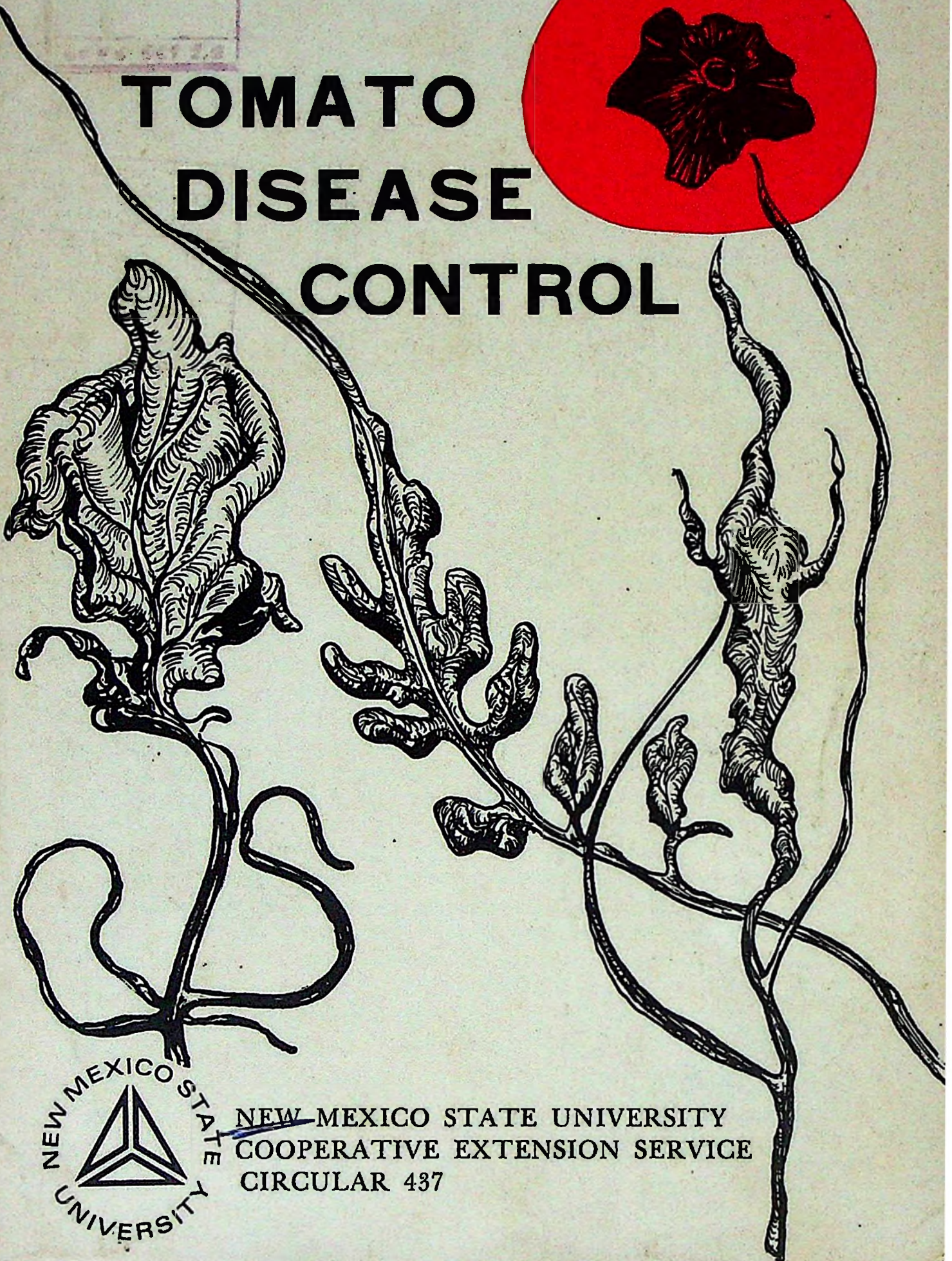


# TOMATO DISEASE CONTROL



NEW MEXICO STATE UNIVERSITY  
COOPERATIVE EXTENSION SERVICE  
CIRCULAR 437

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# Tomato Disease Control

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Tomatoes are attacked by several disease organisms that reduce both yield and quality. Control of these diseases means

the difference between profit and loss. Effective control consists of knowing what diseases you have and implementing an effective control program.

## Root Diseases and Wilts

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### *Seedling Disease*

Seedling disease, commonly called damping-off, is caused by soil-borne fungi. Young seedlings that damp-off commonly topple over, which results in poor stands. Seed may fail to germinate and rot in the ground. Another common symptom is small, brown, dry or water-soaked lesions on the plant at the soil line. The entire root may be brown and rotted.

To control seed rots, treat seed with captan or thiram. When buying transplants, select only vigorous, healthy plants. Do not try to grow seedlings in poorly drained seedbeds or fields. If you raise your own transplants, grow them in soil that you have sterilized with steam, methyl bromide, or other fumigants that destroy fungi.

### *Root-Knot Nematodes*

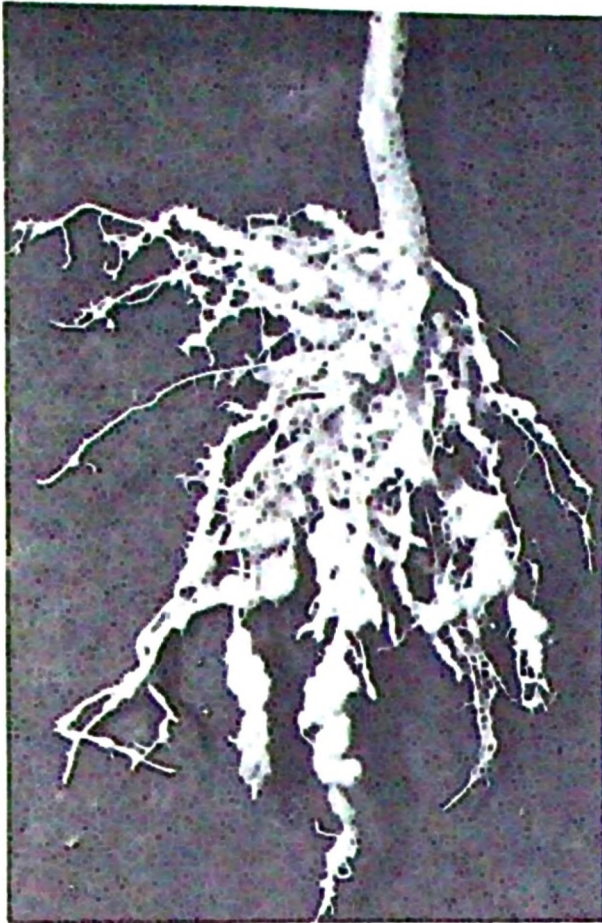
Nematodes are microscopic worms which cause damage by feeding on the roots of plants. Above-ground symptoms include stunting, wilting, yellowing of older leaves, and general plant unthriftiness. Roots infected with root-knot

nematodes have obvious swelling or galls which can be as small as a pinhead or as large as a thumb. Injury is more likely and most severe in sandy soils.

DBCP (Nemagon, Fumazone), D-D, and Telone soil fumigants have given good control of nematodes. These fumigants can be applied in the fall or spring when soil temperatures are between 40 and 80°F. Make sure the soil is free of clods and in seed-bed condition, as if it were ready for planting. Adjust injection chisels to the same spacing as the planter. Inject at least six to eight inches deep, and seal with a roller drag. Check label directions concerning rates of application.

Apply D-D or Telone at least two weeks before planting to avoid injury to tomato plants. DBCP can be applied before planting, at planting, or after the plants are up and established. *Caution: Do not overdose; excess DBCP can cause stunting of tomato plants.*

Home gardeners can use liquid fumigants even though they do not have injection equipment. A quart fruit jar with two ten-penny nail holes in the lid (on opposite sides—one to pour from and the other to equalize the pressure in the jar) can be used. Make a furrow six to eight inches deep directly in the row to be planted. Dribble the chemical into the



*Tomato roots infected by root-knot nematodes. The swellings may contain hundreds of these parasites.*

furrow with the fruit jar applicator. If nemagon granules are used, simply sprinkle them into the furrow.

Handle nematocides with extreme care. Do not breathe vapors. Use rubber gloves when you work with these fumigants because some liquid formulations can be absorbed through the skin.

### ***Root Drowning***

Conditions that lead to root drowning include over-irrigation, heavy soils with poor drainage, frequent rains, and fields with both light-textured and heavy-textured soils.

Grey or black decayed areas appear along the main root of the plant. The interior portions of the root and lower stem turn dark brown with brown streaks extending further up into the stem. Water supply to the upper plant is cut off, causing wilting, stunting, and even death. Many times, new white crown roots form near the soil surface. Plants that form new roots recover, but they may remain stunted.

Control measures center around water management. Avoid fields of different soil textures which must be managed under the same irrigation system. Select fields with soils which are medium-textured and well-drained. Fields which can be drained of excess water are desirable. Apply water carefully, making sure to use the proper amount (not too much) at the proper times.

### ***Salt Injury***

Young plants of field-seeded tomatoes can be damaged or killed by excessive salt. When high concentrations of salts are applied suddenly, roots are burned, foliage wilts in bright sun, and leaflets and sections of whole leaves quickly die. Often the stem below the soil surface dies with no apparent damage to roots. When plants are very young, a good stand suddenly may be lost.

This injury may be caused by a high salt content in the soil or by fertilizer, especially nitrogen, being placed too close to the seed. Symptoms usually develop after a sudden, relatively light rain. The rain water may wash the salt into the root zone and kill the stem or roots below the soil surface.

To avoid injury, plant in soils relatively free of salt. Use a double row and plant

one row on each side of the bed. Sub-irrigate the bed completely in each irrigation to move the salt to the center of the bed and out of the seedling root zone.

### *Verticillium and Fusarium Wilt*

Verticillium and fusarium wilt are two distinct diseases, caused by different soil-borne fungi. The symptoms, however, are essentially the same, and although no complete control is known for either disease, the same measures are used against both. Verticillium wilt is more widespread in New Mexico. It attacks cotton, chile, potatoes, okra, and several other vegetables and ornamental plants.

Both diseases are caused by soil-inhabiting fungi that enter plants through the roots and plug the water-conducting vessels. Lower leaves turn yellow, gradually wither, and fall. As the disease progresses in the plant, only the leaves near

the tips of branches remain alive. A dark brown discoloration in the woody portion of the stem confirms a diagnosis of verticillium wilt or fusarium wilt.

Planting tomatoes in the same field year after year intensifies wilt diseases. Rotation with other vegetable crops is generally of no value in controlling verticillium wilt, since many of them are also susceptible to the fungus. Crop rotation with a small grain, such as barley, will help reduce the severity of the diseases. The best control method is use of resistant varieties. A "V" in the variety name indicates resistance to verticillium wilt; an "F" indicates resistance to fusarium wilt. VF 145, a machine-harvested variety, is resistant to both verticillium and fusarium. Manapal, a greenhouse variety, is resistant to fusarium wilt. Home-garden tomato varieties with resistance include Homestead -24 (F), Heinz 1350 (VF), Bonus (VF), Terrific (VF), Spring Set (VF), and Vine Ripe (VF).

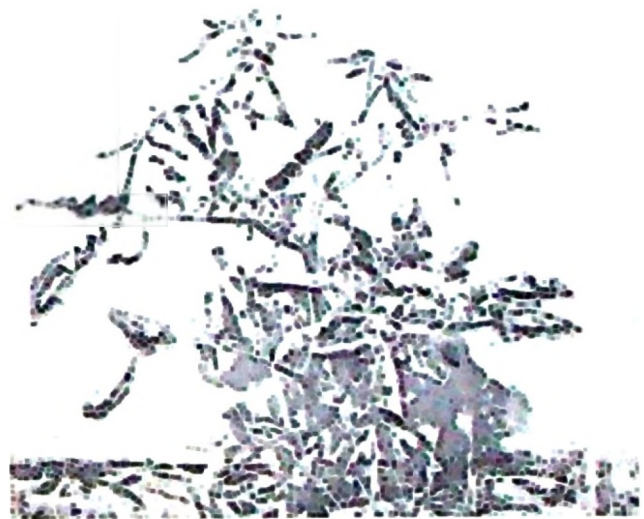
## *Leaf Diseases*

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### *Curly-Top Virus*

This disease is often a problem in chile, beans, and many other vegetables. The virus is spread by the sugar-beet leafhopper. The most striking symptom of the disease is plant stunting. Early in the season, diseased plants growing next to healthy ones appear healthy except for being much smaller, and they may be quite stiff and erect.

As the disease progresses, leaves curl upward and twist so as to expose the undersides. They gradually become leathery and stiff and turn a dull yellow. The veins may turn purplish. The roots die gradually. Diseased plants produce little



*The curly-top virus causes tomato leaflets to roll upward and to twist. The branches are abnormally erect.*

or no fruit. Early infected plants die early in the season.

Disease loss can be reduced by spraying or dusting with insecticides to control leafhoppers. Plant for a thick stand, and thin plants as they become crowded. Remove stunted plants as they appear. Home gardeners can help prevent losses by partially shading plants with muslin tents or by other means early in the season. Leafhoppers which carry the virus do not feed in shady locations.

### *Tobacco Mosaic Virus*

Light and dark areas on young, developing leaves is the most noticeable symptom of this disease. Leaves may be curled, pointed, and malformed. Plants infected early in the season may be stunted. The disease reduces fruit set and lowers fruit quality.

Tobacco mosaic virus is highly infectious and easily spread. You can transmit it by touching a healthy tomato plant after having touched a diseased plant. Aphids can spread the disease throughout a field and from one field to another. Tobacco is often the source of infection. For this reason, workers should wash their hands carefully with soap and water after using tobacco.

Workers should also avoid excessive handling of plants in the plant beds or in the field. Use of insecticides to control aphids will also help control the disease.

### *Cucumber Mosaic Virus*

Symptoms are similar to tobacco mosaic virus. The leaves become very narrow and distorted, with a pronounced shoestring-like appearance. Diseased



*Tomato leaves showing symptoms of tobacco mosaic.*



*Cucumber mosaic virus on tomato leaves causes them to twist and become distorted.*



*Leaflets and stems of tomato showing symptoms of early blight: A. Leaflets showing spots with characteristic target-like markings and yellowing. B. Cankers on stem of an older plant. C. Collar rot injury on seedling stems.*

plants are often stunted and produce small fruits and low yields. The virus is commonly transmitted by aphids and cucumber beetles, but it may also be spread by workers. Good insect control will keep this and other virus diseases at a minimum.

### *Early Blight*

This fungus disease can injure tomato plants at any time during the season. It may affect seedlings causing "collar rot", and it may cause spotting on the leaves and fruit. The disease is identified by the typical concentric rings, or target pattern, on the leaves.

The disease can cause severe defolia-



*Early blight on tomato. Infection usually occurs near stem scar, and the spots have concentric markings.*

tion during wet, humid weather. The fungus also causes dark, leathery, sunken spots on fruit. These spots may reach a considerable size and may have concentric rings like those on leaves. Infected fruit is not fit for marketing.

Control by spraying with a fungicide such as maneb, zineb, or Dyrene if the disease threatens to spread during wet weather. Use a three-year rotation, and plant on wide, high beds.

### *Non-Infectious Leaf Roll*

This sometimes occurs when soils are too wet or dry, or when there is a nutrient imbalance. It sometimes occurs after close cultivation and extremely close pruning, and it is worse on staked tomatoes. On some varieties, leaf roll may be quite pronounced. Leaves start rolling from the bottom of the plant and proceed until nearly all leaves are affected.

## *Fruit Diseases*

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### *Blossom-End Rot*

As the name implies, injury starts at the blossom end of the fruit. The first noticeable symptom is the appearance of a watersoaked spot that enlarges and becomes brown and leathery. One half or more of the fruit may become affected.

Root pruning, fluctuations in water supply, salinity, heavy application of nitrogen fertilizers, and a lack of calcium are associated with blossom-end rot.

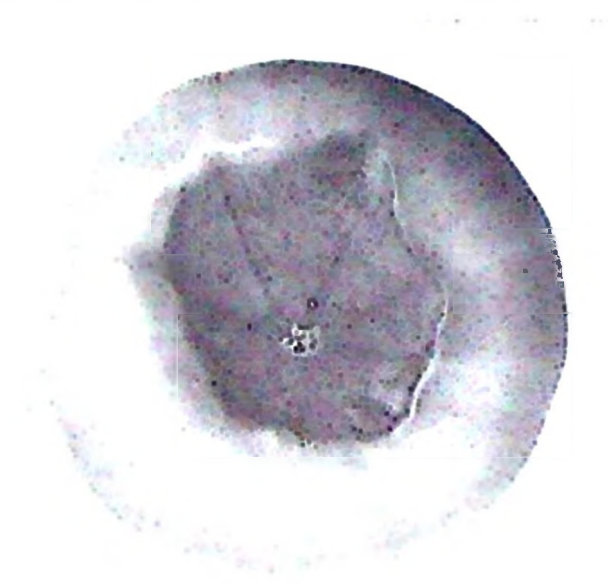
Control this disorder by providing a uniform supply of water; soil mulches may help. Some research reports have shown that calcium applications reduce the occurrence of blossom-end rot.

Ordinarily, plants produce a near-normal crop.

Leaf roll can be reduced by planting tomatoes in a well-drained soil and by watering and fertilizing properly.

### *2. 4-D Injury*

Tomato plants may be injured by a spray drift of 2, 4-D or by using sprayers contaminated with this herbicide and related compounds. Even a small amount of this chemical can cause severely distorted, misshapen leaves. New leaves do not expand fully and they are twisted at the margins and very narrow and elongated, with abnormally pointed tips; veins are prominent and light colored. Fruits are misshapen and of very poor quality. Plants exposed to small amounts of 2, 4-D will outgrow these symptoms, but those exposed to higher concentrations will not recover.



*Blossom-end rot on tomato. The tissues are dark and shrunken, and the surface of the spot is dry and leathery.*



Spray leaves with a calcium chloride solution during periods of rapid growth. Use at the rate of two tablespoons in one gallon of water (4 pounds in 200 gallons of water per acre). Apply two or more sprays at weekly intervals.

### *Fruit Rots*

Small to large gray or black spots appear on fruit during periods of wet weather. Spots gradually enlarge, and the entire fruit usually rots. Fruit touching wet soil is likely to become diseased. Since several species of fungi can cause fruit rots, the symptoms may vary.

Control by preventing fruit from coming into contact with wet soil. Use high and wide beds to obtain surface drying. Home gardeners can tie plants to stakes or wires to keep them off the ground. When the disease threatens to spread during periods of wet weather, spray with zineb, maneb, or Dyrene.



*Soil rot on tomato. The surface is broken, and the markings are concentric.*



*Sunscald-injured tomato. The discolored surface is shrunken and flattened.*

### *Sunscald*

A light spot on the side of the fruit facing the sun is the first symptom of sunscald. Later there is blistering; and finally a large, flattened, grayish-white spot with a dry paperlike surface forms. These spots are often invaded by decay-causing organisms.

Sunscald may be quite pronounced on plants that have suddenly lost leaves because of verticillium wilt or early blight. Control by preventing diseases that cause leaves to shed. Home gardeners may avoid losses by covering exposed fruit with straw or other suitable material.

### *Growth Cracks*

Cracks of varying depth radiating from or encircling the stem end of tomato fruits are typical of this condition. They result from extremely rapid fruit growth. Cracks are most prevalent following a heavy irrigation when temperatures are

high. Control by providing a uniform supply of water and plant nutrients.

### **Catface**

Catface is a condition in which fruits become malformed and scarred; fruits are puckered and may have cavities extending

deep into the flesh. Extreme heat, drought, low temperatures, insects, and herbicide sprays can contribute to this problem. Some varieties are especially subject to catface injury. No adequate controls are available for catface. Most commercial varieties are not susceptible to the condition. When practical, remove malformed fruit as early as possible.

## ***Program for Disease Control***

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*Choose your seed carefully.* The seed should be disease-free and of a variety resistant to verticillium (V) and fusarium (F) wilt.

*Fumigate soil with a nematocide* if nematodes have been a problem.

*Treat seed with a fungicide,* using either captan (Captan 75, Orthocide) or thiram (Arasan, Panoram, Thiram). These chemicals protect sprouting seed from disease-causing organisms on seed and in the soil, and help you get a better stand.

*Use disease-free transplants grown under disease-free conditions.* To produce such plants—

- Use disease-free or chemically fumigated soil in the plant bed every year.
- Use seed treated with captan or thiram.
- Water the seedbed in the morning, so that the soil surface will be dry by nightfall.

—At intervals of four to seven days, spray or drench plants in the plant bed with captan or zineb. Use the rate of 1½ tablespoons per gallon of water.

—Wash hands with soap and water each time after using tobacco before handling plants.

*Change the location of your tomatoes each year.* A rotation with crops such as corn, sorghum, and small grains will help prevent a build-up of disease organisms. Do not plant tomatoes in fields where vegetables grew the previous year.

*Provide plants with an even water supply.* Plants stressed for water are more apt to have blossom-end rot.

*Spray with a fungicide* if the fruit or leaf diseases threaten to spread during periods of wet, humid weather. Use zineb, maneb, or Dyrene according to label directions.

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