MASTER GARDENER
COLORADO STATE UNIVERSITY
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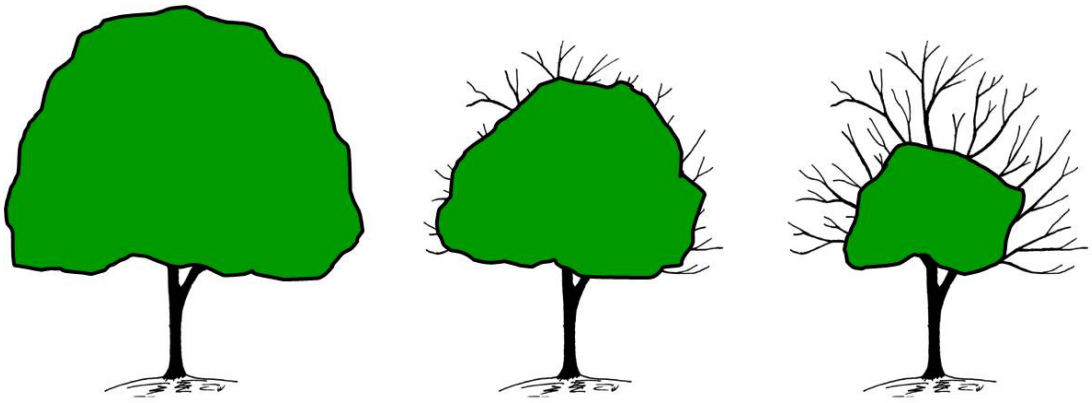

Integrated Pest Management and The Diagnostic Process

References

Books

- ***Abiotic Disorders of Landscape Plants: A Diagnostic Guide***. University of California Agriculture and Natural Resources Publication 3420. 2004. ISBN: 1-879906-58-9
- ***Aspen: A Guide to Common Problems in Colorado***. Colorado State University Extension Publication 559A. 1996. – $5.00 (color)
- ***Insects and Diseases of Woody Plants of the Central Rockies.*** Colorado State University Cooperative Extension Bulletin 506A. 2014.
- ***Plant Health Care for Woody Ornamentals***. University of Illinois Cooperative Extension. 1997. ISBN: 1-883097-17-7

PHC and Diagnosing Plant Disorders curriculum developed by David Whiting (CSU Extension, retired) and Carol O'Meara (Colorado State University Extension). Revised by Mary Small, CSU Extension

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Class Objectives

CMG volunteers approach diagnostic situations as a process. At the end of class, the student will be able to:

- Describe concepts of *Plant Health Care, PHC,* (IPM as it applies to landscape management)
- Outline the life cycle of trees and describe how tree needs changes with stages in the life cycle
- List steps in the diagnostic process
- Using the diagnostic process, diagnose routine insect and disease problems of trees

Review Questions

Plant Health Care and the Diagnostic Process

1. Define IPM and PHC.

2. Describe concepts central to PHC.

3. Give examples of common PHC tools used in home gardening.

4. What is the PIC cycle? What does it explain about tree care and pest problems?

5. In diagnosing *contributing* disorders, why is it important to also identify the *predisposing* and *inciting* factors to the extent possible?

6. List the four steps, with substeps in the diagnostic process.

7. Give examples of living factors that cause plant problems. Give examples of non-living (abiotic) factors that cause plant problems.

8. Why is it important to correctly identify the plant?

9. Define *symptom* and *sign*. Give examples of each.

10. Define the following terms:

    a. Chlorosis
    b. Blight
    c. Dieback
    d. Decline
    f. Leaf spot
    g. Leaf scorch
    h. Canker
    i. Gall
    j. Fruiting bodies
    k. Mycelium
    l. Slime flux

11. Explain why it is important to define what is normal versus abnormal about a plant problem.

12. List the five growth phases, giving growth objectives for each. What indicates that trees have changed their phase?

13. Why is it important to talk about tree care issues as they relate to growth phases?

14. If the average length of annual growth of twigs changes from 8 inches (4 years ago), 1 inch (3 years), 2 inches (2 years) and 1 inch (1 year), what does it suggest about the tree's vigor? What if the growth changes from 6 inches (4 years) 1 inch (3 years), 2 inches (2 years) and 3 inches (1 year)?

Diagnosing Tree Disorders class

1. Describe essential skills used in the diagnostic process.

2. Explain how knowing the context of the situation helps in diagnosing the disorder.

3. Explain how painting a mental picture of a plant problem helps in diagnosing a disorder.

4. Explain how repeating back the details in your own words helps in diagnosing a disorder.

5. Explain how to tactfully change directions when the evidence leads down another road.

6. Why is it important to discuss management options only after the problems have been diagnosed?

7. List the four steps, with substeps in the diagnostic process.

8. List steps for systematically evaluating a tree.

9. In the landscape setting, what is the universal limiting factor for root growth?

10. What percentage of landscape plant problems relate to root/soil/water (underground) issues?

11. Describe the typical rooting system of a tree. Describe location and function of the following root types:

    - Root plate or zone of rapid taper
    - Transport roots
    - Feeder roots
    - Sinker roots
    - Tap root

12. What two factors play into the rooting depth and spread?

13. What is the typical depth and spread of tree roots? How does this change for compacted/clayey soils?

14. Explain how to calculate the *Critical Rooting Radius* and *Tree Protection Zone (Protected Root Zone)*.

15. Describe how potential rooting spread impacts tree growth and vigor. What happens when a tree's root system cannot spread as needed?

16. Describe techniques to evaluate soil/root disorders and soil compaction.

17. Describe worthwhile techniques to reduce soil compaction around trees. Explain why questionable techniques to reduce soil compaction are out of favor.

18. What single factor accounts for the most deaths of landscape trees? What causes trunk-girding roots? How long after planting can trunk-girdling root develop? What can be done for a tree with trunk girdling roots?

19. Describe how a tree balances root growth with canopy growth.

20. In pest management, what are *bionaturals*? What is *preservation* and *importation* of bionataurals? Why don't we import more bionaturals?

21. List the PHC questions for using pesticides.

22. Based on actual records from landscape management, what percentage of pest problems warrant the use of a pesticide?

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CMG GardenNotes #101

IPM and Plant Health Care

Outline:

Gardening and the Environment

Yard care and gardening practices may have positive or negative influences on health and the neighborhood environment. For example, turf enhances the environment by:

- Converting carbon dioxide to oxygen.
- Increasing water infiltration into the soil.
- Reducing surface runoff and erosion.
- Reducing dust.
- Providing a micro-ecosystem that effectively breaks down pollutants.
- Moderating summer temperatures.
- Creating a pleasant "people" space.

On the other hand, lawn care practices negatively affect the environment when grass clippings are mowed or blown onto the street (water quality problem), when fertilizers are over-spread onto hard surfaces, and when the unwarranted use of pesticides occurs.

Several terms (such as *Integrated Pest Management, Plant Health Care, Sustainable Farming/Gardening, Best Management Practices* and O*rganic Gardening*) are used to describe farming/garden management systems designed to help farmers/gardeners maximize positive effects and minimize negative effects. In this class, we will focus on *Integrated Pest Management* with *Plant Health Care* mixed in.

Integrated Pest Management, IPM

Integrated Pest Management, IPM, is a multi-prong approach to pest management. IPM incorporates a variety of management strategies including cultural, mechanical, biological and chemical methods. Objectives include minimizing pest damage and health and environmental hazards while maintaining profitability and/or aesthetics.

Because insect and disease problems vary significantly from crop to crop, application of IPM principles is also often crop specific. IPM techniques used in an alfalfa field (perennial crop), a wheat field (annual crop), an apple orchard (perennial crop with minimal tolerance for pest damage) and the landscape (site with multiple plant species and higher tolerance to pests) will be vastly different.

IPM Strategies

Plant Health Care, PHC

The term ***Plant Health Care, PHC***, was coined by the *International Society of Arboriculture* to define IPM techniques as they apply to tree care and landscape maintenance. You will often find the two terms (IPM and PHC) used interchangeably.

PHC, like IPM, is a holistic approach, but specifically to tree and landscape management. The primary objective is to grow healthy plants and minimize the effects of pests in so doing. Concepts of PHC include the following:

- **Healthy plants have fewer pests.** – Many insect and disease problems only attack stressed plants. Minimizing stress prevents many common pests. For example, Cytospora canker fungus and most borers only attack stressed trees (from factors such as soil compaction, drought, root damage and drought).

- **Healthy plants are more tolerant of pests.** – For example, aphids on shade trees generally do not warrant management efforts. An important exception is that trees that are water stressed (dry soils, non-established root systems, limited root spread, etc.) are intolerant of aphid feeding.

- **Life cycle: Plant needs change with stages in their life cycle.** – A plant's needs for irrigation, fertilizer, pruning, tolerance to pests, etc. continually change through the growth cycles of the plant.

- **PIC cycle: Problems arise from a combination of stress factors.** – For example, over-maturity of forests coupled with drought leads to bark beetles in Western pine forests. Soil compaction, drought and restricted rooting can lead to Cytospora canker disease.

The PIC Cycle

A basic principle of PHC is recognition that plant problems generally arise from a combination of stress factors. This concept is called the ***PIC cycle.***

Predisposing factors reduce a plant's tolerance to stress. These factors should be considered in plant selection. Examples of predisposing factors include:

- Planting trees in a site where root spread will be restricted due to soil compaction or hardscape features.
- Planting trees intolerant of wet soils (like crabapples) in heavily irrigated lawns (leads to root rots).
- Planting trees susceptible to iron chlorosis in soils with *free lime*.
- Failure to structurally train young trees (predisposing trees to storm damage).

Inciting factors include primary insect, disease, and abiotic disorders that attack healthy plants, causing acute stress. Examples include:

- Soil compaction, the most common stress factor leading to many insect and disease problems.
- Planting trees too deep (leads to trunk girdling roots).
- Drought.
- Leaf chewing insects, such as caterpillars and sawfly larva.
- Leaf sucking insects, such as aphids and leafhoppers.
- Bark damage from lawn mowers.
- Bark cankers and frost cracks from rapid winter temperature changes coupled with winter drought.

Contributing factors include secondary insect, disease, and abiotic disorders that attack plants already stressed. They often lead to the plant's death and frequently cannot be controlled. Examples include:

- Bark beetles and borers (secondary to soil compaction, drought, and wind damage).
- Cytospora fungus (secondary to soil compaction, drought, and restricted rooting system).
- Trunk girdling roots caused by planting too deep.

Management of contributing factors typically needs to be directed at the predisposing and inciting factors that stress the plant.

IPM Techniques

Examples of techniques used include the following:

- **Plant selection: *right plant, right place*** – Select plants to minimize future stress issues for the site.

- **Soils management** – Many landscape plant problems relate to soil conditions.

    - Manage soil compaction (low soil oxygen and poor drainage)
    - Manage soil drainage
    - Improve soil tilth with routine applications of organic matter
    - Nutrient (fertilizer) management

- **Water and irrigation management**

    - Water plants appropriately - the water requirement for plants to survive compared to the water needed for plant growth may be vastly different.
    - Use plant tolerance to wet or dry conditions in water management
    - Chronic, springtime overwatering often causes or contributes to the development of iron chlorosis symptoms.

- **Cultural care**

    - Plant at appropriate time
    - Use varieties with resistance to common pests
    - Use a diversity of plants
    - Plant appropriately for good spacing and air flow
    - Consider plant's potential exposure to sun and wind
    - Use mulch
    - Prune appropriately

- **Weather influence on plant growth and pest potential**

    - Consider both high and low temperatures
    - Consider wind and rain effects
    - Consider timing of insect activity

- **Mechanical methods to manage pests**

    - Covers and barriers
    - Traps

- **Bionaturals for managing pests** – Use of predators, parasites, disease organisms, and beneficial nematodes

    - ***Preservation*** is taking steps to encourage naturally occurring predators and parasites.
    - ***Importation*** is the purchase and release of predators and parasites

- **Pesticides –** if selected, use the appropriate pesticide to manage the problem at the correct rate and at the correct time of year.

Pest Management Questions

As part of IPM/PHC, ask the following questions to guide pest management:

1. **What is the plant?** Correctly identifying the plant will shorten the list of potential insects, diseases, and abiotic disorders.

2. **What is the disorder/pest?** Correctly identifying the disorder/pest will guide effective management options. Gardeners often fail to control pests because they have misidentified the problems and are applying ineffective management techniques.

3. **What type of damage/stress does it cause?** In the landscape setting, most insect and disease problems are only cosmetic and may not warrant management efforts. To protect plant health, management may be needed on some pests. Fruits and vegetables typically have low tolerance to insects and diseases.

4. **Under what situations will management efforts be warranted?**

   In production agriculture, ***economic thresholds*** determine how much damage can be tolerated before it becomes economically feasible to treat. For example, this may be determined by counting the number of insects per leaf, the number of insects in a square foot of soil, or the percent of leaves infected.

   In landscape horticulture, ***aesthetic thresholds*** characterize a relative level of cosmetic damage that can be tolerated before treatment is warranted. This threshold will vary considerably from individual to individual and from location to location.

   Spider mites are an example of a common pest generally kept in bounds by nature. However management efforts may be warranted in situations where mite populations flare up due to hot weather, drought, dust on plants (interferes with activity of beneficials) or the use of some insecticides including imidacloprid (Merit) and carbaryl (Sevin).

5. **What management options are effective on the disorder/pest and when are they applied?**

   - Weather – While we cannot control the weather, it directly influences the occurrence of many insects and diseases
   - Cultural – Such as watering more or less

- Mechanical – Such as washing down the plant with a forceful stream of water to wash off pests
- Bionaturals – Use of beneficial predators and parasites
- Pesticides – Many types

Life Cycle of a Plant

A key concept in PHC includes recognizing that plant care changes with various stages of growth. Failure to relate cultural practices to the life cycle often leads to reduced growth and confusion about appropriate cultural practices. Tables 1 and 2 give an overview of the life cycle of trees.

Life cycle of a tree

1. Nursery production
2. Establishment phase
3. Growth phase
4. Maturity
5. Decline phase

Life cycle of a vegetable (annuals)

1. Seed germination and emergence
2. Seedling growth
3. Growth phase
4. Flowering and fruiting phase

Table 1 – Life Cycle of a Tree

Growth Phase	Growth Objectives	Change to Next Growth Phase
Nursery production	Top growth = selling price	Planting
Establishment phase	Root establishment	When roots become established, length of annual twig growth significantly increases.
Growth phase	Period of canopy growth – Balance canopy growth with root growth limitations.	Growth slows as tree approaches mature size (for site limitations).
Maturity	Canopy growth slows as tree matures – Balance canopy growth with root growth limitations.	Minimizing stress on aging trees prolongs tree life.
Decline phase	Minimize stress levels.	Death

Table 2 – Influence of Life Cycle on Cultural Practices for Trees				
Growth Phase	**Irrigation Water Need**	**Fertilization**	**Pruning**	**Pest Tolerance**
Nursery production	Water = Growth	Fertilizer pushes desirable top growth.	*Structural training* desirable.	LOW Could influence sales.
Establishment	CRITICAL Trees are under water stress due to the reduced rooting system.	None to very little as high nitrogen forces canopy growth at the expense of root growth.	Heavy pruning slows root establishment.	LOW due to drought imposed by reduced root system.
Growth	Water = Growth Good tolerance to short-term drought. However, short-term drought will slow growth.	IF other growth factors are not limiting, fertilization supports growth.	*Structural training* sets the tree's structural integrity for life.	HIGH, except in stress situations.
Maturity	Good tolerance to short-term drought. Severe drought leads to decline.	Need for fertilizer reduces. Over fertilization could force canopy growth that the roots cannot support in summer heat and wind.	Maturing trees that were structurally trained while young have minimal needs for pruning.	HIGH, except in stress situations.
Decline	Intolerant of drought	Evaluate stress factors as fertilization can accelerate stress in some situations.	Pruning limited to c*leaning* (removal of dead wood). Do not remove healthy wood on stressed trees.	LOW, pests could accelerate decline.

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CMG GardenNotes #102

Diagnosing Plant Disorders

Outline:

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 refernces 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 <u>symptoms</u> 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 <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**

- **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 leaving 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.

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

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