
Section 28

Diseases and Their Control

Diseases



Diseases cause significant losses to crops grown in Ontario each year. Some diseases are regulated and prevent the movement of produce from region to region due to quarantine restrictions.

Disease symptoms can be caused by environmental stress such as extreme temperatures, too much or too little moisture or by infection caused by viruses, bacteria, nematodes and fungi. It is important that you correctly identify the cause of the symptoms so that you can decide on an effective treatment. Following an integrated crop management strategy that includes cultural and sanitation practices as well as chemical treatments will reduce the risk of a disease causing yield reduction.

Environmental Stress

Problems caused by environmental stress cannot be managed with pesticides.

Unfavourable environmental conditions will stress plants and may cause abnormal growth or disease-like symptoms. Conditions that cause stress include – extremes of light or temperature, too much or too little water or nutrients for the plant, and pollution in the air. Plants weakened by environmental stress are more likely to be infected by pests. If you recognize the stress symptoms and correct the problem, you may prevent the plant from becoming diseased.

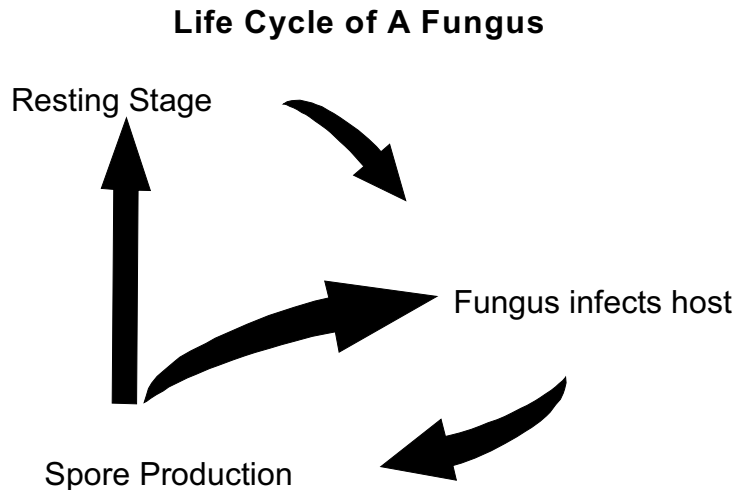
Pest Infection

Pest organisms such as fungi, bacteria, viruses and nematodes can cause diseases. Some diseases can be exaggerated when more than one organism infects the crop. All of these organisms are usually too small to see. Identification is usually based on the symptoms that can be seen.

Fungi

Fungi are the largest group of organisms that cause plant diseases. They are simple organisms which use living or decaying plants as an energy source. Moulds, mushrooms, mildews, smuts and rust are examples of fungi.

Most fungi reproduce by tiny spores. When spores germinate, they usually produce threadlike filaments (mycelium) which absorb nutrients from the host plant. At the same time, the germinating spores release enzymes and toxins that cause disease symptoms. The life cycle of many fungi follow the sequence shown in the diagram below.



Some fungi (such as some rusts) must have two different hosts to complete their life cycle. This means that the fungus lives over the winter on one type of plant, then spreads its spores to another type of plant in the spring. The fungus cannot complete its cycle if one of the host plants is not present. Examples of rust diseases requiring two hosts are Cedar-Apple Rust, and Black Stem Rust on wheat.

To identify a fungus, carefully examine the damaged area of the plant. Look for mycelium or spores and anything else that is abnormal. (Examples include wilting, yellowing, decay, stunting cankers, dieback, galls, leaf spots, rots, rusts and wilts.) Then consider the growing conditions. Are the growing conditions favourable to a disease-causing fungus?

Check the following:

- ▶ the kind of plant
- ▶ the amount of damage
- ▶ the date that damage first appeared
- ▶ the size of the damaged area
- ▶ the shape of the damaged area
- ▶ the weather conditions over the past few weeks
- ▶ how often the plant received water and how much
- ▶ how often fertilizer was applied and how much.

Septoria diseases, for example, will often produce tiny black structures called pycnidia which help identify the disease.

These clues will help you diagnose the disease and identify the fungus. You can then decide on the best control.

Bacteria

Bacteria cause some major plant diseases. Bacteria are one-celled organisms which can only be seen with a microscope. They usually enter a plant through natural openings or wounds. In favourable conditions, bacteria reproduce very quickly, using the plant as a source of food.

Bacteria may be spread by people, animals, equipment, wind, rain and insects. Some blights, galls and rots are caused by bacteria. Examples of diseases caused by bacteria include – Fire Blight in pear and apple, Black Rot of cabbage, Bacterial Spot, Bacterial Speck and Bacterial Canker on tomato, and Crown Gall of many crops including grape. Some bacteria can enter and plug or rot the vasculature (plumbing) of host plants causing severe wilting.

Viruses

Viruses are extremely small strands of genetic material (DNA or RNA) covered with specific protein which grow and reproduce inside living cells. Viruses cause diseases which often reduce plant vigour and crop yields. Some viruses can be spread by mechanical means (for example, during pruning or harvesting), in propagation material (seeds, tubers and other plant parts), and may also be spread by insects, mites, nematodes or fungi. Very few pesticides can control viruses. You can only try to prevent them from getting started or spreading.

Nematodes are small, microscopic worms which may feed on plant stems, leaves and roots. They can affect the movement of water and nutrients in a plant and they create wounds which let fungi, bacteria or viruses enter. Some nematodes produce growth-promoting hormones which are injected into plant roots causing swellings or knots. Female cyst nematodes become small round and pearl-like once they establish a feeding site on a host root. Nematodes are spread on infected plant material or through the movement of infested soil. They also remain in infested soil and will damage future crops. Some nematodes such as the root lesion nematode have a wide host range while other nematodes such as the soybean cyst nematode are specific to a few plant species. Symptoms of nematode infection are wilting, twisting, stunted growth and lack of plant vigour. Often symptoms of root knots, lesions or cysts can be observed on infected plants depending on the species of nematode that has infected the plant.

Disease Control

The key to disease control is to eliminate any one of the three factors which must be present for disease to occur. The three factors are:

- ▶ a disease-causing organism such as bacteria, fungus or virus
- ▶ a host susceptible to the disease
- ▶ an environment favourable for the disease to develop (for example, dampness or cool temperature).

Once you eliminate any one of these factors you will be able to control the disease. Any of the following steps can help:

- ▶ grow varieties that are resistant to a certain disease that you know to be in the area
- ▶ eliminate debris or other plant material that you know carries the disease
- ▶ use crop protectants that will prevent the disease from entering the plant
- ▶ remove plants known to act as a host for a certain disease such as cedar trees near an apple orchard.

You can reduce the impact of disease by keeping plants healthy. This may or may not include using fungicides. To keep plants healthy, give them the water and nutrients they need but be careful not to apply too much or too little. Both over and under application of water and nutrients can lower a plant's resistance to fungi that cause disease. For example – dampness or a nitrogen-rich environment may benefit the plant, but they also give fungi a chance to thrive.

Fungicides

Some moulds, rots, rusts and wilts can be controlled by fungicides. Fungicides are chemicals that either kill the fungus or stop its spores from germinating.

How Fungicides Work

Fungicides can be applied to the growing crop or to the seed before planting. Fungicides are applied as protectants, eradicants or systemics.

1. Protectants

Protectants protect the plant from fungal diseases. These products must be applied to the plant or seed before the pathogen arrives. They form a protective layer on the plant's surface that may last for a week or more depending on the environmental conditions. Once the chemical wears off or new plant growth occurs, there is no longer an effective chemical shield between plant and pathogen. Spraying every seven to ten days, or on a weather-timed schedule, ensures that the plants are protected at all times. These products are routinely used in orchards and vegetable crops.

2. Eradicants

Eradicants can control fungi that have already infected the plant. Some of these fungicides have “kick back” or “reach back” activity. This means that the fungicide can be applied within so many hours after the infection period has begun and spores may have germinated. This kick back period is often stated on the pesticide label as a specified number of hours post infection. Eradicants work best when there is good coverage of all plants. Pest resistance to eradicant fungicides tends to develop more easily than it does for protectant fungicides. For this reason the product label may tell you the maximum number of sprays that you should make one after the other and/or the maximum total number of sprays per season.

3. Systemics

Systemic chemicals are absorbed by plants and move within them. Some systemic chemicals move up while others move down the plant. They may act as protectants, eradicants, or both. Once inside the plant, some systemics move to new areas of plant growth.

Bactericides

Bactericides are chemicals that prevent bacterial infections. They kill bacteria on contact and must be used before the bacteria infect a plant.

Nematicides

Most pesticides used for nematode control are soil fumigants. Some fumigants are applied as a gas and depend on the presence of air spaces to move through the soil. The soil must be covered with an impermeable cover to prevent the fumigant from escaping into the air. Other fumigants come in liquid or granular formulations that release gas into the soil. Soil must be wet and sealed with compacting machinery to ensure that the fumigant does not escape before it controls the pests. Many fumigants are highly toxic and kill beneficial soil microorganisms. A permit from the Ontario Ministry of the Environment is required for soil fumigant application.

How Well Do Pesticides Work?

As with all pesticides, timing the application correctly is very important to produce the best results. When and how often to apply the pesticide, whether it is a fungicide, bactericide or nematicide depends on the type of pest, its life cycle and the weather. **Always monitor the pest conditions and read the label for correct application information!**

Review Questions



1. Disease symptoms are caused by pests such as fungi, bacteria, nematodes and viruses.

TRUE

FALSE

2. Pesticides that are eradicants must be applied to the plant or seed before the disease occurs.

TRUE

FALSE

3. Pesticides that are protectants must be applied to the plant or seed before the disease occurs.

TRUE

FALSE

