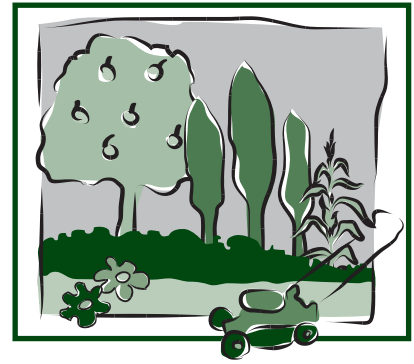


Strawberry Diseases

Fact Sheet No. 2.931

Gardening Series | Diseases



by C.E. Swift*

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, on a workers boots or shoes, 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 clay or high salt 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* var. *fragariae*, is a serious disease of strawberries in the United States. This fungal-like organism 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 throughout 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. A well-prepared soil that drains quickly has less problems with the disease. Strawberries grown in raised beds typically have less problems with this disease as long as the soil is well-drained.

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 when plants are stressed due to fruit production. 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 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

Planting resistant varieties (Table 1) is 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.

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 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, proper soil preparation, a rotation period of three to five years when strawberry plants are not grown in the area, and proper irrigation.

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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

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 traditional and organic control options see Table 2.

Black Root Rot

Identification

This problem is caused by a complex of soil-inhabiting pathogens, nematodes, drought, winter injury, excessive application of fertilizer, and 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*. Also referred to as Ramularia leaf spot, "rust," bird's eye spot, "gray spotness," and white spot, 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 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 pathogen can stunt the entire plant. Severely infected plants may die. Temperature affects symptom expression. Warm, humid weather results in spots being rusty brown without the reddish purple borders or light colored centers.

Control

Mowing the strawberry bed after the plants have finished fruiting will remove old infected leaves and reduce infectious material. Fertilizing after mowing helps stimulate growth making the plants healthier and less susceptible to many diseases.

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 are included in Table 3. Avoid overhead irrigation unless watering between 10 p.m. and 6 a.m. For control options see Table 2.

Fruit Rot and Blossom Blight

Identification

The most serious fruit rot and blossom blight 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 applications are the most important preventive measures. Disease is more severe when fertilizer is applied in the spring, when the matted row system is used (e.g. all daughter plants are allowed to take root), 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* f.sp. *fragariae*, 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

Mowing as suggested above to remove infected tissue, applying protective systemic fungicides as soon as flowering begins, and planting resistant cultivars is recommended. Use resistant cultivars - see Table 3. Table 2 lists synthetic and organic pesticides for control of this disease.

Leaf Scorch

Identification

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

Watering at the wrong time of day results in tissue that is wet for too long a period and increases the likelihood of this and other disease problems becoming serious. This disease is more problematic when the leaf tissue is wet for 12 hours or longer. Other disease control strategies are similar to those given for leaf spot. Use resistant cultivars (see Table 3).

References

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Table 2. Organic and conventional pesticides for the 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 use products.
Red Stele - <i>Phytophthora fragariae</i>	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.
Phytophthora, Fusarium, Verticillium and other Root Rot Diseases	Actinovate AG <i>Streptomyces lydicus</i>	Soil Drench – 3 – 12 oz. / acre Approved for organic production. PHI = 0 REI = 1 hour
Leaf Spot and fruit rot	Captan 50 WP	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.
Foliar diseases	Actinovate AG <i>Streptomyces lydicus</i>	Foliar Spray: Suppresses/controls many foliar diseases. 3 – 12 ounces per acre in 20 to 200 gallons water at 7 to 14 day interval. Organic production approved. PHI = 0; REI = 1 hour
Leaf spot	Copper compounds	Apply at prebloom and postharvest. Follow label directions.
Botrytis (Gray Mold)	Elevate 50WDG (Fenhexamid)	1.5 lbs/acre. Begin applications at early bloom period prior to disease establishment. No later than 10% bloom; Every 7 to 14 days. PHI = 0; REI = 12 hours.
Fruit rot, leaf scorch, leaf blight, powdery mildew	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: also effective on Botrytis and many insects	JMS 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. Organic Production Approved. 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 = 0; REI = 24 hours.
Botrytis Fruit Rot, and Powdery Mildew	Potassium bicarbonate - Sold under various brand names to include Kaligreen	2 ½ to 3 pounds per acre at first sign of disease. PHI = 1 day; REI = until product is dry.

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.ext.colostate.edu/pubs/garden/07615.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

Table 3. Strawberry cultivars and their susceptibility to diseases.

Cultivar	Leaf Spot	Leaf Scorch	Red Stele	Powdery Mildew
Allstar	T	T	R	T
Annapolis	VS	U	T - R	VS
Atlas	R	U	U	U
Blomidon	U	U	S	U
Cavendish	R	R	R	S to T
Earliglow	R	R	R	S to I
Guardian	S to I	R	R	S
Honeoye	S to T	T	S	I
Jewel	R	R	S	T
Kent	S	I	S	S
Lateglow	R	R	R	S
Lester	U	R	R	R
Midway	VS	S	R	T
Pathfinder	U	U	R	U
Raritan	S	S	S	S
Redchief	S	R	R	R
Sable	U	U	R	U
Scott	S to T	R	R	R
Sparkle	S	S	R	S
Stelemaster	U	U	R	VS
Surecrop	I to R	I	R	U
Tennessee Beauty	R	R to S	S	S
Tribute (day neutral)	T	T	R	R
Tristar	T	T	R	R

T = tolerant, R = resistant, I = intermediate, S = susceptible, VS = very susceptible, U = unknown

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 Extension county office for diagnosis and control recommendations. Dig up the complete plant so the roots can be examined along with the foliage, blossoms, and any fruit that is on the plant.

Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating. CSU Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.