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

CMG GardenNotes #101

IPM: 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 microecosystem 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.

Integrated Pest Management, IPM

Integrated Pest Management, IPM, incorporates a variety of pest management strategies, including cultural methods, mechanical methods, use of bionaturals, and use of organic and manufactured pesticides. Objectives include minimizing pest damage, health-related hazards, and environmental hazards, while maintaining profitability.

Because insect and disease problems vary significantly from crop to crop, application of IPM principles is also 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.

Plant Health Care, PHC

The term ***Plant Health Care, PHC***, was coined by the *International Society of Arboriculture* to more clearly define IPM techniques as they apply to tree care and landscape maintenance.

PHC is a holistic approach to 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 plants under stress. Minimizing stress prevents many common pests. For example, Cytospora fungus and most borers only attack trees under stress (primarily soil compaction 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 under water stress (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 leads to Cytospora.

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.

***C**ontributing* factors include secondary insect, disease, and abiotic disorders that attack plants already under stress. 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.

Plant Health Care Techniques

Examples of techniques used in PHC include the following:

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

- **Soils management** – 80% of all landscape plant problems relate to soil conditions.
  - Soil compaction (low soil oxygen and poor drainage)
  - Drainage
  - Improve soils tilth with routine applications of organic matter
  - Nutrient (fertilizer) management

- **Water and irrigation management**
  - The water requirement for plants to survive compared to the water need for plants to grow may be vastly different.
  - Plant tolerance to wet (wetland plants) or dry (xeric plants) conditions
  - Iron chlorosis is an issue of chronic, springtime overwatering.

- **Cultural care**
  - Planting dates
  - Varieties with resistance to common pests
  - Plant diversity
  - Spacing and air flow
  - Exposure to sun and wind
  - Mulching
  - Pruning

- **Weather influence on plant growth and pest potential**
  - Temperatures
  - Wind and rain
  - 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 –** both "organic" and manufactured

Pest Management Questions

As part of 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 set the direction for 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. On fruits and vegetables, tolerance to insects and diseases is typically low.

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 Mother Nature. However management efforts may be warranted in situation where mite populations explode due to hot weather, drought, dust on the 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 do not 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 – Including both "organic" and manufactured

Life Cycle of a Plant

Another 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. The table 1and 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 pushes 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 under stress situations.
Maturity	Good tolerance to short-term drought. Severe drought leads to decline.	Need for fertilizer reduces. Over fertilization could push out 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 under 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 trees under stress.	LOW, pests could accelerate decline.

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