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# Diseases of Tomatoes and Their Control

The tomato crop will play an important role in achieving our "Food for Freedom" goal.

Fresh or canned tomato fruits are high in vitamin C, have some vitamin A, are fair in amounts of vitamins B<sub>1</sub> and G, and also have some minerals, which make them especially valuable in the diet for maintaining health.

Protect tomato plants from their disease enemies, and, as an excellent food, tomato fruit will help to protect you.

# Diseases of Tomatoes and Their Control

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The tomato is one of the most widely cultivated of the vegetable crops in Colorado. There is scarcely a garden where it does not have a prominent place, and commercially there is an annual average of 16,300 tons of canning tomatoes and an annual average of 440,000 bushels of market tomatoes produced in the State.

As a "FOOD FOR FREEDOM," tomato is rated among the most important of the vegetables. The government has requested a 32 percent increase in canners, and an 18 percent increase in markets.

The tomato plant also rates as one of the most congenial hosts for fungus, bacterial, and virus diseases. The diseases of economic importance in the State are: Damping-off of seedlings, bacterial canker, blossom-end rot, collar-rot, early blight, fusarium wilt, phytophthora fruit-rot, and several virus diseases.

## Bacterial Canker

The symptoms of bacterial canker are easily detected by the upward rolling of leaves at the midribs. Browning of the leaves often occurs, followed by yellowish streaks and brownish, cankered areas extending up the outside of the stems. Either separate branches or the entire plant may die. The woody portion of infected stems show yellow to brown streaks extending upward in the vicinity of the vascular area. This infected tissue may collapse and the pith become discolored in the cankered area. A yellowish bacteria can usually be squeezed from the ends of infected stems. Often "bird's eye" or "halo" spots occur on fruits, as well as premature ripening.

The disease may be controlled by planting disease-free seed, harvested either from healthy plants or seed which has been allowed to remain in the fermenting pulp for 3 to 6 days previous to seed extraction. As an additional precaution, all seed should be treated

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Published and distributed in furtherance of the Acts of May 8 and June 30, 1914, by the Colorado State College, Extension Service, F. A. Anderson, Director, and U. S. Department of Agriculture cooperating.

either with semesan, at the rate of  $\frac{1}{4}$  teaspoonful per pound, or cuprocide, at the rate of  $1\frac{1}{2}$  teaspoonfuls per pound. Treat the soil of hotbeds with steam, formaldehyde, or chloropicrin (tear gas), as described in Colorado Extension Circular D-8, on Control of Damping-off. It is also advisable to practice a 3-to-4-year crop rotation.

### Blossom-End Rot

Recent investigations show that blossom-end rot is caused by fluctuation of the soil-moisture supply, together with a lack of phosphate and an excess of nitrogen in the soil.

The initial symptoms are the manifestation of small, water-soaked spots at the blossom-end. These spots enlarge and become sunken because of the shrinkage of the infected tissue. The rot is firm and leathery except when secondary soft-rot organisms invade the affected regions.

To control this disease, Colorado tomato growers should irrigate more often and reduce the amount of water per application, so that there will not be an alternating dry and wet soil condition, but rather an even supply of soil moisture, particularly during the early part of the fruiting season. Commercial fertilizers low in nitrogen and high in phosphate have been found to help control the disease.

### Collar-Rot

Collar-rot occurs in the State about once every 5 years and it has been known to cause a loss of 20 percent of the tomato plants in many fields of the Arkansas Valley and Grand Valley.

The disease is characterized by a brown, shriveled, sunken band, which either partially or completely girdles the stem near the ground line. It usually occurs on seedlings and young plants in hotbeds and greenhouses but may appear on older plants in the field.

All seed should be treated either with semesan, at the rate of  $\frac{1}{4}$  teaspoonful per pound of seed, or cuprocide, at  $1\frac{1}{2}$  teaspoonfuls per pound of seed. Disinfect the soils of hotbeds either with formaldehyde, steam, or chloropicrin. See Extension Circular No. D-8 on Control of Damping-off, for details on soil disinfection methods. Expose the seedlings to plenty of sunshine and have good ventilation for circulation of air around the plants. Spray seedlings and top soil of the hotbeds either with yellow cuprocide or dust with cuprocide dust.

### Damping-Off

This disease is quite common in hotbeds and greenhouses of the State. It causes rotting of seeds in the soil, death of young seedlings before they emerge, or a water-soaked rotting of the stems above the ground line, causing them to fall over and die. Damping-off can be controlled by the seed treatment, soil disinfection, and proper cultural practices which are given in detail in Extension Circular No. D-8, on Control of Damping-off.

### Early Blight

Early blight is a seasonal trouble in Colorado; however, like early blight of potato, it usually causes serious losses when and where it occurs.

The outstanding symptoms are the irregular black spots on the leaves which show rather indefinite concentric rings. Sunken black spots may appear on the stems. The fruits often show sunken black spots which may have a black, velvety, mold growth.

Treat all seeds either with semesan, at the rate of  $\frac{1}{4}$  teaspoonful per pound, or  $1\frac{1}{2}$  teaspoonfuls of cuprocide per pound. Disinfect hotbeds with steam, formaldehyde, or chloropicrin (tear gas), as given in Extension Circular No. D-8, on Control of Damping-off. Spray the seedlings, and top soil of hotbeds with yellow cuprocide. Use  $1\frac{1}{2}$  lb. of yellow cuprocide and  $\frac{1}{3}$  pt. emulsifier B-1956 per 100 gal. water. Either cuprocide dust, or copper oxychloride dust may be substituted for the spray. Cuprocide dust is made by thoroughly mixing 5 lb. yellow cuprocide with either 5 lb. vatsol K, or vatsol O. S. sticker, and brought to 100 lb. with cherokee clay filler. Make the first application when the disease first appears, and then at 10-day intervals. Apply 30 lb. of either dust per acre. Make two or three applications at weekly intervals and do not apply when plants are blooming. Best results are obtained when applied with power equipment.

### Fusarium Wilt

Fusarium wilt is caused by a soil-borne organism, and occurs quite generally on the Eastern Slope, but causes little or no trouble on the Western Slope. It is one of the most serious diseases of tomato.

The leaves of infected plants roll upward at the midribs and wilt during the middle of the day, but recover in the cooler part of the day and night. The lower leaves turn yellow and drop off, and the yellowing progresses upward until all the leaves of the entire plant are involved. The woody portion or vascular area of the stems show a dark-brown discoloration.

The only satisfactory control for fusarium wilt is the use of resistant varieties. In the Arkansas Valley the Early Baltimore resistant variety is well adapted. In the Montrose, Delta, and Grand Junction districts, the Marglobe resistant variety produces quite well. There are no fusarium wilt-resistant varieties adaptable in the Greeley, Arvada, Denver, Brighton, and Littleton districts.

### Phytophthora Fruit Rot

This is a relatively new disease of tomato in the State, and is especially serious in the Arkansas Valley and Brighton districts. The causal organism is known to be soil borne. The symptoms are manifested as irregular water-soaked areas on fruit, that are wrinkled, sunken, and light buff to brown in color. Under high, humid, growing conditions, such as may be created in a moist-chamber, a fine, cottony, somewhat-water-soaked, and sparse growth of the causal fungus appears over the infected area.

Preliminary control methods have been devised by Dr. Kreutzer, plant pathologist, and Mr. Hoerner, entomologist, of the Colorado Agricultural Experiment Station, and Mr. Fauber, superintendent of the Rocky Ford Sub-experiment Station. These investigators outlined the following tentative control methods: (1) Tomato plants should be planted on slight ridges. (2) Irrigate in fairly deep furrows and apply more often, with less water per run, to avoid alternation of wet and dry soil conditions. (3) Spray the plants with yellow cuprocide, or dust them either with cuprocide dust, or copper oxychloride. The method of making cuprocide dust is given under early blight of this circular. Mr. Hoerner has found that when either the tomato hornworms or corn earworms are causing damage, at the time the phytophthora fruit-rot is present, that the addition of 25 pounds of either cryolite or calcium arsenate, and applying it as above, will effectively control the worms as well as the disease. When either the cryolite or calcium arsenate is added, the amount of cherokee clay filler should be reduced an equal amount. Make the first application soon after a majority of the fruits have set, and continue at 10-day intervals for the remainder of the season.

### Fernleaf

Fernleaf is a virus disease of tomato that is characterized by dwarfing and general yellowing of the plants, with more than the usual number of deformed leaves. Some of the leaves are fern-like while others are string-like. Quite frequently the disease is referred to as shoe-string. Diseased plants are unproductive.

To control the disease, (1) Rogue all infected plants from crops. (2) Control weeds and sucking insects.

## Mosaic

The mosaic disease is quite common, and often causes serious losses in field and greenhouse tomato crops. It is caused by a virus that may be transmitted from infected to healthy plants by man, tools, and plant lice.

Usually the symptoms of mosaic are not noticeable until the plants are fairly well grown. All or possibly only a few leaves of the new growth show typical light and dark-green mottling, irregularly distributed over the surface. There is also considerable distortion and puckering of the leaves, which are somewhat narrower than normal leaves. The entire plant appears spindling, and paler than healthy ones. Symptoms do not show on leaves that were developed prior to inoculation. Certain strains of mosaic produce barely detectable, or mild symptoms, while others produce brilliant-yellow blotches on the leaves.

Mosaic is not easily controlled, but by employing the following recommendations it will cause little or no trouble. (1) Rogue out all infected plants in seedbeds and fields as soon as symptoms appear, and also remove all plants adjacent to the diseased plants. (2) Control sucking insects. (3) After handling mosaic-infected plants, workers should wash their hands with soap and water before touching healthy plants. (4) Do not use tobacco in any form while handling tomato plants. (5) Do not crowd plants either in the greenhouse or field because contact between infected and healthy plants will spread the causal virus. (6) Practice clean culture. (7) Destroy all weed carriers, such as groundcherry and wild cucumber within 300 feet of tomato fields. (8) Do not plant such crops as petunias, eggplant, potatoes, peppers, tobacco, or cucumbers in fields adjacent to tomato crops.

## Mottle

This virus disease can be recognized by the pale-green areas between the leaf veins. There is also little or no dwarfing of the plants, and the production of fruits is almost normal.

For control of this disease use the same methods that were given for mosaic.

## Ring-Spot

This virus disease may be recognized by the conspicuous brown ring-spots on the leaves, fruit, and stems which usually occur late in the growing season.

The virus is spread by insects, and by handling. Use the same method of control given for mosaic.

### Streak

The streak disease of tomato is caused by a virus that is easily transmitted from infected plants to healthy plants by man, insects, and pruning tools. It occurs quite commonly in greenhouse and field crops.

Usually the symptoms are not noticeable until the plants are fairly well grown. Dark-green streaks appear on the sides of stems and a spotting and rather sudden blighting of the upper leaves. The entire plant shows considerable dwarfing. Light-brown, sunken spots of variable size may be found on the fruit. In severe cases the plants may die.

The control for this disease consists of the following steps: (1) Destroy all of the old plants after harvest. (2) In the case of greenhouse crops, fumigate the house prior to planting to destroy sucking insects. (3) The virus which causes streak will live for about 3 months in the dead, tomato-plant refuse. It is, therefore, advisable to allow a lapse of 3 months or more, disinfect the soil with steam, formaldehyde, or chloropicrin (tear gas), or change to new soil, where successive tomato crops are grown. (4) Rogue out infected plants from seedbed and crop regularly. (5) Do not use knife when pruning; if so, dip the blade in (1 to 20) formaldehyde solution before pruning each plant. (6) After touching an infected plant, workers should wash their hands with soap and water before handling healthy plants.

### Spotted Wilt

Spotted wilt is a virus disease of tomato that causes brown spotting, and bronzing of the leaves, a dark discoloration of the stems and leaf-petioles, and a conspicuous circular spot on the fruit. The virus is spread from infected plants to healthy ones by thrip insects, and by contact.

The disease may be controlled by: (1) Roguing infected plants from greenhouse and field crops. (2) When workers have handled infected plants, they should wash their hands with soap and water before touching healthy plants. (3) Do not grow dahlia, zinnia, aster, chrysanthemum, cineraria, potato, winter cherry, lupine, nasturtium, plantain, tobacco, eggplant, pepper, campanula, broad bean, and lily plants within 300 feet of tomato crops in the field or in the same greenhouse with tomato crops.

### Verticillium Wilt

Verticillium wilt is becoming a serious disease in many of the tomato-producing areas of Colorado.

The entire plant appears unhealthy, and with basal leaves that manifest a dull green color, which later turn a slight yellow, roll upward along the midribs, but with no definite wilting. Internally the stems show a very light, uniform-brown discoloration of the woody part, which often fades out at the upper portion of the stem. The roots show uniform, internal, light-brown discoloration of the woody part.

There isn't any satisfactory control for this disease in Colorado at the present time. Resistant varieties are being developed in certain states but none of the work has been completed.

### Western Yellow Blight

This disease is caused by the virus of curly-top of sugar beets. Infected seedlings usually die while older plants show a retardation of growth, leaves roll upward along midrib, become leathery and turn yellow with purplish discoloration of veins. Fruit often ripens prematurely, and the plants may die.

Should the disease become abundant in greenhouse-grown crops, shading the plants, destruction of diseased plants and control of leafhoppers by fumigation will give good control. There are no practical control methods for western yellow blight in the field crops.