



# Managing Diseases in Home Vegetable Gardens

*All vegetables are susceptible to several diseases. Thus, in North Carolina you can expect to have disease problems in your vegetable garden sooner or later, especially if you grow a garden on the same site year after year. However, by following good cultural practices and taking preventive measures, good yields and high-quality vegetables may be obtained even if some diseases are present.*

*This publication gives guidelines that will help you obtain good yields of disease-free vegetables. It is not intended to provide the final answer to all questions about vegetable disease control. Remember that disease management starts with proper disease identification; have a knowledgeable person identify the problem before implementing any control strategy. Successful disease management in vegetable gardens will result from using the control methods discussed in this publication.*

## Crop Rotation

Rotating crops is one of the oldest and most economical methods of controlling plant diseases, including plant-parasitic nematodes. Rotation is the practice of not growing a certain crop on the same site for more than one year. Frequently, just by planting a susceptible crop a few feet from where it was grown the previous year, you can avoid damage from disease-producing organisms (pathogens), particularly nematodes. Also, if space is available, the entire garden site may be moved to a new location after two or three years. When you move the garden site, select a new site that has been covered by grass for several years.

Be sure to consider succession planting (multiple cropping) in the rotational scheme. For example, if a short-season vegetable that is susceptible to root-knot nematodes is grown in one area of the garden, you can often produce a fall crop (such as a resistant variety of tomato or sweet corn) in the same soil without a yield loss. Plan a rotational program by dividing the garden site into thirds. With this scheme, it is easier to consider all factors that affect plant growth, such as shade, fertilization, water, and time of harvest.

## Resistant Varieties

Planting resistant varieties is a very economical way of controlling vegetable diseases. Use resistant varieties in areas where diseases are present or where the soil is known to be infested with disease-causing organisms. Home gardeners can often use the disease-resistant varieties that commercial growers avoid because of handling and marketing considerations, such as fruit size, shape, color, and storage characteristics. (For example, Venus and Saturn



tomatoes are resistant to southern bacterial wilt, but the fruit is too small for commercial use.) You may need to use rotation and chemicals to control diseases to which the selected variety is not resistant.

## Disease-Free Seed and Transplants

Using disease-free planting stock is a must because many important vegetable diseases, particularly bacterial diseases, are caused by pathogens that are seed borne or brought into the garden site on infected transplants. Do not save seed from gardens where diseases are prevalent. However, if you prefer to save seed of your favorite vegetable variety (for example, beans), select seed only from healthy, nonhybrid plants. Purchase seed from a reputable dealer because external appearances normally do not reveal whether the seed is contaminated with disease-causing organisms. People in certain geographical areas are able to produce disease-free seed because of climatic conditions. For example, western-grown bean seed are usually free of pathogens because of the arid climate in which they are produced. Request seed from such regions. Likewise, if you are starting your crop from transplants, insist on disease-free transplants. If a plant is infected at an early age, the disease will only get worse and the plant will not perform as expected. A good disease-control program is based on prevention, not cure.

## Sanitation

Sanitary practices are very important in helping to prevent or control plant diseases. Many disease-causing organisms survive the winter in plant debris, cull piles, compost piles, or plant stubble that remains in the garden site. Any practice that eliminates these overwintering sites for fungi, bacteria, viruses, and nematodes reduces the occurrence of disease problems the following year. Some disease-producing organisms can also survive the off-season on contaminated equipment or containers. Equipment that has been used in disease-infested vegetable gardens and containers that have been used to harvest diseased vegetables should be disinfected before being used in vegetable gardens. Also, as soon as harvest is complete, remove the remaining plant residue from the garden site and expose the roots to the sun and wind to kill the pathogens, particularly nematodes.

## Solarization

Once the soil has been prepared and is ready for planting, place a clear sheet of plastic over the site, burying the edges in the soil. Over the course of several warm, sunny days, temperatures under the plastic will rise to over 125°F, killing many soil-borne pests including plant pathogens, nematodes, insects, and weeds. However, these pests may not be affected if they are more than 4 inches below the soil surface. It normally takes four to six weeks

of very sunny weather to eliminate disease-causing organisms at greater depths.

Solarization also works well for preparing soil to use in producing transplants. In this case, put the soil in a sealed plastic bag and place it on the driveway, walkway, or similar location so that the bag can remain in bright sunshine for a period of several weeks. Solarization probably works best for fall-planted vegetables because the optimum time to use this technique in North Carolina is during June, July, or August.

## Seed Treatment

Seed is usually treated by the seed producer or seller; if you purchase untreated seed, treat it with a proper fungicide before you plant it. Properly treated seed will produce a better stand than untreated seed and will normally produce more vigorous plants that are better able to resist attack by weak pathogens.

*Thiram and captan are good fungicides to use on most vegetable seed.* However, be sure to check the label to determine if the vegetable that you want to treat is listed. Treat only those vegetables listed on the label. Treat seed by placing the desired amount of fungicide in the seed container and shaking vigorously. A small jar or can with a lid attached also works well.

## Proper Nutrition

Proper fertilization helps to control several diseases, such as tomato blossom-end rot and potato scab. Always have the soil in the garden site analyzed and apply fertilizer and lime according to the directions of the North Carolina Department of Agriculture (Agronomic Division). The NCDA also assays the soil for nematodes and suggests whether or not it is necessary to treat for nematodes. (There is a small fee for the latter service.) Your county Cooperative Extension agent can supply the necessary forms, containers, and address to ensure that your soil samples are handled properly.

Also be aware of the organic-matter content of the soil in the garden site and maintain it at as high a level as possible. This helps to control some diseases and to maintain a uniform water supply, which is very important in obtaining good yields from vegetable plants. Ideally, a vegetable plant should not suffer from any stress during its life.

## Time of Planting

Planting vegetables at the proper time of year helps reduce losses from several pests. Damping-off is less of a problem if the seed are planted in soil within the desirable temperature range for a particular vegetable.

For example, garden peas and potatoes may be planted in relatively cool soil, whereas squash, beans, or cucumbers must be planted in fairly warm soil. Quite often, vegetables planted in the spring do not become as heavily in-

fectured with pathogens as those planted in the fall, particularly for second plantings of the same vegetable or same variety. Thus, many growers produce most of their vegetables in the spring and do not try to produce a fall crop because of the pest pressure.

## Chemical Control

Many growers prefer to produce their vegetables without the use of pesticides. However, even if you follow the above practices, you may still find that you want to use fungicides and nematicides in the garden to prevent diseases and to obtain the maximum yield of blemish-free fruit. For a detailed discussion on control of root-knot nematodes in home vegetable gardens, see Cooperative Extension Service publication AG-420, *Control of Root-Knot Nematodes in the Home Vegetable Garden* (available from your county Cooperative Extension Center).

Table 1 lists some of the more important diseases of vegetables widely grown in North Carolina gardens and provides suggestions on how to reduce losses from these diseases. Always be sure to read and follow all label directions on the pesticide container and use the chemical only on the vegetables listed on the label. The labeling of a

pesticide can change without notice. It is your responsibility to be sure the chemical is labeled for use on the vegetable before you apply it to that crop.

Chlorothalonil, the common name for Bravo or Evade, is available in several formulations (both liquid and dry) and is suggested in the table as the choice to control several diseases on many vegetables. In the table, chlorothalonil refers to a formulation containing 40.4 percent active ingredient (Evade). Thus, if another formulation is used, the rates must be adjusted accordingly. For example, if a formulation such as Bravo W-75 (75 percent wettable powder) is used, follow the rates listed on the label. Generally, it is accepted that if the rate is 1 pound per acre, a tablespoonful per gallon is a reasonable alternative.

Also, it is best to use a fungicide in a preventive program. Most will not perform satisfactorily if they are applied after the disease has reached damaging levels.

Copper, available in several formulations, is labeled for use on several vegetables and is an excellent bactericide as well as a good fungicide. You may want to consider the use of this material, even if you are an organic gardener, because it is approved by several organizations that are strong proponents of organic farming.

**Table 1. Disease Control in Home Vegetable Gardens**

Crop	Disease	Control
Asparagus	Rust	Plant a resistant variety such as Mary Washington.
	Crown rot	Plant in a well-drained site.
Bean (snap, pole, and lima)	Bacterial blights	Use disease-free seed. Do not save your own seed.
	Damping-off Root rot	Use seed treated with a fungicide. Grow beans on a ridge to get good air movement. Reseed if necessary. Use soil solarization.
	Rust	Spray with chlorothalonil (1 1/2 to 3 tablespoons) <sup>1</sup> during early bloom stage or when disease first threatens and repeat weekly. Do not apply within 7 days of harvest.
Cabbage, Cauliflower, and Broccoli	Black rot Black leg	Use western-grown, hot-water-treated seed and healthy plants. Use a two-year rotation.
	Downy mildew Alternaria leafspot	Spray with chlorothalonil (1 2/3 tablespoons) beginning when plants are set in the field, or when conditions favor disease development. Repeat at 7- to 10-day intervals.
	Club root Wirestem	Use 1 pound of hydrated lime per 33 square feet. Use PCNB (Terraclor 75 WP) in the plant water. Apply a solution containing 1.5 pounds of Terraclor 75 WP in 25 gallons of water at the rate of 3/4 pint per plant.
	Cabbage yellows	Plant resistant varieties.

<sup>1</sup> The rate given for chlorothalonil is to be mixed in 2.5 gallons of water, which should be applied to 1,000 square feet (based on 40.4% active ingredient = 0.52 pound per pint). The crops listed and rates given were labeled as of October, 1991.

Crop	Disease	Control
Cucumber	Angular leafspot	Plant certified seed; plant treated seed; rotate crops.
	Bacterial wilt	Use approved insecticide or other means to control the cucumber beetles.
	Anthracnose Downy mildew	Plant resistant variety. Spray with chlorothalonil (1 2/3 to 2 tablespoons) when plants are in first true leaf stage or when conditions are favorable for disease development. Repeat applications at 7-day intervals.
	Powdery mildew Scab	Plant resistant variety. Spray with chlorothalonil as above except use 2 to 3 tablespoons.
	Fruit rots	Grow the cucumbers on a trellis using cucumber-mosaic-resistant variety. Spray with chlorothalonil (9 tablespoons in sufficient water to obtain runoff). Make a single application when vines begin to run. (Use Bravo for these diseases only if a trellis is not used.)
Cantaloupe, Squash, Muskmelon, Honeydew melon, Watermelon, Squash, Pumpkin	Anthracnose	Spray with chlorothalonil (1 2/3 to 3 tablespoons) beginning when plants are in the first true leaf stage or when conditions are favorable for disease development. Repeat applications at 7-day intervals.
	Downy mildew	
	Cercospora leafspot	
	Gummy stem blight	
	Leaf blight	
	Scab	
	Powdery mildew	
Pepper	Damping-off (Plant bed)	Locate plant bed in sunny, well-drained area. Produce plants in sterilized soil. To get sterile soil, purchase sterile potting soil or bake soil in the oven until a medium-sized potato placed in the middle of the soil is done; or have a licensed pesticide applicator treat the soil with methyl bromide or Vapam or use solarization. If damping-off becomes a problem, drench with captan (50 WP) at the rate of approximately 2 tablespoons per gallon of water applied to 100 square feet at first appearance of disease and repeat if necessary.
	Bacterial leafspot	Spray with copper (2 to 3 tablespoons per gallon of water) at first appearance of disease. Repeat every 7 to 10 days.
Potato	Early blight Late blight and other leaf diseases	Spray with chlorothalonil (1 to 1 1/2 tablespoons). Begin applications when plants are 6 to 8 inches high or when diseases first appear. Continue at 7- to 10-day intervals or as needed to maintain control.
	Seed-piece decay	Warm potatoes to 55°F before cutting; after cutting, keep potatoes at 55°F and high relative humidity (95 percent) for 3 to 5 days to aid the healing process, but do not let water condense on the potatoes; dust with maneb or captan before planting.
	Scab	Do not grow potatoes in soil that has been limed too heavily. (A pH of 5.2 to 5.5 is preferred.)
	Virus diseases	Plant only certified seed.
Sweet corn	Bacterial wilt (Stewart's disease)	Plant resistant varieties. Spray susceptible varieties with a labeled insecticide to control flea beetles.
	Southern corn leaf blight and other leaf diseases	Plant resistant varieties.
	Smut	Plant resistant varieties; grow corn in full sun; use only recommended amount of nitrogen.
Sweetpotato	Black rot Scurf	Use only disease-free roots for plant production; use cut plants; produce cuttings in pathogen-free soil.
	Storage rots	Do not expose sweetpotatoes to temperatures below 55°F. Cure roots immediately after digging for one week at 85°F and high humidity. Never place sweetpotatoes in airtight bag or container.

Crop	Disease	Control
Tomato	Bacterial leafspot	Use disease-free transplants. Spray with copper fungicide (2 to 4 tablespoons per gallon of water) at first appearance of disease and repeat at 7- to 10-day intervals.
	Damping-off (Plant bed)	Same as pepper.
	Early blight	Rotate; use disease-free transplants; follow good sanitation practices; spray with chlorothalonil (1 1/2 to 2 1/2 tablespoons) when disease first appears and repeat every 7 to 10 days.
	Late blight	
	Grey leafspot	
	Septoria leafspot	
	Leaf mold	
	Southern bacterial wilt	Plant resistant variety, either Venus or Saturn. Follow a long rotation (three years or more).
Verticillium wilt Fusarium wilt	Plant resistant variety (many are available). VFN used in the name means that a variety is resistant to Verticillium wilt (V), Fusarium wilt (F), and root-knot nematodes (N). Varieties are available with resistance to one or more of these diseases.	
Tobacco mosaic	Only preventive measures are effective. Do not use tobacco products (or, if you do, wash hands with a strong soap after you use tobacco) before handling plants or foliage.	
Other Vegetables	Virus diseases	Plant resistant varieties whenever possible. Many viruses that affect vegetables are present in weeds and are carried from the weed host to vegetable plants by insects, particularly aphids and leafhoppers. Controlling insects and removing weeds will decrease the threat of virus infection. Use virus-free plants.
	Damping-off (Plant beds)	Locate the plant bed in a well-drained site in full sun. Use sterilized soil (see pepper). Use only disease-free seed. Plant at proper time. Use solarization.

*Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by the North Carolina Cooperative Extension Service nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension Service agent.*

Prepared by  
Harry E. Duncan and Charles W. Averre  
Extension Plant Pathology Specialists

10,000 copies of this public document were printed at a cost of \$1,185.00 or \$0.12 per copy.

Published by  
**NORTH CAROLINA COOPERATIVE EXTENSION SERVICE**

---

Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Employment and program opportunities are offered to all people regardless of race, color, national origin, sex, age, or handicap. North Carolina State University, North Carolina A&T State University, U.S. Department of Agriculture, and local governments cooperating.

---