



Strawberry Anthracnose Fruit & Crown Rot

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IMPORTANCE

Anthracnose diseases can severely reduce plant stands and yields in commercial and residential strawberry plantings. Disease may develop on

blossoms, fruit, petioles, runners (stolons), leaves, and crowns; however, it is most destructive when fruit and/or crowns are affected.

SYMPTOMS

Fruit

Ripening fruit develop round, firm, sunken spots (FIGURE 1) ranging in color from tan to dark brown. Spots enlarge rapidly until entire fruit are affected. Under rainy or humid conditions, masses of salmon-colored spores ooze from lesions (FIGURE 2A and B). Diseased fruits eventually become dried, shriveled mummies (FIGURE 3). Fruit infections may also follow blossom infections.

Crowns

The first visible evidence of crown rot includes stunting and/or sudden wilting of plants. Early infections may cause plants to wilt during the day when water stress is high and then recover at night as water stress decreases. Eventually, infected plants collapse and die. When diseased crowns are split lengthwise, internal tissues are firm with a reddish-brown discoloration (FIGURE 4A), often with streaking or marbling (FIGURE 4B). Roots are not affected and remain healthy, turgid, and white.

Petioles, Stolons, and Leaves

Small, dark lesions develop on stolons and petioles and gradually become black, dry, and sunken. Girdling lesions (FIGURE 5) on stolons result in the death of unrooted daughter plants; leaves die when their petioles are girdled. Small, round, black-to-gray spots may appear on expanding leaflets even before petiole or stolon symptoms are noticed.



FIGURE 1. ANTHRACNOSE FRUIT ROT CAUSES DARK, SUNKEN SPOTS.

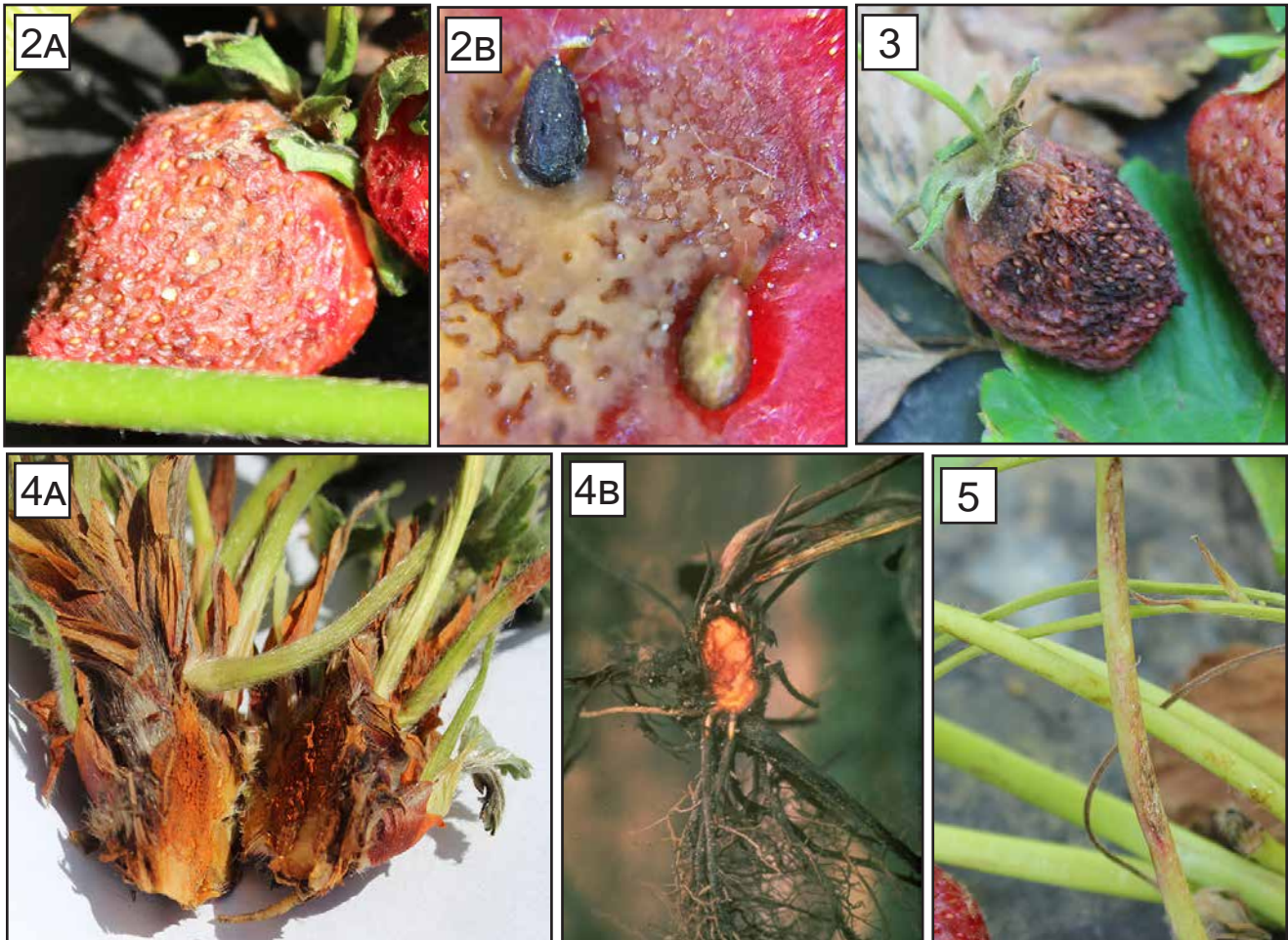


FIGURE 2. (A) SALMON-COLORED SPORES COMMONLY OOZE FROM LESIONS DURING RAINY OR HUMID WEATHER, AND **(B)** CLOSE-UP OF OOZING CONIDIA. **FIGURE 3.** DISEASED FRUIT BECOME DRY AND HARD, DEVELOPING INTO MUMMIES. **FIGURE 4. (A)** CROWN ROT SYMPTOMS INCLUDE REDDISH-BROWN DISCOLORATION OF INTERNAL CROWN TISSUE AND **(B)** CROWN ROT MAY SHOWING MARBLING. **FIGURE 5.** INFECTIONS ON STOLONS (RUNNERS) CAUSE GIRDLING.

HOW PRODUCTION SYSTEMS IMPACT DISEASE

There are two primary types of strawberry production systems. Anthracnose fruit rot is common in both systems; however, each system is affected differently by anthracnose crown rot. Regardless of the production system, once anthracnose is introduced, it can persist and become more severe in subsequent years as long as strawberries are grown in that field.

Perennial Strawberries

Traditional perennial matted row systems are used by both commercial and residential growers. Plants remain in beds for 3 years or more, and beds are renovated annually by thinning. The risk of introducing anthracnose into fields occurs when new plants are brought in from other sources. However, since the same runners often remain when beds

are renovated, introductions are minimal. Once the fungus is introduced, disease can easily spread and persist throughout the life of the planting.

Annual Strawberries

Annual plasticulture systems are common in large commercial operations; approximately half of the commercial strawberries in Kentucky are grown using this production system. Strawberry plug plants are set in early September, covered by floating row covers for the winter, and removed immediately after harvest the following year; new plants are installed each year. Most crown rot is introduced into annual systems through incoming plugs. In addition, because new plugs are planted each year, the risk for introducing anthracnose-infected plants is greater.

CAUSE & DISEASE DEVELOPMENT

In Kentucky, fruit rots are caused primarily by *Colletotrichum nymphaeae* (acutatum group) and crown rots are caused by *C. nymphaeae* (acutatum group) and/or *C. siamense* (gloeosporioides group). These species also cause bitter rot of apple and other fruit anthracnose diseases.

Colletotrichum fungi overwinter in infected plants, mummified fruit, and plant debris as dormant spores or other fungal structures (e.g. mycelia or acervuli). Anthracnose pathogens can survive in soils for up to 9 months in the absence of a host. During warm, rainy, or humid weather, the pathogens become active, producing abundant spores and spreading rapidly. Spores continue to be produced throughout spring and summer, whenever conditions are favorable.

Infections can occur in nurseries on transplants or on plants within fields. Crown infections may

be initiated when spores from debris or from leaf and/or petiole infections splash into central buds; the pathogen is also able to penetrate directly into crown tissue. Blossoms may become infected when spores splash upward during bloom; these infections can sometimes result in fruit infections. Fruit may be infected at any stage of development; however, symptoms do not become evident until fruit begins to ripen.

Short distance disease spread occurs in fields via rain splash, overhead irrigation, movement of contaminated equipment, and on workers' shoes, hands, and clothing. Long distance spread occurs by movement of strawberry transplants from the nursery to the grower.

Fruit infected in the field can develop symptoms in storage and shorten shelf-life.

DISEASE MANAGEMENT — RESIDENTIAL PLANTINGS

Anthracnose is best controlled by avoiding its introduction into strawberry plantings and preventing the pathogen from becoming established. When recommended cultural practices are followed carefully, fungicide use can be greatly reduced.

Pre-planting & Planting

- Purchase only disease-free transplants from a reputable nursery. Carefully inspect plants prior to planting; discard and destroy those with visible disease symptoms.
- Do not plant strawberry plants in sites where anthracnose was present the previous season.

Bloom through Harvest

Cultural practices

- In matted row systems, maintain a thick layer of straw mulch to prevent developing fruit from touching the ground and to reduce soil water dispersal and disease spread.
- Avoid use of overhead irrigation; use trickle or drip irrigation.
- Do not work in beds when plants are wet.

- Manage weeds, which reduce air circulation and cause plant tissues to stay wet for longer periods. Some weeds may also harbor the pathogens.

- Scout plantings regularly and remove infected berries; remove symptomatic plants as soon as they are detected to stop or slow disease spread.

- Clean pick. Remove damaged and diseased berries from the planting through the season and during harvest.

Fungicides

Fungicides are used differently for management of anthracnose fruit rot and crown rot diseases. Refer to the publications listed below or contact a local county Extension office for current fungicide recommendations. Follow all label instructions concerning re-entry and pre-harvest intervals.

- *Anthracnose fruit rot*—Protectant fungicides are recommended for prevention of fruit rot. If anthracnose was a problem during the previous growing season, fungicides may be necessary to prevent fruit losses. Applications should begin at bloom and continue through harvest, especially when weather is wet or rainy.

DISEASE MANAGEMENT — RESIDENTIAL PLANTINGS (CONT'D)

- *Anthracnose crown rot*—Protectant fungicides are not recommended for prevention of crown rot. Once anthracnose crown rot becomes established, plants cannot be cured. Fungicides applied to diseased plants only slow disease progression so that fruit can be salvaged.

Post-harvest

- Remove infected berries, plant parts, old leaves, and other plant debris at the end of the season. This reduces sources of inoculum (spores) that can carry over to the next season.

DISEASE MANAGEMENT — COMMERCIAL PLANTINGS

Anthracnose is best managed by avoiding its introduction into strawberry fields and by preventing the pathogen from becoming established. Cultural practices can help reduce inoculum and increase fungicide efficacy.

Pre-planting & Planting

- Purchase only disease-free transplants from a reputable nursery. Carefully inspect plants prior to planting; discard and destroy those with visible disease symptoms.
- Rotate fields; do **not** plant strawberry in the same location during two consecutive seasons.
- A pre-plant fungicide dip can be used to help protect against anthracnose crown rot. Refer to the publications listed below or contact a local county Extension office for current fungicide recommendations.

Bloom through Harvest

Cultural practices

- In matted row systems, maintain a thick layer of straw mulch to prevent developing fruit from touching the ground and to reduce soil water dispersal and disease spread.
- Manage weeds, which reduce air circulation and cause plant tissues to stay wet for longer periods. Some weeds may also harbor the pathogens.
- Do not work in fields when plants are wet.
- Scout plantings regularly, removing infected plants and berries.
- Do not allow people (workers and pickers) or machinery to move from a field or area that is infected to a clean or uninfected field.

- Clean pick. Remove damaged and diseased berries from the planting through the season and during harvest. Do **not** leave infected berries and debris in or between rows.

Fungicides

Fungicides are used differently depending on the anthracnose disease. Refer to the publications listed below or contact a local county Extension office for current fungicide recommendations. Follow all label instructions concerning re-entry and pre-harvest intervals.

- *Anthracnose fruit rot*—Protectant fungicides are important for prevention of anthracnose fruit rot. Begin applications at bloom and continue through harvest. If anthracnose was a problem during the previous growing season, consider a more intensified spray program, beginning sprays as new leaves expand and flower buds are evident; continue through harvest.

- *Anthracnose crown rot*—Fungicide drenches or sprays directed at crowns can help suppress anthracnose crown rot if it becomes problematic. Treat plants regularly until cool weather sets in, and then begin again in spring when weather warms (60°F to 70°F). Once anthracnose crown rot becomes established, plants cannot be cured. Fungicides applied to diseased plants only slow disease progression so that fruit can be salvaged. Commercial plasticulture systems benefit from pre-plant fungicide dips.

Post-harvest

- Remove infected berries, plant parts, old leaves, and other plant debris, which can serve as sources of inoculum (spores).
- Till beds once plants are removed in a plasticulture system.

ADDITIONAL RESOURCES

- Plant Pathology Extension Publications on Small Fruit Diseases and Management <https://plantpathology.ca.uky.edu/extension/publications#SMALLFRUIT>
- Backyard Berry Disease, Pest, and Cultural Practices Calendar (PPFS-FR-S-25) <https://plantpathology.ca.uky.edu/files/ppfs-fr-s-25.pdf>
- Commercial Midwest Fruit Pest Management Guide (ID-232) <https://plantpathology.ca.uky.edu/files/id-232.pdf>
- Cultural Calendar for Commercial Strawberry Production (PPFS-FR-S-30) <https://plantpathology.ca.uky.edu/files/ppfs-fr-s-30.pdf>
- Bitter Rot of Apple (PPFS-FR-T-24) <https://plantpathology.ca.uky.edu/files/ppfs-fr-t-24.pdf>

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