing? It shares the same soil growth-limiting factors.
    - Push a screwdriver into the soil. How easy or hard it is to push into a moist soil provides an estimation of soil compaction.
    - With a soil probe, take some cores from the rooting area. It may indicate issues with soil texture changes and rooting.
    - Surface roots indicate soil compaction and/or wet soils, as the roots develop closer to the surface where oxygen is available.
    - The lack of a root flare suggests that the tree was planted too deeply or that soil was added over the rooting area (smothering the fine feeder roots). Planting too deep causes trunk girdling roots.
    - Trunk girdling (circling) roots is the most common cause of death in landscape trees. Trees often show a gradual decline from the trunk girdling roots 12-20 years after planting. The girdling root may be below the surface.
    - Decline of the tree from the top down or a uniform decline of the entire tree suggests root/soil problems.

4. **Trunk** – Things to look for include the following:

    - Cankers that go into the ground are always actively growing.
    - "Lawn mower decline" (bark damage at ground level from lawn mowers and weed trimmers) is common in many landscapes. If the bark is removed down to the wood on more than 50% around the tree, the tree is considered to have no value.
    - Look for evidence of decay in large size pruning cuts. A drum-like hollow sound when the trunk is tapped with a wood mallet is a symptom of extensive internal decay.
    - Ridges and valleys along the trunk are symptoms of internal problems and decay.
    - Borer exit holes indicate stress issues.

5. **Major branches** (scaffold branches or secondary trunks) – Things to look for include the following:

    - Cankers
    - Large pruning cuts and evidence of storm damage (suggest the possibility of internal decay)
    - Borer exit holes indicate stress issues.

6. **Minor branches and limbs** –

    An important part of the evaluation is to get an assessment of the tree growth and vigor by comparing the annual growth increments of the twigs. (figure 1) Starting at the branch tip, look at the length back to the first ***annual growth ring*** (*terminal bud scare*). This is where the growth ended the previous year. The annual growth ring looks like a small ring or crown going completely around the twig. On some trees it is easy to identify, on other trees it is only a simple ring. To avoid confusing it with a side bud, the annual growth ring goes completely around the twig. On some trees, a slight change in bark color helps identify where the annual growth rings are located. [Figure 1]

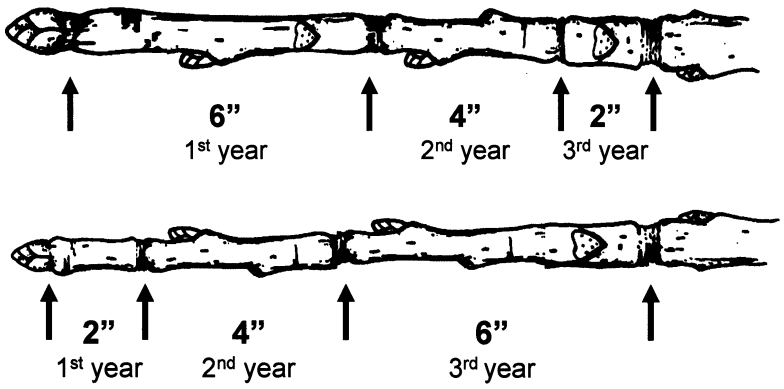

Figure 1 – Comparison of Annual Growth

- Twig on top shows a decrease in stress levels as grows increases from 2 inches to 4 inches to 6 inches in current year.
- Twig on bottom shows an increase in stress levels as growth cuts from 6 inches to 4 inches to 2 inches in current year.

In evaluation, look at several branches around the tree. Going back three to five years, determine what is typical for each year, not what is longest or shortest. Is the annual growth what would be expected for that species of tree? For example, a young honeylocust tree in an open lawn could readily put on 18 to over 24 inches per year. The same tree where buildings and hardscape features limit root spread may put on only 6 to 12 inches per year. This reduced growth is in response to the restrictions in rooting.

Another important comparison is the change from year to year. For example, if the length of annual growth is shortening each year, it indicates that the stress levels are increasing. On newly planted trees, twig growth will be minimal until the root system establishes. A significant increase in annual twig growth indicates that the root system has established.

On mature trees, growth will naturally be reduced and must be evaluated by looking at the growth near the top rather than the bottom of the tree.

Evaluating annual growth help interrupt the effects of other problems (like soil/root issues) observed in previous steps.

Other things to look for include scale and other twig insects, borer exit holes (indicate stress issues), cankers, and galls.

7. **Foliage** – Things to look for include the following:

   - Leaf color and size.
   - Leaf spots and other foliage diseases – Typically more serious on the lower inner foliage where humidity is higher.
   - Leaf chewing insects, sucking insects, mites and galls.
   - Leaf scorch and dieback from the top down are generic symptoms of root problems and/or drought.
   - Leaf scorch on a specific side suggests abiotic disorders coming from that side.
   - Early fall color is a generic symptom of stress.

Authors: David Whiting (CSU Extension, retired) and Carol O'Meara (CSU Extension). Artwork by David Whiting; used by permission.

- Colorado Master Gardener *GardenNotes* are available online at www.cmg.colostate.edu.
- Colorado Master Gardener training is made possible, in part, by a grant from the *Colorado Garden Show, Inc.*
- Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating.
- Extension programs are available to all without discrimination.
- No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

Revised October 2014