



## STRAWBERRY LEAF DISEASES

Three major leaf diseases can cause serious damage to strawberry plants in Illinois: leaf spot, leaf scorch, and leaf blight. Strawberries (*Fragaria* spp) are the only hosts of the pathogens causing these diseases. Depending on the cultivar and climatic conditions, these diseases may occur singly or together on the same plant – even on the same leaf. Damage to the plant occurs as premature leaf death, reduction in yield and fruit quality, and a general weakening that leads to reduced runner production, or rarely, the plant death. These leaf diseases require control to maximize production.

Leaf spot and leaf scorch usually occur in early to mid-spring. Leaf blight is more common during the summer and early fall.

### SYMPTOMS

1. **Leaf spot.** This disease (upper photo) is caused by the fungus *Mycosphaerella fragariae* (imperfect stage is *Ramularia tulasnei*). Leaf spot infects leaves, petioles, runners, fruit stalks (pedicels), and berry caps or calyxes. Small, dark purple to reddish-purple, round spots, 1/8 to 1/4 inch in diameter (3 to 6 millimeters), appear on the upper leaf surfaces. The center of the spots soon become tan or gray and eventually almost white, while the broad margins remain dark purple. Later in the season, dark specks (sclerotia and/or perithecia) may be seen in the older lesions. Indistinct, tan or bluish areas form on the underleaf surface. The symptoms on the other plant parts, except the fruit, are almost identical to those on the upper leaf surface. Only young, succulent plant parts are infected by the leaf spot fungus.



Strawberry leaf spot



Strawberry leaf scorch



Strawberry leaf blight

In moist weather, superficial black spots about 1/4 inch (6 millimeters) in diameter form on ripe berries. There is no general decay of an infected berry. The spots surround groups of seeds (achenes) on the fruit surface. Usually, only one or two spots occur on a berry; but some fruits may have as many as eight or ten "black-seed."

2. **Leaf scorch.** The leaf scorch fungus, *Diplocarpon earlianum*, attacks the leaves, petioles, runners, pedicels, and calyxes of strawberry plants. The fungus most frequently infects strawberry leaves at any stage of development. The symptoms of leaf scorch (middle picture) are very similar to the early stages of leaf spot. Round to angular dark-purple spots, up to about 1/4 inch (6 millimeters) in diameter, are scattered over the upper leaf surface. As the spots gradually enlarge, they resemble small drops of tar due to the production of large numbers of minute, black, fungal fruiting bodies (acervuli).

**The center of the spot remains dark purple**, thus distinguishing this disease from leaf spot. When numerous infections occur on a single leaf, the leaf takes on a reddish or light purple color. Severely infected leaves dry up and appear scorched. Similar but elongated spots may also appear on other plant parts. Lesions may girdle the pedicels causing flowers and young fruits to die. Infections on green berries are rare, appearing as red-to-brown discolorations or a flecking of the fruit surface.

3. **Leaf blight.** This disease is caused by the fungus *Dendrophoma obscurans*. Leaf blight (lower picture) is commonly found on plants after harvest. This disease is distinctly different from leaf spot and leaf scorch. The enlarging leaf spots are round to elliptical or angular and 1/4 inch to an inch in diameter (6 to 25 millimeters). The spots are initially uniformly reddish-purple, but soon develop a darker brown or reddish-brown center surrounded by a light-brown area with a purple border. Similar spots sometimes develop on the fruit calyx.

Normally, one to six lesions develop on a single leaflet. Frequently, the infected area becomes V-shaped, with the widest part of the "V" at the leaf margin. Small black dots, pycnidia of the causal fungus, appear scattered over the center of older spots. New lesions appear throughout the summer and fall when weather conditions are favorable. Older blighted leaves may die in large numbers.

Leaf blight is particularly destructive on slow-growing or weak plants. It seldom damages young, runner plants. The same fungus rarely causes an enlarging, soft, pale pink rot of the stem end of the fruit.

## DISEASE CYCLES

All three fungal pathogens overwinter in infected living or dead strawberry leaf tissue.

1. **The leaf spot fungus** produces microscopic spores from three different sources that infect new leaves in the spring. Firstly, older infected leaves that remain alive during the winter give rise to conidia that are splashed by water, or by handling wet infected plants, to the new foliage. The conidia are produced in large numbers on clusters of short stalks (conidiophores) that form over the entire underleaf surface.

Secondly, conidia can also be produced from black fungal structures (sclerotia) that resist cold winter temperatures. These sclerotia form on dead strawberry leaves. Thirdly, speck-sized black perithecia develop at the edges of the leaf spots during the autumn months. Ascospores are produced within

the perithecia on these dead leaves during the winter. The ascospores are forcibly ejected in the spring and are carried by wind or water to new leaf tissue.

Infection by both spore types occurs only through the lower leaf surface. The incubation period between infection and the appearance of lesions on the upper leaf surface is from 10 to 14 days. Large numbers of new conidia, which appear as a downy white growth on the underleaf surface, are produced and cause secondary infections during fairly prolonged periods of damp to wet, moderately warm weather.

Temperatures between 65° and 75°F (18° to 24°C) are optimal for the growth of the leaf spot fungus and lesion development. Infections continue to occur throughout the growing season – except during hot, dry weather. Young, expanding leaves are much more susceptible to infection than mature leaves. If frequent rains occur during early- and mid-spring, a few infection sites can start an epidemic.

2. **The leaf scorch fungus** also produces ascospores in the early spring, within disk-shaped apothecia that appear as black dots in old lesions on the lower surface of dead leaves. Conidia are also produced on both leaf surfaces in glistening, speck-sized, black acervuli. These acervuli form on diseased leaves that survive the winter.

Infection by the leaf scorch fungus, like the leaf spot pathogen, occurs almost entirely through the lower leaf surface. In the presence of moisture, ascospores germinate and infect within 24 hours. The incubation period between infection and the appearance of lesions with conidia is 14 days. Conidia are produced in large numbers throughout the growing season, so that repeated secondary infections occur whenever weather conditions are favorable. The conidia are disseminated primarily by splashing water and to a much lesser extent by insects, birds, and by handling wet plants.

3. **The leaf blight fungus** produces only conidia in speck-sized, black pycnidia which are embedded in the centers of older lesions. The conidia ooze from the pycnidia during damp weather when the temperatures are warm to hot. The spores are splashed by water to new leaf tissue, where they germinate in the presence of free water and initiate new infections on the leaves and fruit caps.

The spread of all these leaf-infecting fungi is favored by frequent rains, overhead irrigation, and heavy dews. There is little spread during hot, dry weather in the summer, although the symptoms of leaf blight may continue to develop during this period.

A rapid buildup of all three leaf diseases occurs in autumn during rainy periods or when overhead irrigations are frequent after renovation. The buildup of leaf diseases can seriously weaken strawberry plants and can provide large amounts of inoculum that may result in heavy infections the following spring.

## CONTROL

Leaf diseases of strawberries are effectively controlled when the practices outlined below are followed.

1. **Choose disease resistant cultivars adapted to your location.** The table on page 5 lists the disease reactions to leaf spot and leaf scorch of 22 strawberry cultivars commonly grown in Illinois. This table can be used only as a guide for selecting cultivars, since it represents **average** disease reactions.

Due to the presence of different races of the pathogens, strawberry cultivars rated as resistant in one location may be susceptible in another.

2. **Start with certified, disease-free plants purchased from a reputable nursery.**
3. **These cultural practices help reduce infections.**
  - A. Plant in full sunlight in well-drained soil with good air circulation.
  - B. Prevent weed growth by cultural or chemical methods.
  - C. Take care in spacing runner plants in matted-row culture. Do not allow an over-population of plants.
  - D. Always remove the old infected leaves from runner plants before setting.
4. **Apply nitrogen fertilizers only at renovation time.** Applications of nitrogen in the spring produce an overabundance of young leaf tissue susceptible to leaf-disease fungi.
5. **Follow a fungicide spray schedule recommended for the control of leaf diseases and fruit rots.** Home fruit growers should follow the spray program for strawberries in the current Midwest Small Fruit Pest Management Handbook. Commercial strawberry growers should consult the most recent copy of the Illinois Extension Circular Md-1, Illinois Commercial Small Fruit and Grape Spray Guide. The first spray should be made in the spring just before the first blossoms open. For June-bearing cultivars, repeat the fungicide applications at 7- to 10-day intervals through to final harvest. An additional fungicide application should be made on June-bearing cultivars a week or two after renovation. Spray ever bearing cultivars at 7- to 10-day intervals during the primary fruiting periods. The spray intervals can be lengthened to two or three weeks for the remainder of the season.

Thoroughly cover all above-ground plant parts with each spray. Since the leaf spot and leaf scorch pathogens infect only through the underleaf surface, the undersides must be well sprayed with fungicide. Sprays give more effective and longer-lasting protection than dusts. It helps to apply fungicides when the air is calm and the plants are damp from rain or dew. Always consult a current fungicide label for directions and restrictions on use before application, and follow the instructions given carefully.
6. **In seriously infected plantings, mow, rake, and destroy (burn) all diseased strawberry debris at renovation time immediately after harvest.** In such plantings, fungicides should be applied immediately after renovation and at 2- to 3-week intervals until new foliar growth ceases in the fall (see No. 5, above).

*For more details concerning suggested cultural management practices, including fertilization, commercial growers should check the most recent Proceedings of the Illinois Small Fruit and Strawberry Schools. Copies of the proceedings can be obtained by writing to Jeff Kindhart, Dixon Springs Agricultural Center, Simpson, Illinois 62985.*

Disease Resistance of Strawberry Cultivars Commonly Grown in Illinois

Cultivar	Red stele	Verticillium wilt	Leaf spot	Leaf scorch	Powdery mildew
Allstar	VR <sup>a</sup>	R	R	R	R
Canoga	I	I	R	R	—
Cardinal	S	S	R	R	R
Catskill	S	VR	S	R	R
Delite	R <sup>b</sup>	R	R	S-R	S
Earliglow	R <sup>b</sup>	T-R	S-R	R	I
Guardian	R <sup>b</sup>	T-R	S-R	R	S-R
Honeoye	S	S	R	R	—
Jewel	S	S	R	R	—
Lester	R	R	R	R	R
Midway	R <sup>b</sup>	S-I	S	S	I
Pocahontas	S	S	S-R	S-I	R
Raritan	S	S	S	S	I
Redchief	R <sup>b</sup>	R	S-R	R	S-R
Scott	R	9-R	S-R	R	R
Sparkle	S-R	S	S	S-I	R
Sunrise	R <sup>b</sup>	R	VS	R	R
Surecrop	R <sup>b</sup>	VR	S-R	S-R	—
Tennessee Beauty	S	R	R	S-R	S
<u>Ever bearing</u>					
Tribute	VR	T-R	T	T	R
Tristar	R	R	T	T	R

<sup>a</sup> VS = very susceptible; S = susceptible; I = intermediate; T = tolerant; R = resistant; VR = very resistant; — = unknown. Resistant characteristics of the cultivar usually preclude the need for other controls.

<sup>b</sup> Resistant to several races of the red stele fungus.