



### Quick Facts

- Winter damage and poor cultural management predispose strawberry plants to diseases. Red stele, Botrytis fruit rot and leaf spot are the most important strawberry fungus diseases in Colorado.
- Heavy (clay) soils are associated with red stele disease.
- Strawberry plants are most susceptible to disease-causing organisms when subjected to stress.
- Botrytis fruit rot infection usually begins on berries that are touching soil, but also may develop on that part of a berry touching another decayed berry or dead leaf.
- The best way to prevent strawberry diseases in the field or garden is to use disease-resistant, disease-free certified plants.

Strawberries are attacked by numerous diseases. Organisms causing these diseases may be on plants when they are purchased or in the soil where plants are set. Disease spores also may be carried into strawberry fields by wind, birds, insects and farm implements.

In most areas losses may be reduced by 1) using proper cultural methods, 2) selecting varieties adapted for the area, and 3) planting disease-free stock.

### Preventing Stress

Strawberry plants are most susceptible to disease-causing organisms when subjected to stress. Stress results from planting in the wrong type of soil, incorrect planting depth, too much or too little water, too much shade, winter desiccation and frost heaving.

Mulching may serve to prevent winter damage and frost heaving.

Mulching after the ground is frozen (approximately December 1st) reduces excessive dehydration and soil temperature fluctuations and may serve to reduce winter damage and frost heaving. *Frost heaving* is movement of the plant roots and crowns that tears roots and severely damages the crown of the plant. Plants damaged but not killed by frost heaving are thus more susceptible to diseases the following growing season.

Further information on proper site selection, soil preparation, planting and cultural methods as well as mulching can be found in Service in Action sheet 7.000, *Strawberries for the home garden*.

### Red Stele Root Rot

#### Identification

Red stele\* caused by *Phytophthora fragariae* is the most serious fungus disease of strawberries in the United States. This fungus attacks plants during late winter and spring. It is most destructive in heavy clay soils saturated with water.

Infected plants appear stunted and lose their shiny green luster. The plants' younger leaves often have a metallic, bluish-green cast. Older leaves turn prematurely yellow or red. Diseased plants wilt in dry weather and often die before the fruit starts to ripen.

Since pathogen spread is favored by water, red stele may appear to be fairly well distributed over an entire strawberry patch during a cool, wet spring. Normally, however, this disease is prevalent only in the poorly drained areas of a field or patch.

Red stele usually does not appear in a new planting until spring of the first bearing year. It is most evident from full bloom to harvest. Some symptoms, however, may appear in late fall of the first growing season.

Proper identification of the disease can be made by examination of the center of the root stele region. In a normal root, both the center (stele) and the part surrounding the stele are yellowish-white. In a plant infected with red stele disease, the stele is a distinctive brownish-red. This red color may show only near the dead tip, or it may extend the length of the root. The red center is most evident in the spring before fruiting. Later in the season, this discoloration may be less evident as the decaying roots are replaced by new roots.

#### Control

The only practical control in fields infected with the disease is replanting with red stele-resistant, certified, disease-free plants. Resistant cultivars include Darrow, Delite, Earliglow, Guardian, Sparkle, Stelemaster and Surecrop. Not all of these cultivars are resistant in all infected soils, as different races or strains of the fungus may be present. At the present no chemical or cultural treatment will assure a normal crop in an infected planting.

Upon receiving plants, look roots over carefully to see if any have the rattail appearance that may indicate red stele. Cut open any suspicious roots to see if red stele symptoms are present. **Avoid** planting infected stock.

<sup>1/</sup> C. E. Swift, CSU extension agent, horticulture; L. E. Dickens, retired CSU extension professor, plant pathology; the authors gratefully acknowledge the technical assistance of Dr. Harrison Hughes, CSU assistant professor, horticulture (1/1/81)

Select a planting site that has good to excellent soil drainage, no history of red stele, and is located where water from nearby land will not drain through it. Avoid low, wet spots and heavy (clay) soils.

Thoroughly clean soil and plant debris from cultivation equipment before use, especially if borrowing tools.

Soil fumigation is feasible on commercial plantings and may be helpful in situations where resistant varieties are not available (or not adapted). A commercial pesticide applicator should be contacted if fumigation is necessary. In home gardens, soil fumigation—due to its extreme toxicity to humans—is not recommended.

\*For a more detailed description of red stele, refer to U.S. Department of Agriculture Farmers Bulletin No. 2140, Strawberry Diseases.

## Leaf Spot

### Identification

Leaf spot is caused by the fungus *Mycosphaerella fragariae*. This disease organism can be carried into the field on new plants from nearby fields by birds or insects, by farm implements, or on hands and clothing of workers.

The fungus overwinters in purple spots on infected plants. These spots on the upper leaf surface produce spores, which initiate the disease cycle in the spring. Splashing rain helps scatter spores about the field. Damp, humid weather favors spore germination and the development of leaf spot disease.

Centers of spots that initially are purple, later become tan or gray, then almost white. Older spots usually are white with a light purple border. Similar spots may appear on leaf stem, fruit stalks, runners and caps. Occasionally, dark colored spots surrounded by discolored areas about 1/4 inch (6 millimeters) in size appear on green fruit. This phase of the disease is called "black seed."

The loss of foliage due to this disease can stunt the entire plant. Severely infected plants may die.

### Control

The use of resistant varieties of strawberry plants is the most practical and effective means of controlling leaf spot disease. Several strains of the fungus are known. Each affects varieties differently. Varieties that have demonstrated resistance include Albritton, Appolo, Atlas, Titan, Surecrop, Tennessee Beauty, Dabreak, Fairfax, Headliner and Midland.

For chemical control, see Table 1.

## Fruit Rot

### Identification

The most serious fruit rot found in Colorado is Botrytis (gray mold), caused by the fungus *Botrytis cinerea*. Infection usually begins on berries touching the soil; however, infection may start in that part of a berry that touches another decayed berry or dead leaf.

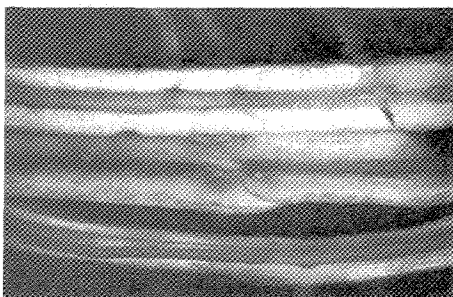


Figure 1: Red stele disease; root cross-section showing discolored stele.



Figure 2: *Mycosphaerella fragariae*; leaf spot on a strawberry leaf.

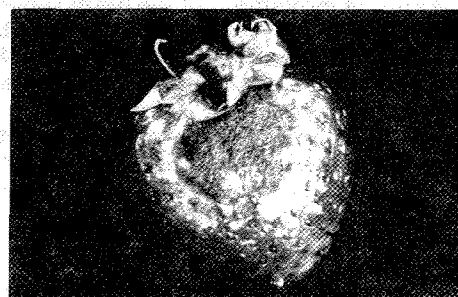


Figure 3: *Botrytis cinerea*; gray mold on strawberry fruit.

Gray mold often starts on blossoms and green fruit injured by frost. Sometimes the disease affects flower stalks enough to prevent the development of fruit.

### Control

The proper spacing of plants and correct timing of fertilizer application are the most important gray mold preventative measures. Disease is more severe when fertilizer is applied in the spring, when the matted row system is utilized and/or when rows are kept narrow. These cultural practices result in dense, lush foliage that prevents rapid drying of fruit after rains or irrigating. Water on the foliage then results in suitable conditions for development of rot.

A clean straw mulch will aid in producing cleaner berries and will reduce fruit rot by keeping berries off the ground. Removing overripe or infected berries also will help reduce this disease problem.

See Table 1 for chemical controls.

## Other Diseases

Other diseases infrequently noted include *Verticillium*, black root rot complex, *Armillariella* scorch, tip burn and powdery mildew. If unsure of the problem, diseased plants can be taken to your local Colorado State University Cooperative Extension Service office, or they can be sent to the Extension Plant Pathologist, Department of Botany and Plant Pathology, Colorado State University, Fort Collins, Colo. 80523, for diagnosis and control recommendations.

Table 1: Chemical control of strawberry diseases.<sup>1</sup>

| Disease                 | Fungicide                      | Application Rate* and Instructions <sup>2</sup>  |
|-------------------------|--------------------------------|--|
| Red stele               | Non effective                  | —  |
| Leaf spot and fruit rot | Benomyl (Benlate) <sup>3</sup> | C - 1 pound/acre at 10% bloom and full bloom + 1/4 pound/acre every 2 weeks until harvest.<br>H - 1/2 tablespoon/gallon water on above schedule.   |
|                         | OR                             |  |
|                         | Captan (50% WP) <sup>3</sup>   | C - 4-6 pounds/acre in 200 gallons water. Begin applications when growth starts in spring and before fruit starts to form. Repeat at weekly intervals.<br>H - 2 teaspoon/gallon water on above schedule. |

<sup>1</sup>Follow label directions and observe all restrictions and precautions on pesticide labels. Store all pesticides behind locked doors in original containers with labels intact. Use pesticides at correct dosage and intervals to avoid excessive residues and injury to plants and animals.

<sup>2</sup>Commercial (C) and homeowner (H) rates.

<sup>3</sup>There is no waiting period between last application and harvest.

\*To convert to metrics, use the following conversions: 1 pound = .45 kilogram; 1 acre = .4 hectare; 1 tablespoon = 15 milliliters; 1 teaspoon = 5 milliliters; 1 gallon = 3.8 liters.