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# CONTROL DISEASES FOR FINER TOMATOES



Circular 635

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V. P. I. Agricultural Extension Service  
Blacksburg, Virginia

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# Tomato Disease Control

by

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**T**OMATO yield and quality are reduced by a wide variety of diseases. This circular describes their most common diseases and lists the principal control measures. To be successful a grower must prevent these diseases; there is no cure. The following measures should be followed every year:

1. Rotate the location of your tomatoes each year. Don't go back to a site for 3 or more years because many destructive disease organisms survive in the soil for several years. Don't plant tomatoes following potatoes, peppers or eggplants. When possible avoid fields adjacent to these crops.

2. Grow plants from certified seed or from disease-free certified plants. Plants should not be bruised, and they should be set just after they are pulled.

3. Allow plants ample growing space to hasten evaporation of excessive moisture and to promote vigorous growth. For effective disease control, minimum injury, and convenience in picking, rows should be at least 5 feet apart.

4. Keep plants growing vigorously. The first step is selecting good soil and fertilizing as recommended for it. Controlling weeds helps delay disease development.

5. Use only recommended varieties.

After all these practices have been carefully followed, there may be times when the proper use of fungicides will pay handsome dividends. In damp locations or where past history indicates that leafspot diseases or late blight is liable to occur, it may pay to apply fungicides as a general practice each year. Watch for the Late Blight Warning Service reports. If weather conditions are such that late blight might become severe in certain areas, warnings will be sent out, by

radio and newspapers, advising you to start spray applications immediately.

Fungicides control diseases not by curing infected plants, but by preventing diseases from starting and spreading. The important steps to follow in an effective fungicide program are: (a) Use a fungicide that will control threatening diseases; (b) apply the fungicide before plants are infected; (c) apply it often enough to cover new growth and to replace fungicide washed off by rain; and (d) cover completely all leaves, stems and fruit. Less material is required for disease control when it is used as a liquid spray rather than as a dust. Experiments show that tomato diseases can best be controlled by applying fungicides from the ground; not from an airplane.

Wet sprays may be applied at any daylight hour when the air is quiet. For best results, dusting should be done in the early morning, late evening, or at night, while plants are damp with dew and the air is still.

For good spray coverage apply 150 to 200 gallons of spray per acre at a pressure of 250 to 350 pounds. For effective dust coverage apply 35 to 50 pounds of dust per acre. Spray booms should carry 3 to 6 nozzles per row; dusters 2 or 3 nozzles per row. Nozzles should be adjusted to give complete coverage of the plants.

Sprays usually should be applied every 10 to 12 days; dusts every 7 to 10 days. To do a comparable job, it will take more applications of dusts than of sprays. If the weather is cool and wet, and diseases are prevalent, applications should be made at 7-day intervals. Because disease organisms are very active during foggy, wet weather, it is important to have plants covered with fungicide during such times. If the weather turns hot and dry, applications may be made every 12 to 14 days.

Timing of the first fungicide application depends on weather conditions and the de-

velopment of the disease. Both also determine the number of applications that will be necessary. Normally, a program of 5 sprayings or 6 or 7 dustings for the season should be satisfactory. Wet weather and a disease epidemic will increase the number of applications required. Unless late blight is present or threatening, the first application can be delayed about 6 weeks, until the fruits of the first cluster are about half grown. But if late blight is present or threatening, an application should be made immediately regardless of plant size.

Newer organic fungicides, such as maneb and zineb, are replacing the older copper sprays. Maneb is sold under the trade names of Manzate and Dithane M-22. Two pounds of 70% wettable powder should be mixed with 100 gallons of water and applied at the rate of 150 gallons per acre. For a smaller quantity of tomatoes 1½ tablespoons should be mixed with 1 gallon of water. Mixing directions are given on the label. If dusts are preferred, use a 6% material.

Zineb satisfactorily controls most leaf-spotting diseases. Two and one-half pounds should be mixed with 100 gallons of water and applied at the rate of 150 gallons per acre. For a smaller quantity of tomatoes use 2½ level tablespoons in 1 gallon of water. If dusts are preferred, use 6% material.

Fixed copper sprays are superior to the organic materials for controlling late blight, but they are not as effective for controlling the other leafspot diseases of tomatoes. Copper sprays should contain 2 pounds of actual copper per 100 gallons (4 pounds of a 50% material, or 8 pounds of a 25% material). Copper dusts should contain 7% copper.

Bordeaux mixture is not a fixed copper, but is made by combining copper sulfate and hydrated lime in water. It is an excellent fungicide; however, it may injure tomato plants and reduce yields. Stunted growth is especially noticeable on young plants and

on older plants that have received several applications of spray at short intervals. Bordeaux mixture may be used, where late blight has become established, to check further spread of the disease. It may also be used with safety toward the end of the season. A freshly prepared Bordeaux mixture is superior to the commercially prepared dry types.

A new organic fungicide sold under the trade name of Dyrene looks very promising on tomatoes. Two to 3 pounds of 50% wettable powder should be mixed with 100 gallons of water. A 5% Dyrene dust effectively controls early blight and grey leafspot. Dyrene is less effective than the copper fungicides against late blight. If late blight threatens, switch or alternate with applications of copper or maneb.

### **Seedling Treatment at Transplanting Time**

Tomato seedlings are very tender. They receive a severe shock when transplanted from a protective greenhouse or plant bed to a windy, sunny and insect infested field. Their root systems are damaged; it takes 10 days to 2 weeks for each seedling to become established. During this period a seedling is very susceptible to collar rot, early blight and similar diseases. Such insects as flea beetles and cutworms prey on them.

Protection can be provided by spraying the seedlings with a fungicide-insecticide mixture just before transplanting. It should be repeated 5 to 7 days after they are set in the field or garden. Either zineb or maneb may be used. For the control of flea beetles, add 2 tablespoonfuls of 50% DDT wettable powder to a gallon of spray for each treatment. Cutworms may be controlled with 10% DDT or 10% toxaphene dust applied to the surface of the ground around each transplant at the time of setting. Repeat the treatments at 7-day intervals as long as needed or as long as cold weather prevails.

## TOMATO DISEASE CHART

Disease	When to Treat	What to Use
Rootknot	Fumigate in fall or spring prior to planting	Rotate planting site with non-susceptible crops. If rootknot has been a serious problem, fumigate with DD or EDB. (Note "A").
Fusarium wilt	Prior to seeding plant bed or transplanting plants	Use a Fusarium wilt resistant variety and select a new plant bed site, or sterilize soil with methyl bromide. Use a 3- or 4-year rotation in the field. (Note "B").
Damping-off and leaf diseases in plant bed	Before seeding	Treat seed with New Improved Ceresan (Note "C"). Spray plant bed weekly with zineb (2½ tablespoons per gallon). (Note "D").
Leaf and fruit diseases in field. Early blight, late blight & other leafspots	Start when fruits are about the size of pullet eggs (about 6 weeks after planting). Repeat sprays at 7- to 10-day intervals.	Maneb, zineb or fixed copper applied according to directions on the label. (Note "D").

### Notes

- A. Ask for V.P.I. Circular 651, "Fumigation for Rootknot Control in the Home Garden." See your county agent.
- B. Homestead is resistant to Fusarium wilt.
- C. See V.P.I. Circular 768, "Vegetable Seed Treatment."
- D. Apply spray at the rate of 150 to 200 gallons per acre, at 300 to 350 pounds pressure. Apply dust when the air is still, at the rate of 40 to 50 pounds per acre. Thorough coverage is essential; all parts of the plant must be covered. Repeat spray applications every 10-12 days; dust every 7-10 days.
- E. Federal residue tolerances must be considered, especially by the fresh-market growers. All pesticide labels specify on which crops the chemical may be safely used, the amount to be used, and time necessary to elapse between using and harvesting. Growers must read and follow directions on labels.

### DESCRIPTION OF SOME FUNGICIDES

Some Trade Names*	Descriptive or Coined Name†	Type of Formulation or Constituents‡	% Active Ingredient
Orthocide, Captan	captan	N-(trichloromethylthio) 4-cyclohexene-1, 2-dicarboximide	50% or 75% WP and various % dusts
Dyrene	dyrene	2, 4-dichloro-6-(0-chloroanilino) triazine	50% WP 5% D
Copper-Hydro, C.O.C.S. Copper A, Basicop, Cupro-K, Tribasic, Micro Nu-Cop, Ortho 53	fixed copper	Various forms of low soluble copper	23-53% WP 7% D
Manzate, Dithane M-22	maneb	manganous ethylenebis (dithiocarbamate)	70% WP 4.9% to 6% D
Dithane D-14, Parzate Liquid	nabam	disodium ethylenebis (dithiocarbamate)	19% liquid
Terraclor	terraclor	pentachloronitrobenzene	75% WP 20% D
Arasan, Tersan, Thiram Naugets	thiram	bis (dimethylthio carbamoyl) disulfide	75% WP
Dithane Z-78, Parzate	zineb	zinc ethylenebis (dithiocarbamate)	65% WP 4.5% to 6% D
Zerlate, ZC, Karbam White, Corozate, Methasan, 22	ziram	zinc dimethyldithio carbamate	76% WP 5.3% D

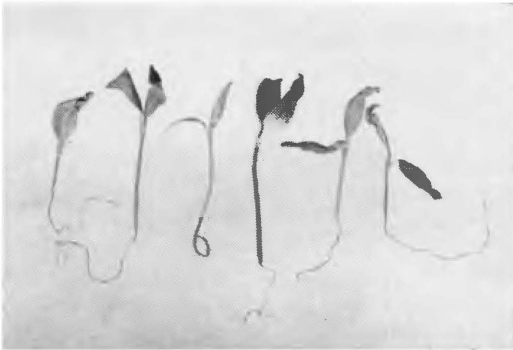
\*No attempt is made to list all brands. A few widely distributed brands are listed as examples.

†Some chemicals have technical names or letters; others have the same technical name as trade name.

‡Formulations may be changed from time to time. These are intended only as a guide. *Read the label.* Formulation abbreviations: WP = Wettable Powder; D = Dust.

## DISEASES AFFECTING THE ENTIRE PLANT

### DAMPING-OFF



**Symptoms** — Young seedlings are killed, or become infected, soon after emergence. Stems are affected at, or near, the ground level. Seedlings wilt, usually fall over and die. The disease is often confined to certain sections or spots in the plant bed.

**Control** — Use a plant bed that has clean soil with good drainage. Where practical sterile the soil. Treat the seed with a fungicide such as New Improved Ceresan; avoid overcrowding and overwatering the seedlings; provide adequate ventilation in the plant bed. When damping-off starts, drenching the soil with a fungicide (captan, zineb or ferbam) will aid in checking further spread.

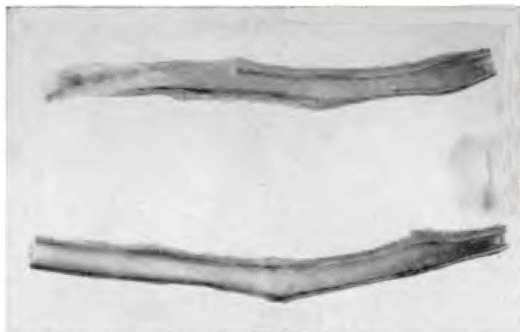
### BACTERIAL WILT



**Symptoms** — Wilting is rapid and complete with no apparent yellowing of the foliage. Affected plants soon die; leaves do not drop off. Stems cut at the ground level show a dark water-soaked condition.

**Control** — Practice rotation. Avoid planting tomatoes after Irish potatoes, eggplants, or peppers. Use disease-free plants and avoid poorly drained soils.

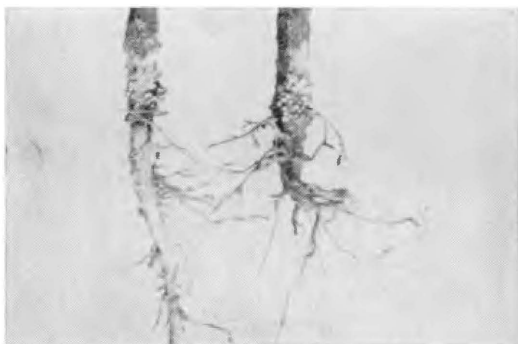
## FUSARIUM WILT



**Symptoms** — The first symptoms are a yellowing and wilting of the lower leaves, often more pronounced on one side or on one shoot. Gradually the entire plant turns yellow, wilts and dies. Cut stems show dark-brown, discolored, water conducting tissues.

**Control** — Use a resistant variety and grow plants on clean soil, or buy disease-free plants. Practice long rotations (4 or 5 years). The most commonly grown resistant variety is Homestead. Other varieties, such as Pan-America and Southland, possess greater resistance but are not as well adapted to Virginia conditions.

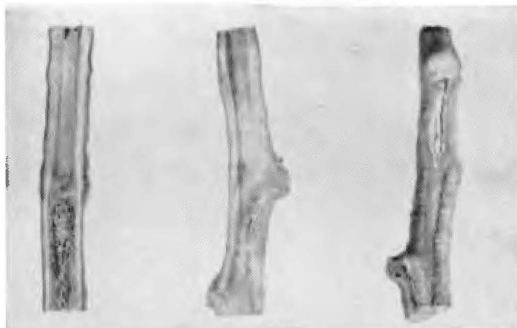
## SOUTHERN BLIGHT



**Symptoms** — First there is a gradual wilting of the entire plant without much change in color of foliage. At the soil line the main stem is decayed and covered with a white fungus growth. Usually it contains small, dark-colored sclerotia (seed-like bodies). Southern blight may also attack the fruits that are on or near the soil.

**Control** — Use clean, disease-free plants. Since many other crops are affected, avoid fields in which a recent crop showed this trouble. Avoid the use of contaminated manure.

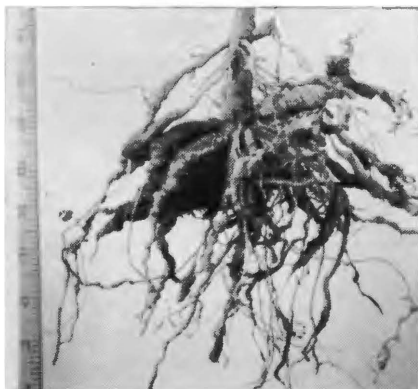
## BACTERIAL CANKER



**Symptoms** — At first the leaflets roll, then wilt on the ground upward, and die. The leaf petioles remain green and firm. Later open cankers develop on the stem, and the pith can readily be separated from outer parts of the stem. Fruits sometime develop spots (tan centers with white margins).

**Control** — Since the disease is seed-borne, use disease-free, certified seed or plants. Avoid planting tomatoes for 3 or 4 years in fields where this disease has occurred.

## ROOTKNOT

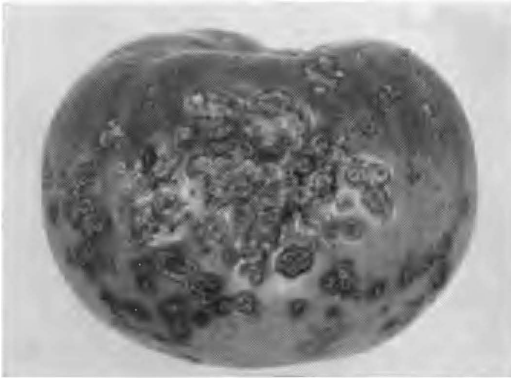


**Symptoms** — Severely affected plants are stunted and sickly, wilt in dry weather but may recover at night for a time, then may die. Roots of such plants show large swellings or galls.

**Control** — Use certified or disease-free plants. Include small grains or other resistant crops in the rotation. Applications of soil fumigants will control rootknot and several other nematode diseases.

## DISEASES AFFECTING FOLIAGE AND FRUIT

### BACTERIAL SPOT



**Symptoms** — Small, dark, irregular, greasy-appearing spots appear on leaves, later enlarge, turn black, and sink slightly on the underside of the leaf. Severely affected leaves turn yellow and drop off. On green fruit the spots at first are small, black and raised, later become slightly sunken and light brown with a scabby, roughened surface.

**Control** — Disease is seed-borne. Treat seed with New Improved Ceresan or use disease-free plants.

### LATE BLIGHT



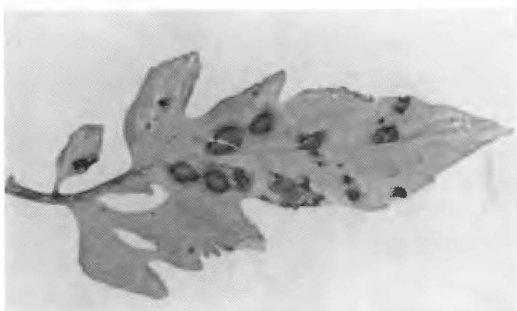
**Symptoms** — Leaves, stems and fruit are affected. On leaves, greenish-black, irregular, water-soaked patches develop. Under moist conditions spots enlarge rapidly and develop a moldy growth on the underside of the leaf. Elongated black cankers may develop on stems and leaf petioles. On the fruit, water-soaked spots develop, enlarge rapidly, and gradually turn to a blotchy greenish-brown canker. The surface of the affected areas is firm and irregular, sometimes covering half the fruit. Rainy, foggy weather with temperatures of 40 to

60° F. at night and 70 to 80° F. in the daytime favors the disease.

**Control** — Use disease-free seedling plants, and spray with a fungicide (maneb or copper). When late blight is severe, Bordeaux mixture may be used to check the disease.

## DISEASES THAT CHIEFLY AFFECT FOLIAGE

### EARLY BLIGHT



**Symptoms** — The most conspicuous symptoms are large, dark, circular spots with concentric markings making a target spot effect on leaves, and dark, sunken lesions on stems. In severe attacks the leaves fall off. Stem lesions near the base of the plant (collar rot) stunt the plants and often cause them to topple over and break off. Fruits may develop dark, leathery spots at or near the stem end.

**Control** — The use of disease-free seedling plants is very important. Practice rotation, and spray or dust with one of the recommended fungicides (maneb or zineb). Well fertilized soils usually have less damage.

### TOMATO MOSAIC



**Symptoms** — This disease is caused by a virus. Leaves are mottled with light- and dark-green areas, and are often distorted or malformed. Tomato mosaic in combination with the latent potato

virus, produces a disease known as streak showing up as spotting of leaves, streaking of stems, and blotching of fruit. Another virus disease of tomatoes is caused by cucumber mosaic (shoestring type of malformation of leaves).

**Control** — Avoid unnecessary handling of plants in the plant bed and in the field. When potting seedlings or setting plants, practice sanitation; wash hands with soap and water and avoid use of tobacco. Practice clean cultivation, destroy weeds and volunteer potato plants, and control insects, especially aphids.

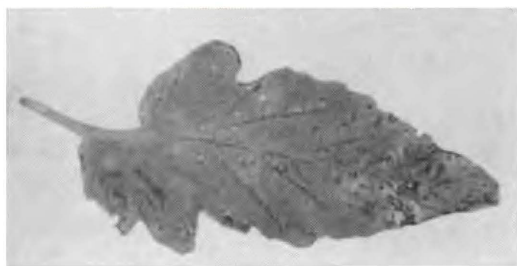
#### SEPTORIA LEAFSPOT



**Symptoms** — Affected leaves show numerous small spots with dark margins and gray centers containing numerous black specks. When severely attacked the leaves turn yellow and drop off.

**Control** — Practice rotation and clean cultivation. Spray or dust with suitable fungicide (maneb or zineb).

#### GREY LEAFSPOT



**Symptoms** — Diseased plants show numerous small dark-brown spots on the leaves, which have a glazed grayish-brown appearance. Leaves become yellow, wither and drop, starting with the lower leaves and progressing upwards until only tufts of new leaves remain at the tips of the stems.

**Control** — Same as for early blight.

## LEAF ROLL



**Symptoms** — Leaf roll is a physiological disease. Older leaves roll upward and inward at the margins. Foliage does not turn yellow but becomes firm and leathery to the touch.

**Control** — Avoid severe pruning of staked tomatoes. Provide good growing conditions. When possible, maintain an adequate and uniform supply of moisture.

## DISEASES THAT AFFECT THE FRUIT ONLY

### ANTHRACNOSE



**Symptoms** — Anthracnose causes light-brown circular, sunken spots with rings of darker color on ripe fruit. Small black specks often develop in the center of these spots. Soft rots may follow.

**Control** — Follow a rotation. Avoid poorly drained soils. Staking or mulching plants will reduce the disease. Follow a regular spray program, using maneb or zineb.

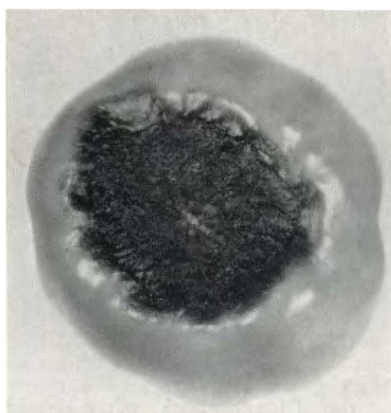
## SUN SCALD



**Symptoms** — Sunscald causes whitish patches with a scalded appearance on the portion of the fruit exposed to the sun. Injured areas often turn dark or develop a soft rot due to invasion by secondary organisms.

**Control** — Keep plants in a good growing condition by proper fertilization and controlling leaf-spot diseases. Use varieties with heavy foliage.

## BLOSSOM-END ROT



**Symptoms** — Blossom-end rot is a physiological disease. Dark, sunken, leathery spots appear on the blossom end of fruits. Spots vary in size, sometimes affecting half the fruit.

**Control** — Avoid excessive applications of nitrogen. Maintain an even supply of moisture by using a mulch and adding organic matter to the soil.