



MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #101

IPM and Plant Health Care

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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 *Organic 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

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.	<i>Structural training</i> 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.	<i>Structural training</i> 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 <i>cleaning</i> (removal of dead wood). Do not remove healthy wood on stressed trees.	LOW, pests could accelerate decline.

Author: David Whiting, Extension Consumer Horticulture Specialist (retired), Department of Horticulture & LA, Colorado State University. Revised by Mary Small, state Colorado Master Gardener coordinator, Colorado State University Extension.

- o Colorado Master Gardener *GardenNotes* are available online at www.cmg.colostate.edu.
- o Colorado Master Gardener/Colorado Gardener Certificate Training is made possible, in part, from a grant from the Colorado Garden Show, Inc. www.gardeningcolorado.com
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Revised and updated June 2017