



MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #102

Diagnosing Plant Disorders

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Skills Essential to the Diagnostic Process

Judiciously examine the plant – Many gardeners have a difficult time describing their plants and plant problems. For example, the description “leaves are yellow” is so general that nothing can be diagnosed without more details. A typical home gardener may say they have “black bugs”. What do they mean by “bug”? Are they saying they have a black insect? More details are needed to diagnose the problem.

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 or other references on the same topic gives a better understanding of a pests’ description and management situation. In diagnostic work, read for the details.

Ask questions – Diagnosis requires extensive two-way conversations. Often the person 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, knowledge and 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. Don't guess. Take the time to work the process, asking lots of questions.

In pest management, first diagnose the problem and then discuss management options. Because management options are very pest specific, correct diagnosis of the problems must be completed before management can be discussed.

Asking Questions and 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. Descriptions, like “yellow leaves” or “poor growth” are inadequate descriptions for a diagnosis.

Diagnosis must be done in the context of the plant's environment. – For example, is a 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 calls with concerns that her tree looks wilted. Should she water more? After asking questions, it is 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. - 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 plant, that is creating a mental picture of it and its surroundings. As you create the picture, ask questions about details. Verify the details. Explain to the client that you are trying to create a mental picture of their plant problem will encourage them to more patiently provide the needed information.

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

When 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.

Diagnosis is not possible when general symptoms are all we have to work with. Keep in mind that multiple problems can 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 discussion. For details on predisposing, inciting and contributing factors (the *PIC Cycle*) refer to CMG GardenNotes #101, *IPM: Plant Health Care*.

Steps in the Diagnostic Process

Part A: Diagnosis

1. Identify the plant.
2. Identify the problem(s).
 - a. LOOK – look at the big picture – the site the affected plant is growing in.
 - b. LOOK at the plant itself including leaves, flowers, fruit, twigs, branches and trunk.
 - c. LOOK for symptoms and signs.
 - d. DEFINE the problem by describing the symptoms and signs.
 - d. OBSERVE the turf or soil the plant is growing in. Is it difficult to push a screwdriver into the turf or soil?
 - e. ASK questions
 - f. READ – Refer to reference materials describing similar signs and symptoms.
 - g. COMPARE – Determine probable cause(s) through comparison and elimination.

Part B: 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 be warranted?
 - c. Is management warranted in *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 plants in 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 a small percent 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 them. Identification is not practical over the phone. A branch sample with leaves attached should be brought to the Extension office or good photographs

should be sent to the diagnostician.(It's really best to see a sample.)

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 symptoms are too general, diagnosis will be impossible. When diagnosing abiotic disorders, systematically evaluating a plant will help organize questions.

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.

Terminology used to describe common symptoms includes:

- **Blight** – A rapid discoloration and death of twigs, foliage or flowers.
- **Canker** – Dead area on bark or stem, often sunken and discolored.
- **Chlorosis** – Yellowing.
- **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** – Browning along the leaf margin and into the leaf from the margin.
- **Leaf spot** – A spot or lesion on the leaf.
- **Necrosis** – Dead tissue – additional details are needed.
- **Wilt** – General wilting of the plant or plant part.
- **Witches broom** – Abnormal broom-like growth of many weak shoots.

Terminology used to describe signs includes:

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

- **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 (non-living) 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).
- 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 Is 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 in the fall. The number of years that needles are retained is a factor of plant genetics and stress. Under stressful conditions, 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 plant to look for more details.

A key in the back of the CSU Extension publication *Insects and Diseases of Woody Plants* makes this step easier for diagnosing insects and diseases of landscape trees and shrubs. Many common abiotic problems are also included.

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, back up. Is the plant correctly identified? Work through the process again paying attention to details missed.

Let the process guide you through the diagnosis rather than trying to match symptoms to fit a diagnosis.

Abiotic disorders are generally difficult to diagnose. A systematic evaluation of a plant will be helpful in diagnosing abiotic disorders. Abiotic disorders occur in about 80% of the samples diagnosed by CSU Extension and often predispose the plant 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 a plant or if it is potentially life threatening. This may depend, in part, on the overall health of the plant before the disorder/pest started.

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

Many insect and disease problems are only cosmetic on healthy, stress-free plants. However, stressed plants are much less tolerant.

For example, aphids feeding on shade trees are generally only cosmetic and normally do not warrant management efforts unless they become a nuisance (like dripping honeydew on a car or patio table). However, under water stress, aphid feeding increases the water needs of the tree creating a potentially serious stress issue. In this situation, 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 leafing surface before stress becomes a management issue. Tolerance is much less for trees with growth limiting factors.

Evergreens are much less tolerant because the needles last for multiple years. For example, a sawfly larva outbreak that removes 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*. The answer needs to be focused on the *specifics of this situation*.

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

Management options may take many forms or directions. For example, hosing off a plant with a strong force of water may be an effective mechanical option for some insect pests. 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 over-watering with better irrigation system design and management.

Management options include far more than just spraying an insecticide. Only four percent of the insect problems on landscape trees 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

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 may indicate that a pesticide may or may not be warranted at the point in time.

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