



Quick Facts...

Winter damage and poor cultural management predispose strawberry plants to diseases.

Red stele, black root rot, powdery mildew, botrytis, fruit rot, leaf spot, and leaf scorch are the most important strawberry fungus diseases in Colorado.

Strawberry plants are most susceptible to disease-causing organisms when subjected to stress.

The best way to prevent strawberry diseases is to use disease-resistant, disease-free certified plants and plant in soil free of strawberry diseases.

**Colorado
State**
University

Extension

DISEASES

Strawberry Diseases

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Many diseases attack strawberries. Disease-causing organisms 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:

- using proper cultural methods to include crop rotation,
- selecting varieties adapted for the area,
- selecting disease resistant varieties, and
- planting disease-free plants.

For more information on site selection, soil preparation, planting and cultural methods, see fact sheet 7.000, *Strawberries for the Home Garden*.

Prevent Stress

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

Mulching may prevent winter damage and frost heaving. Mulch after the ground freezes (approximately December 1) to reduce excessive dehydration, soil temperature fluctuations, and winter damage and frost heaving. Frost heaving tears roots and severely damages the crown. Plants damaged but not killed by frost heaving are more susceptible to diseases the following growing season.

Red Stele Root Rot

Identification

Red stele, caused by *Phytophthora fragariae*, is a 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 plant's 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.

Because pathogen spread is favored by water, red stele may 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.

To identify the disease, examine the center of the root stele region. In a

Table 1. Red stele resistant cultivars.

June-bearing	
Allstar	Pathfinder
Darrow	Redchief
Delite	Sparkle
Earliglow	Stelemaster
Guardian	Sunrise
Joliette	Surecrop
Midway	

Day neutral	
Tribute	Tristar

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 rusty-red to dark brown. This discoloration may show only near the dead tip, or it may extend the length of the root. This condition is most evident in the spring before fruiting. Later in the season, this discoloration may be less evident as decaying roots are replaced by new roots.

Control

The only practical control in fields infected with the disease is to replant with resistant, certified, disease-free plants (Table 1). Resistant varieties are an effective means of control. Resistance to red stele disease is, however, a relative term. There are at least seven distinct biological races of the causal fungus and not all varieties of strawberries are resistant to all races. No chemical or cultural treatment ensures a normal crop in an infected planting.

Upon receiving plants, carefully look roots over 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. Do not plant infected stock.

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. Contact a commercial pesticide applicator if fumigation is necessary. In home gardens, chemical soil fumigation is not recommended due to the extreme toxicity of these products. For chemical controls see Table 2.

Black Root Rot

Identification

This problem is caused by a complex of soil-inhabiting pathogens (fungi and nematodes) as well as drought, winter injury, excessive application of fertilizer, or excessive soil moisture. Symptoms are most often noted in the spring. These include wilted plants, brown and/or distorted leaves, and black roots. Purple leaves with red petioles also have been associated with this problem.

When infected plants are dug up at the time of fruit-coloring, fine lateral roots will be missing or dead and irregular black patches may be visible on the fleshy white roots. On severely diseased plants these black patches grow together and no fleshy white roots will be visible. The interior (stele) of infected roots will be black.

Control

Proper soil preparation to improve organic matter content and drainage, combined with correct fertilization and watering practices, and steps to avoid soil compaction, are necessary to prevent black root rot. Make sure the strawberry bed is moist going into winter. To prevent frost heaving and root damage, mulch after the ground has frozen to a depth of several inches. Mulch applied during the summer helps prevent drought and excessive soil temperature, both associated with plant stress and black root rot.

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.

Other Diseases

Other diseases infrequently seen include Verticillium, Armillaria scorch, and tip burn.

If you are unsure of the problem, take diseased plants to your Colorado State University Cooperative Extension county office for diagnosis and control recommendations.

The fungus overwinters in purple spots on infected plants. These spots on the upper leaf surface produce spores, which start 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 initially are purple and later become tan or gray, then almost white. Older spots usually are white with a light purple border. Similar spots may appear on leaf stems, fruit stalks, runners and caps. Occasionally, dark spots surrounded by discolored areas about 1/4 inch 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 is the most practical and effective means to control 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. Avoid overhead irrigation. For chemical control, see Table 2.

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. 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 preventive measures. Disease is more severe when fertilizer is applied in the spring, when the matted row system is used, 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 aids in producing cleaner berries and reduces fruit rot by keeping berries off the ground. Remove overripe or infected berries to help reduce this disease problem. See Table 2 for chemical controls.

Powdery Mildew

Identification

Powdery mildew, caused by the fungus *Sphaerotheca macularis*, results in the rolling of infected leaves in late summer and fall, purplish or reddish blotches on leaves and sometimes a powdery growth. Pepper-like black specks appear on the underside of infected leaves in the fall. Infected flowers and fruit will be covered with a fine white fungal growth.

Control

Plant resistant varieties. Powdery mildew resistant cultivars include: Leater, Pocahontas, Scott, Sparkle, and Sunrise. For chemical controls see Table 2.

Leaf Scorch

Identification

Symptoms caused by this fungus (*Diplocarpon earlianum*) include

Table 2. Chemical control of strawberry diseases.¹

Disease	Fungicide	Application Rate and Instructions ²
Black root rot complex	Vapam and Telon C-17	Must be applied pre-plant by a licensed commercial applicator. These are restricted products.
Red Stele	Aliette WDG (Aluminum tris)	Preplant dip – 2.5 lbs/100 gallons of water Foliar application – 2.5 to 5 lbs/acre. Begin application when plants start active growth. Make additional applications on a 30-60 day interval.
PHI & REI = 12 hours.		
Leaf Spot and fruit rot	Captan; numerous fruit sprays contain captan	Follow label directions for application rate. Begin applications when growth starts in spring and before fruit starts to form. Repeat at 7-14 day intervals. PHI = up to day of harvest; REI = 24 hours.
Leaf spot	Copper compounds	Apply at prebloom and postharvest. Follow label directions.
Fruit rot/Gray Mold	Elevate 50WP (Fenhexamid)	1.5 lbs/acre. Begin applications at early bloom period prior to disease establishment. PHI = 0 days; REI = 12 hours.
Fruit rot, leaf scorch, leaf blight, powdery mildews	Topsin M 70WP (Thiophanate-methyl)	0.75 – 1 lb/acre. Begin applications at early bloom and repeat at 7 – 10 day intervals as needed. PHI = 1 day; REI = 12 hours.
Fruit rot and powdery mildew	JMS Stylet oil (Paraffinic oil) and JMS Organic Stylet oil	3 quarts/100 gallons of water. Spray weekly or once every two weeks depending on level of disease pressure. PHI = 0; REI = 4 hours.
Powdery mildew and leaf spot	Nova 40W & Rally 40W (Myclobutanil)	2.5 – 5 oz/acre. Begin applications when disease first appears or when conditions favor disease. Repeat at 14 – 21 day intervals. PHI = up to the day of harvest; REI = 24 hours.

¹Follow 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 the environment. Refer to www.coopext.colostate.edu/TRA/PLANTS/smquant.html for mixing small quantities of pesticides.

²PHI = the minimum amount of time between the last fungicide application and fruit harvest;

REI = restricted-entry interval. Do not enter or allow workers entry into treated areas during this period following fungicide application

numerous, small, irregular shaped purple spots on leaves. The spots, unlike leaf spot (*M. fragariae*), are purple throughout (no light centers) and have no well-defined border. Blotches may grow together until the entire leaflet appears purplish or reddish brown.

Control

Disease control strategies are similar to those given for leaf spot.

References

- Maas, J.L., ed. 1998. Compendium of Strawberry Diseases, Second Editions. APS Press, St. Paul, MN. 128 pages.
- Nickerson, N.L., and Jamieson, A.R. 1995. Canadian races of the red stele root rot fungus, *Phytophthora fragariae* var. *fragariae*. *Advances in Strawberry Research* 14:31-35.
- Pritts, M., and Handley, D. 1998. *Strawberry Production Guide*. NRAES-88. Cooperative Extension, Ithaca, NY.
- Ries, S.M. 1994. Strawberry red stele root rot. Pp. 109-111, in: *Proceedings 1994 Illinois Small Fruit and Strawberry Schools*. Horticulture Series 96, University of Illinois, Urbana, IL
- Wilcox, K.B., and Pritts, M. 1994. Strawberry black root rot: A review. *Advances in Strawberry Research*, 13:13-19.