



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 consult peer-reviewed references, comparing the symptoms and signs of plant 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 pest or disease’s description and its management options. 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 must rely on the descriptions of someone else. In this situation, diagnosis can be difficult or impossible. Even with good samples or when visiting the site, information about the care of the plant, history of the site, and progression of symptoms is valuable for the diagnostic process.

Practice. The diagnostic process requires the integration of observation, gardening experience, and scientific information. While reference information is necessary for diagnosing plant diseases and pests, practical knowledge and horticulture experience are important tools.

Patience. Diagnosing plant disorders is a process and is usually not a simple answer to a question. It takes time and patience. Never jump at an answer just because it seems easy. Do not 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 can be very pest specific, the correct diagnosis of the problem 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 overwater 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. Obtain as much information as you can.

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 a tree looks wilted. Should the tree be watered 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 why most of the roots have been cut.

A useful tool in diagnosis is visualizing the plant. Create a mental picture of it and its surroundings. As you create the picture, ask questions about details. Verify the details. Explain to clients that you are trying to create a mental picture of their plant problem; this will encourage them to provide the needed information more patiently. When possible, ask the client to provide photographs.

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 the only ones with which we have to work. 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 may focus in more than one area, or where the client does not expect.

Steps in the Diagnostic Process

Step 1: Diagnosis – Identify the Plant

Hundreds of pests and diseases that attack plants can be found in any geographic region. Once the host plant has been correctly identified, the list of potential insects and diseases is

substantially shortened. When working with abiotic disorders, plant identification will still be helpful but will not shorten the list of potential possibilities 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 is really best to see a sample.) For ornamental grasses and flowering plants, samples with as many plant parts as possible (stems, roots, leaves, and especially flowers and/or fruits) are most helpful. If asking for photographs, remember to ask for both “wide shots” of the whole plant with its surroundings as well as close-ups of the symptoms and/or signs.

Step 2: Diagnosis – 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. Systematically evaluating a plant will help organize questions.

- **Symptoms** are changes in the plant’s growth or appearance in response to causal factors, for example, leaf cupping, wilting, or galls.
- **Signs** are the presence of the causal organism or direct evidence of the causal factors, for example, frass, mycelium, or insects.

Time development. Knowing the time frame for the development of signs and symptoms is a helpful tool. Did damage occur suddenly or over a period of time? Keep in mind that the gardener may not actually know as early development may not have been noticed. Symptoms that occur suddenly and do not progress, or are across several plant species, are typical of abiotic disorders. Symptoms that develop progressively, are not uniformly distributed on the plant, and affect only one or a few related plant species are typical of biotic factors (pests 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 include:

- **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.
- **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.

- **Wilt** – General drooping of the plant or plant part caused by loss of turgor pressure within the plant.
- **Witch’s broom** – Dense twiggy growth originating at or near a single point of woody plants.

Terminology used to describe signs include:

- **Bacterial streaming** – A cloudy discharge from cut plant parts when submerged in (usually distilled) water.
- **Fruiting bodies** – Reproductive structures of fungi; could be in the form of mushrooms, pycnidia, rusts, or conks.
- **Hypha (pl Hyphae)** – A branching filament of fungal tissue; the basic fungal unit.
- **Mycelium (pl Mycelia)** – A mass of fungal threads (hyphae).
- **Rhizomorphs** – Root-like fungal threads found under the bark of stressed and dying trees caused by *Armillaria* fungi.
- **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 include 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 springtime freezing temperatures or severe winter temperatures.
- Hardscape over tree rooting area.
- Soil tests indicate high soil salts.

Define What Is Normal Versus Abnormal

It is common for the home gardener to suddenly observe normal characteristics of a plant 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.

Other examples of “normal” occurrences often mistaken for problems include:

- Fuzz on underside of leaves.
- Variegated leaves.
- Male pollen cones on pine or spruce.
- Inconspicuous fruit, such as juniper berries.
- Mushrooms.
- Bluegrass going to seed.
- Spores on the underside of fern fronds.
- Flowers and fruit on potatoes.
- 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.

While these examples may seem straightforward enough, remember that not all diagnosis of “normal” is so simple. For example, while yellowing and dropping needles from the interior of a conifer is normal in the fall, it can still be a sign of plant problems. Under stressful conditions or as a result of diseases like needle-casts or Cytospora canker, older needles may drop sooner than normal. Do not assume normality; careful, open-minded observation is key.

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

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

Resources from other parts of the country or world should be used only with the recognition that they may not be completely relevant in Colorado. Try to find comprehensive resources that include regional occurrences for pests and disease or that are regionally organized.

References from Cooperative Extension, the USDA, and the American Phytopathological Society are often available in Extension offices.

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 may be 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. Some problems can only be confirmed in a diagnostic laboratory, so be sure to report to clients only what you know, not what you assume. For example, “Based on what you described and what I can see, these symptoms are consistent with Fire Blight. A laboratory test would be needed to confirm this diagnosis.”

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 often predispose plants to insects and disease problems. In these cases, diagnosing the underlying abiotic stress is just as important as diagnosing the more obvious insect or disease issue.

Step 3: Management – 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, or if it is potentially life-threatening to the plant. This may depend, in part, on the overall health of the plant before the problem starts.

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 resilient.

For example, aphids feeding on shade trees 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 can create a potentially serious stress issue. In this situation, cultural (watering the tree), mechanical (hosing off the aphids with a strong jet of water), biological (adding beneficials to feed on the aphids) or insecticidal management efforts could be warranted to protect the tree.

As a rule of thumb, healthy deciduous trees can tolerate the loss of one-third 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 of defoliation because the needles last for multiple years. For example, a sawfly 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**; the individual plant, what the client will accept aesthetically or otherwise, and what treatment options are available.

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

Management options may take many forms or directions. For pest and disease issues to persist, the pest or pathogen must be present along with susceptible host plants and conditions favorable for disease/pest development. Management could be directed at the pest, the host, or the conditions, or at a combination of two or all three. Management recommendations should be considered in the context of an Integrated Pest Management Plan, discussed in more detail in GardenNotes 101, *IPM and Plant Health Care*.

Ultimately, the client will make the decision of what control options to apply on their property. Strive to provide an accurate diagnosis and, whenever possible, suggest several science-backed solutions as options from which to choose.

Pesticide Use Questions

When pesticides are a management option, encourage clients to answer these important questions below to guide pesticide application. Remember that pesticide use must be in strict accordance with the label instructions, which represent a contract between the purchaser and the product manufacturer. Tell clients to read the label and follow the directions explicitly; **the label is the law**.

- Which pesticides have the lowest **risks of exposure** to the user or others? (Refer to the pesticide label.)
- Which have the lowest **health hazards**? (Refer to the pesticide label and signal words.)
- Which have minimal **environmental risks** for the site? (Refer to the pesticide label.)
- When are they applied to be effective? (Refer to the pesticide label and Extension Fact Sheets.)
- How are they applied and is specialized equipment needed? (Refer to the pesticide label.)

- What is the re-entry period and the application-to-harvest interval following application? (Refer to the pesticide label.)

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