Colorado Master Gardener[sm] *Program*
Colorado Gardener Certificate Training
Colorado State University Extension

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 homeowner 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. No one can remember it all.

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 patients 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. Homeowners 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.

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 – Distinguish between possible causes by comparing signs and symptoms with details in reference information.
   c. COMPARE – Determine probable cause(s) through comparison and elimination.

Management

3. Evaluate damage/stress potential
   a. What type of damage/stress does this disorder/pest cause?
   b. Under what situations would management efforts be warranted?
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 in Colorado. 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.

Many gardeners are not familiar with plant materials and need help to correctly identify trees.

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 we can't work with the details, diagnosis cannot be complete. Many landscape problems can't be diagnosed!

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.

Terminology used to describe common symptoms include:

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 signs include:

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.

Define what's normal versus abnormal

It's common for homeowners 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" often confused as problems include:

- Fuzz on underside of leaves
- Male pollen cones on pine or spruce are 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
- June drop of apples and other fruit
- Aerial roots on tomatoes
- Seed stalk on rhubarb and onions

Step 2b – READ – Distinguish between possible causes by comparing the *signs* and *symptoms* observed with descriptions in reference materials.

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. 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 don't match, backup. Is the plant correctly identified? Work through the process again paying attention to details missed.

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 damage/stress potential

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 don't 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 a caterpillar or sawfly larva 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 since the needles last for multiple years. For example, a sawfly larva outbreak that takes off all the new needles would have an impact over multiple years; this would bring a healthy tree to a threshold where management would have been warranted.

Step 4 – Evaluate management <u>options</u> 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.

Steps to Systematically Evaluate a Tree

In diagnostics, it's 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's 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 can't see the root system, other clues will help evaluate the root system. Examples of things to look for include:

- 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 accounts for 57% of the landscape tree deaths! 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:

    - 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:

    - 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.

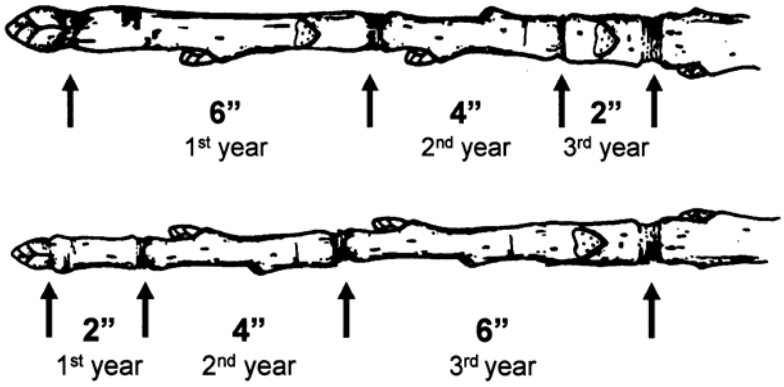

Figure 1 – Comparison of Annual Growth

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

In evaluation, look at several branches around the tree. Going back three to five years, determine what's typical for each year, not what's 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 impact 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
- Galls

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

- 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
- Leaf sucking insects and mites
- 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.

Asking Questions, Gathering Information

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

Diagnosis must be done in the context of the tree's environment. – For example, is the tree in a routinely watered 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. – Homeowners frequently don't know what questions to ask. In the diagnostic process, CMG volunteers must often help frame questions as well as provide answers. For example, in the situation above with the tree in the construction site, an important question is the stability of the tree with respect to wind since 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,

don't 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.

Management should only be addressed AFTER the diagnosis is complete. Since 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 #111, ***Plant Health Care***).

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