

Principles of Plant Disease Control



After you diagnose a plant disease, you are only half finished. The equally challenging task of designing the proper control recommendation is next. Understanding the specific disease or the life cycle of the pathogen involved is necessary to make an adequate control recommendation.

The Disease Triangle

Three major factors contribute to the development of a plant disease: a susceptible host, a virulent pathogen, and a favorable environment. A plant disease results when these three factors occur simultaneously. If one or more of these factors do not occur, then the disease does not occur. The genetic

makeup of the host plant determines its susceptibility to disease. This susceptibility or resistance may be determined by various physical and biochemical factors. Plant stature, growth habit, cuticle thickness, and stomatal shape are a few physical factors that influence disease development. The plant's developmental stage also may influence disease development. Pathogens differ in their ability to survive, spread, and reproduce. Environmental extremes of temperature, light, or moisture can accentuate many diseases. Cool, moist conditions are ideal for many fungal pathogens.

The Disease Cycle

Understanding the disease cycle is important when considering control options. Learning the chain of events that contribute to a disease helps point out the weakest links. Control measures can then be used to break the cycle. Most pathogens must survive an adverse period, when they do not actively incite plant diseases and affect the plant later. Some diseases are characterized by a single cycle during the year. Other diseases continually produce new inoculum, repeating the cycle many times during the course of a single growing season.

Disease Control

The five basic principles of plant disease control are: exclusion, avoidance, eradication, protection, and resistance.

Exclusion

This includes quarantines, inspections, and certification. Plant material is examined to prevent entry of a disease that does not already occur in a particular country, state, or geographic area.

Avoidance

If the disease does occur in your area, there may be techniques to avoid disease development. Choices of planting site, time of planting, storage conditions or avoiding wounds are a few of these techniques. Phytophthora root rots can be avoided by not planting in heavy, poorly drained soils. Planting later in the year when soils are dryer and warmer will avoid some damping-off diseases common to many vegetables. Wounding can cause entry points for pathogens or weaken a plant to the point that it cannot defend itself. Avoiding wounds also helps to control the crown gall bacterium which needs an injury to begin the infection process. Planting certified virus-free stock is a good way to avoid virus-related diseases.

Good horticultural practices such as proper fertility, pruning, watering, and proper training will go a long way to help control plant diseases.

Eradication

When a plant is infected or an area is infested with a plant pathogen, eradication can eliminate or reduce the



disease threat. Rotation, sanitation, heat treatment, eliminating the alternate host, and certain chemicals can be used to reduce or eliminate diseases. Crop rotation is a common method in both commercial agriculture and home gardens. It is necessary to know the pathogen and its host range. Rotation reduces soil populations of fungi or nematodes only if non-host plants are used.

Removing plant debris (sanitation) is important where pathogens may overwinter. Raking leaves, removing rotted fruit, picking up old vines, and pruning out dead wood or canes all are part of sanitation. Once collected, dispose of debris by burning, burying, or hot composting. If you decide to compost, it must be done correctly or completely or you will not benefit from your efforts. Field burning is another method of sanitation which destroys grass stubble where plant pathogens may overwinter.

Rusts are a group of fungi that can complete their life cycle on two or more different hosts. Eliminating an alternate host may help reduce pressure from these diseases. Heat treatment is usually used to eliminate viruses from propagation material.

Certain chemicals can be used to eliminate infections or infestations. Soil can be fumigated to reduce populations of certain fungi and nematodes. Lime sulfur is used during the dormant season to denature and kill fungal fruiting bodies or spores. Some fungicides have kickback activity, meaning that infections of some fungi can be stopped if the chemical is applied within a few days after the infection has started.

Protection

Protection is treating a healthy plant before it becomes diseased. There are both biological and chemical means of protection. One of

the most successful biological protections has been the use of a bacterium to protect against a bacterial disease known as crown gall. The roots of a seedling or nursery plant are merely dipped into a suspension of a commercial preparation of the bacterium prior to planting.

Chemical protection is one of the most widely used means of control. Some fungicides (such as copper and sulfur products) are allowed for use under several "organic" growing guidelines. Many fungicides are on the market but few can be obtained easily by the homeowner. It is necessary to know the disease cycle and host susceptibility to get good control using fungicides. Proper timing, coverage, and selection of fungicides is also needed.

Resistance

Resistance is a term sometimes mistakenly used interchangeably or in conjunction with "immunity," "tolerance," and "susceptibility." These terms describe the inherent genetic makeup of the plant and thus its reaction to plant pathogens. Resistance and its opposite, susceptibility, are levels or degrees of a plant's reaction. Some cultivars of a plant can be more or less resistant (or susceptible) than another cultivar. Resistant cultivars can still become diseased but not as much as (or more

than) another. If a plant does not ever become diseased, then the term "immune" can be used. Tolerance describes a plant (usually a food crop) that may become diseased but produces yields similar to a healthy plant.

Lists of resistant plants can be found in many texts and seed catalogues. Planning ahead is essential and planting resistant cultivars is the easiest means of disease control.

Knowing what diseases a plant is susceptible or resistant to can help in the diagnostic process. One can eliminate possibilities by knowing which diseases are likely to occur.

Summary

Experience and practice are the best teachers of plant disease diagnosis. Examination of the plants physical environment and management history are essential. Observing patterns and specific symptoms and signs are important in arriving at a correct diagnosis. Once diagnosed, the proper control measures can be formulated. Knowledge of the host, pathogen life cycle and environmental factors also aid selection of the most effective control measures. A combination of exclusion, avoidance, resistance, eradication, and protection will control most plant diseases.

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