

Programme-	B.Sc (Agriculture)
Course -	Crop Disease and Their Management
Course Code-	BSCAG-317
Semester -	Vth
Year-	2020-21
Unit-	2
Topic-	Methods of Plant Disease Management
Sub-Topic-	Plant Disease Management, Disease Control, Plant Pathology and Parasites
Faculty-	Dr. Partap Singh
E-mail-	hod.ag@monad.edu.in

What is plant disease management?

The goal of **plant disease management** is to reduce the economic and aesthetic damage caused by **plant** diseases. Traditionally, this has been called **plant disease control**, but current social and environmental values deem “**control**” as being absolute and the term too rigid.

Disease Control:

The infectious **diseases** may be prevented in one of two general ways: (1) by preventing contact, and therefore transmission of infection, between the susceptible host and the source of infection and (2) by rendering the host unsusceptible, either by selective breeding or by induction of an effective artificial immunity.

Plant pathology = the study of plant diseases (cause, development, control, etc.)

Plant disease = a change in the normal structure, function, or development of a plant. What’s so important about plant diseases? Diseases affect our food supply, \$\$, landscape, health (mycotoxins) and even our culture Basic plant pathology terminology:

Parasite - feeds on another living organism. Saprophyte - feeds entirely on dead matter. Pathogen – entity capable of causing disease. Life cycle - successive stages in the growth and development of a pathogen. Vector- assist in spread/movement of disease agent (inoculum) Host plant - plant with the ability to develop a disease caused by a particular pathogen. Nonhost plant - plant that cannot be

infected by a particular pathogen. Host range- all the plant species (cvs./var.) that can be infected by a particular pathogen. Resistance - ability of a host plant to resist a pathogen, either partially or completely. Susceptibility - inability of a host plant to resist a pathogen, either partially or completely. Symptom - abnormal appearance of a plant. Sign - physical presence of a pathogen. What Causes Plant Diseases? Living Causes: pathogens (called diseases, pathogenic diseases, biotic diseases) ***Most microorganisms (except viruses) do not cause plant problems*** types of plant pathogens: fungi: multicellular heterotrophs- kill plants with toxins- like cool, wet , conditions vegetative growth = hypha(e) or mycelium; often produce spores (fruiting bodies) bacteria single celled heterotrophs- kill plants with toxins- like cool, wet , conditions reproduce by division; can only enter plant passively (openings, wounds) viruses submicroscopic genetic material in protein coat- hijack cells nematodes (aquatic minute roundworms with plant piercing stylets) parasitic higher plants (dodder, mistletoe) have haustoria (not true roots) Know life cycle to determine pathogen's "Achilles' heel"- best places to direct management Nonliving Causes: environmental, physiological, chemical, mechanical factors (called disorders, nonpathogenic diseases, abiotic diseases) nonliving stresses may predispose plant to infection by pathogens.

MANAGEMENT OF PLANT DISEASES (see Chapter 15 of 2000 WA/OR Sustainable Gardening)

Disease → Diagnosis → Management: Use Integrated Pest Management (IPM) Combining different management practices (cultural, chemical, physical, and biological) to reduce the amount of disease to a tolerable level (threshold) in a manner that is economical, efficient, and environmentally-safe. The basic question: How can you manipulate a component(s) of the disease triangle to favor the host and 'disfavor' the pathogen: pathogen host environment Know the life cycle of the pathogen/pest – exploit window(s) of opportunity For Management Recommendations, check out: HortSense - WA homeowner recommendations: <http://pep.wsu.edu/hortsense/> PNW Plant Disease Management Handbook yearly updates, local (PNW) problems cultural & chemical management recommendations registered homeowner [H] &. commercial pesticide listing When using pesticides: LABEL = LAW! READ & FOLLOW THE LABEL! never use a pesticide on a plant that is not listed on the label never use a pesticide above the recommended rates on the label never use a pesticide within the restricted preharvest interval (PHI) METHODS OF PLANT DISEASE MANAGEMENT General strategies: Exclude the pathogen - prevent inoculum from coming into an area where the pathogen does not occur (e.g., quarantines, inspections, certifications). Eradicate the pathogen - remove or reduce inoculum (e.g., rotation, sanitation, eliminating alternate hosts, heat treatment, some pesticides). Protect the healthy plant against infection - provide a "barrier" (chemical, biological, or physical) between the host plant and pathogen. Genetic resistance of the plant against the pathogen - grow a less susceptible host plant. Avoidance - avoid development of a disease on a plant(s) even though it does occur in the area.

MANAGEMENT PRACTICES:

Cultural Management Sanitation - clean environment; remove or reduce sources of inoculum (weed and alternative hosts, insect vectors, debris). Pruning - remove infected tissue, promote more vigorous growth, increase air circulation Watering - avoid overwatering or underwatering; flooding soils. Planting date - unfavorable conditions for pathogen, favorable for host. Fertility - avoid overfertilization or

underfertilization. Rotation - nonhost plants and resistant varieties; reduce soilborne pathogen populations Trap plants & antagonistic plants - e.g. marigolds. Quarantines, restrictions on moving plant materials across county, state, or national borders. Chemical Management Chemical barrier to protect the host plant and/or eradicate an existing infection. Pesticides typically cannot “cure” heavily diseased plants Types of pesticides: fungicides, bactericides, nematocides, insecticides, biocides. Contact fungicide: effective only at the site of application (protectant) must be applied BEFORE pathogen infects the plant; new growth emerging after application is not protected. examples: mancozeb, coppers, chlorothalonil, captan. Systemic fungicide: absorbed & translocated (moved from application site) by the plant locally systemic = moves short distances (towards leaf margin) within the plant from the site of application (e.g., benomyl, triforine) systemic = moves further within the plant from the site of application (e.g., metalaxyl moves from roots up to shoots and foliage). READ and FOLLOW THE LABEL! pesticide timing can be crucial pathogen/vector present (or potential) & susceptible: know life cycles, monitor diligently repeat applications may be necessary: protectant vs. systemic, new growth, rain/irrigation time dormant applications carefully, e.g., lime sulfur will burn young foliage of most plants avoid conditions leading to phytotoxicity (climate influences, antagonistic tank mix) AVOID Resistance to Pesticides: Reduce the chance of resistant strains of a pathogen developing by 1) using integrated management strategy, 2) minimal applications of narrow-spectrum pesticides, & 3) alternating classes of pesticides Pesticide names: Common Name = name of the active ingredient (e.g., chlorothalonil) Trade Name = name under which the pesticide is sold to the home market (e.g., Daconil 2787, Funginil, or Multi-Purpose Fungicide for the home market) Commercial Trade Name = name under which the pesticide is sold to commercial markets (e.g., Bravo or Exotherm Termil)

Genetic Resistance:

Most plants resist infection by the majority of microorganisms. Degree of resistance/susceptibility varies among plant species and varieties Resistance is dynamic (changes) - races or strains of a pathogen vary in pathogenicity (how severe a pathogen), and the environment affects host resistance. HEALTHY PLANTS ARE MORE RESISTANT! Physical Management Heat treatment – steam sterilization of soil/materials; soil solarization, heat treatments Cold treatment - refrigeration (postharvest). Moisture management: reducing humidity; drying out of bulbs, tubers, etc. for winter storage Biological Management = using a parasite to manage a pathogen Limited options available at the moment. Example: Crown gall caused by *Agrobacterium tumefaciens*, can be reduced by using a product containing the competitive bacteria *Agrobacterium radiobacter* strain 84 (Galltrol or K-84).

Reference Book

1. Shweta Garg and Ashish kumar Tripathi (2016), Crop Disease and Management.
2. Singh and Neelu Singh(2013), Plant Disease Management, principles and practices