

## Introduction

There is probably nothing more frustrating for a home gardener than to see the fruits of his or her labors lost to diseases and other pests. Diseases occur when environmental conditions are suitable for pathogens to develop on susceptible hosts. Some pathogens attack a wide variety of plants, whereas others attack only specific plants. Additionally, some pathogens can attack all plant parts, whereas others attack only selected tissues.

Many types of organisms cause infectious diseases of plants, but the five major groups of plant pathogens are the fungi, water molds, bacteria, viruses and nematodes. Adverse environmental conditions also can cause non-infectious diseases of plants. These include improper soil pH, nutrient deficiencies and toxicities, soil compaction, excess water and more. Plants weakened by adverse conditions may be further predisposed to attack by pathogens.

Successful disease management begins with accurate identification of the cause of the problem. Knowing the common diseases of individual crops aids greatly in disease identification. Many diseases are readily identified based on characteristic signs (observation of the pathogen itself) and symptoms of disease. The identification of other diseases requires microscopic examination of diseased tissues or even more sophisticated laboratory techniques, which are available through the LSU AgCenter Plant Disease Diagnostic Laboratory.



## Disease Management

Prevention is the key to the management of diseases in the home garden. Although foliar diseases, such as leaf spots and mildews, are generally manageable once they are observed, root diseases generally are not. Several fungicides are available to aid in the management of these diseases, but they should always be used in conjunction with cultural practices intended to modify the environment to make it less conducive to disease development.

**Site Selection and Preparation.** Choose a sunny, well-drained site and follow general recommendations for proper soil (and bed) preparation, fertilization, irrigation, insect and weed control and planting. Following proper cultural practices is essential to maintaining a healthy garden.

**Resistant Varieties.** Many varieties of vegetables have been developed that are resistant to specific diseases. This does not mean that they are immune to these diseases, but when disease does develop, it will generally be less severe on them than on susceptible varieties. Resistant varieties should always be used in combination with other management practices. For many diseases, such as the vascular wilts and viruses, the use of resistant varieties is the primary means of control. Please check with your county extension agent for information on resistant varieties of specific crops.

**Fallowing and Crop Rotation.** Fallowing, or letting the land lay idle without a crop, is a common practice for reducing populations of soilborne plant pathogens or preventing their buildup. This is done by moving the location of the garden every 2-3 years. For gardeners with limited space who must use the same site year after year, crop rotation should be practiced. In this case, rotate plantings of susceptible crops with crops not subject to the same diseases. A good practice is to treat members of the same plant family as a group (for example, tomatoes, potatoes, peppers and eggplants) and rotate based on groups rather than individual crops.

**Solarization.** Soil solarization is a practice that utilizes the sun's energy to heat the soil and reduce populations of soil-borne pathogens, insects and weed seeds. The goal of solarization is to heat the soil to a depth of 4-6 inches to at least 100 degrees for 4-6 weeks or longer. The best time to do this is during the heat of the summer, especially during July and August. To do this, prepare the soil as you would for planting, making sure that it is free of clods and is moist but not overly wet. Then cover the soil with a clear plastic or polyethylene tarp (1 to 6 mils thick) being sure to repair any holes in the plastic to prevent the loss of heat. Stretch the plastic so that it is in contact with the soil and bury the edges. Be careful when removing the plastic to prevent recontamination of the soil.

**Organic Mulches and Amendments.** The addition of organic matter and other soil amendments can aid in reducing diseases caused by soilborne pathogens. Organic matter serves as a food base for a myriad of microorganisms in soil that contribute to biological control. The addition of organic matter also helps to improve soil structure and improves its ability to hold water and nutrients. The decomposition of some plants, such as cabbage and broccoli, releases chemicals into the soil that are toxic to some pathogens.

**Sanitation.** Sanitation includes various physical practices intended to reduce pathogen populations and prevent their spread. Many pathogens survive between crops in or on the residue from diseased plants, so it is important to remove as much of the old plant debris as possible. Similarly, weeds should be eliminated as they may harbor pathogens or serve as a host for insects that may transmit viruses and other pathogens. Frequent disinfestations of tools will also help prevent the spread of pathogens.

## Home Garden Fungicides

Only a few of the many fungicides available for the control of vegetable diseases are readily available to the home gardener, and most of these are contact fungicides that must be applied to prevent disease rather than to cure it once it has become established. As the same fungicides are often sold by several companies, the brand you will find will depend upon where you shop. A table listing the most commonly available fungicides is provided.

## Diseases Affecting Roots and Crowns

**Seedling damping-off.** Prepare the beds to ensure good drainage and do not overwater during germination. Sow seeds when soil temperatures are favorable for rapid germination and growth, and do not sow them too deeply. The use of fungicide-treated seeds also may help prevent these diseases.

**Root, crown and stem rots.** Check the condition of the roots of transplants visually before purchasing them to avoid introducing these diseases into the garden. Choose a well-drained site, or plant on raised beds that allow for adequate drainage. Water on a regular basis, but do not overwater.

**Southern blight.** Do not plant susceptible crops for 2-3 years in areas known to be infested with the pathogen. Turn the soil to bury the sclerotia (mustard seed-like survival structures) as deeply as possible (at least 8-10 inches). For small plantings, aluminum foil wrapped around the lower part of the stem (from just below the soil line to approximately 2 inches above the soil) provides a physical barrier that prevents the pathogen from reaching the plant.

**Nematodes.** Once established in a garden, nematodes can be very difficult to manage. When establishing a garden, rotate the location of the garden as often as possible, or at least rotate the location of susceptible crops within the garden from year to year. In addition to the use of resistant crops and varieties, plants should be started early in the spring before nematodes become active. The addition of organic matter to the soil will stimulate natural

enemies of the nematodes in the soil that will aid in reducing nematode populations. Removal of susceptible plants and as much of their roots as possible as soon as the crop is harvested will also help to reduce the build up of nematode populations.

## Diseases Affecting Leaves, Stems and Fruit

**Anthracnose, leaf spots, leaf blights and fruit rots.** Buy disease-free transplants. Choose resistant varieties, if available. Plant in sunny locations with good air circulation to reduce the length of time the leaves remain wet. Avoid the use of overhead irrigation. Fixed copper or other fungicide sprays applied prior to the onset of rainy periods will provide some protection. Only copper-containing fungicides are effective against bacterial diseases.

**Powdery mildew.** Choose resistant varieties or plant susceptible varieties in sunny locations with good air movement. Protect the plants with sprays of potassium bicarbonate, sulfur or other fungicides.

**White mold.** Allow sufficient space when planting to provide good air circulation to promote drying of the soil surface and the interior of the lower canopy. Remove and destroy infected plants as soon as they are evident. The sclerotia can be destroyed by turning the soil to bury them at least 10 inches deep.

**Downy Mildew.** Choose resistant varieties, if available, or plant susceptible varieties in sunny locations with good air movement. Protect the plants with mancozeb, maneb or copper fungicides.

## Diseases Affecting the Whole Plant

**Vascular wilts.** Choose resistant cultivars or do not plant susceptible plants for three years in areas known to be infested with these pathogens.

**Viruses.** Choose resistant varieties when possible. Do not introduce virus-infected plants into the garden. Prevent their spread by controlling insects and weeds that may serve as alternate hosts and by regularly disinfesting tools used to work with the plants. The use of reflective mulches aids in disrupting insect transmission of some viruses, like the thrips-transmitted tomato spotted wilt virus.

**Environmental factors.** Remedial action depends upon the cause of the disorder.

## Common Diseases of Vegetables

**Beans and Peas (Southern):** anthracnose, bacterial blights, gray mold, leaf spots and blights (fungal), powdery mildew, root-knot nematode, rust, viruses and white mold.

**Bulb vegetables (garlic, onions, etc.):** Botrytis blight, downy mildew, leaf blights (fungal), purple blotch and white rot.

**Cole crops (broccoli, Brussels sprouts, cabbage, cauliflower, etc.):** Alternaria leaf spot, black rot and downy mildew.

**Corn (Sweet):** leaf blights (fungal) and rust.

**Cucurbits (cucumbers, melons, squash, watermelons, etc.):** angular leaf spot, anthracnose, bacterial wilt, downy

mildew, Fusarium wilt, gummy stem blight, leaf spots (fungal), powdery mildew, root-knot nematode, scab and viruses.

**Eggplant:** leaf blights (fungal), Phomopsis fruit rot, and southern blight.

**Leafy greens (collards, mustard, turnip, etc.):** Alternaria leaf spot & blight, downy mildew, and powdery mildew.

**Lettuce:** anthracnose, downy mildew, and powdery mildew.

**Okra:** Fusarium wilt, powdery mildew and root-knot nematode.

**Peas (English):** anthracnose, powdery mildew and rust.

**Peppers:** anthracnose fruit rot, bacterial spot, Phytophthora blight, southern blight, tomato spotted wilt and other viruses.

**Potatoes (Irish):** early blight, late blight and white mold.

**Root vegetables (beets, carrots, parsnips, turnips, etc.):** leaf spots & blights (fungal) and root-knot nematode.

**Spinach:** downy mildew and white rust.

**Tomatoes:** bacterial speck, bacterial spot, bacterial wilt, early blight, leaf spots (fungal), root-knot nematode, southern blight, tomato spotted wilt and other viruses.

## Fungicides for Use in the Home Vegetable Garden

Fungicide	Disease(s) Controlled	Crops	Comments
captan	Damping-off	Beans, beets, cabbage, corn, melons, peas, spinach, squash & Swiss chard	For use as a seed treatment <u>only!</u>
chlorothalonil	Anthrachnose, <i>Botrytis</i> , downy mildew, early blight, fruit rots, fungal leaf spots & blights, gummy stem blight, late blight, powdery mildew & rust	Most vegetables	
copper	Anthrachnose, bacterial leaf spots & blights, downy mildew, early blight, fungal leaf spots & blights, gummy stem blight, late blight, powdery mildew, scab, white rust & white mold	Most vegetables	Do not mix with liquid fertilizers. Do not use in spray solutions with a pH of less than 6.5.
mancozeb	Anthrachnose, downy mildew, early blight, fungal leaf spots & blights, gummy stem blight, late blight & rust	Asparagus, corn, cucurbits, onions, potatoes & tomatoes	
maneb	Anthrachnose, downy mildew, early blight, fruit rots, fungal leaf spots & blights, gummy stem blight, late blight & rust	Beans, brassicas (cole crops), corn, cucurbits, eggplant, onions, peppers, potatoes & tomatoes	
neem oil	Anthrachnose, downy mildew, fungal leaf spots & blights, gray mold, powdery mildew, rust & scab	All vegetables, herbs & spices	
pentachloronitrobenzene (PCNB)	Root & stem rot ( <i>Rhizoctonia</i> ), club root, & southern blight	Beans, brassicas (cole crops), peppers & tomatoes	<b>Highly toxic!</b> For use only as a soil treatment before or at transplanting.
phosphorous acid (mono- & di-potassium salts)	Root, crown & fruit rots caused by <i>Phytophthora</i> & <i>Pythium</i> , downy mildew & late blight	Most vegetables	Best when applied 2-3 times before disease onset.
potassium bicarbonate	Powdery mildew	All vegetables	
sulfur	<i>Botrytis</i> , downy mildew, powdery mildew & rust	Beans (may injure some varieties), brassicas (cole crops), onions & peas  <b>Do not use on cucurbits!</b>	Do not use during periods of high temperatures (85 or higher) or within 2-4 weeks of using an oil spray.
sulfur + potassium salts of fatty acids	Powdery mildew	Beans, cucumbers, peas, potatoes & squash	See sulfur.

## Trade Names of Fungicides for Use in the Home Vegetable Garden

Fungicide	Trade Name(s)
<b>captan</b>	<i>Hi-Yield Captan Fungicide 50% WP</i>
<b>chlorothalonil</b>	<i>Bonide Fung-onil Multi-purpose Fungicide Ferti-lome Broad Spectrum Liquid Fungicide GardenTech Daconil Fungicide Gordon's Multi-purpose Fungicide Hi-Yield Vegetable, Flower, Fruit and Ornamental Fungicide Ortho Garden Disease Control</i>
<b>copper</b>	<i>Bonide Copper Spray or Dust Bonide Liquid Copper Fungicide Concern Copper Soap Fungicide Gordon's Bordeaux Mixture Hi-Yield Bordeaux Mix Fungicide Hi-Yield Copper Fungicide Lilly Miller Cueva Copper Soap Fungicide Natural Guard Copper Soap Liquid Fungicide SA-50 Southern Ag Liquid Copper Fungicide</i>
<b>mancozeb</b>	<i>Bonide Mancozeb Flowable with Zinc Southern Ag Dithane M-45</i>
<b>maneb</b>	<i>Gordon's Maneb Tomato &amp; Vegetable Fungicide Hi-Yield Maneb Garden Fungicide</i>
<b>neem oil</b>	<i>Bonide Rose Rx 3 in 1 Bonide Tomato &amp; Vegetable 3 in 1 Concern Garden Defense Multi-purpose Spray Ferti-lome Rose, Flower &amp; Vegetable Spray Gardens Alive! Shield-All II Garden Safe Fungicide 3-in-1 Green Light Neem Concentrate Green Light Powdery Mildew Killer RTU Natural Guard Neem Py Southern Ag Triple Action Neem Oil</i>
<b>pentachloronitrobenzene (PCNB)</b>	<i>SA-50 Terraclor 75% WP</i>
<b>phosphorous acid (mono- &amp; di-potassium salts)</b>	<i>Monterey Agri-Fos Systemic Fungicide</i>
<b>potassium bicarbonate</b>	<i>Garden-ville Potassium Bicarbonate</i>
<b>sulfur</b>	<i>Bonide Sulfur Plant Fungicide Ferti-lome Dusting Sulfur Green Light Wettable Dusting Sulfur Hi-Yield Wettable Dusting Sulfur Lilly Miller Sulfur Dust Safer Brand Garden Fungicide II Southern Ag Wettable or Dusting Sulfur</i>
<b>sulfur + potassium salts of fatty acids</b>	<i>Safer Brand 3-in-1 Garden Spray II (concentrate &amp; RTU)</i>



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Pub. 3050 (7.5) 4/08

Issued in furtherance of Cooperative Extension work, Acts of Congress of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. The Louisiana Cooperative Extension Service provides equal opportunities in programs and employment.