



Foliar Diseases of Tomato

Early Blight – Septoria Leaf Spot – Target Spot

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IMPORTANCE

Early blight (FIGURE 1A) and Septoria leaf spot (FIGURE 1B) are the most common fungal diseases of tomato in Kentucky. Disease often begins in early summer and extends through the growing season. Target spot (FIGURE 1C) is a disease once thought to be confined to the subtropical areas of the U.S. but has recently become prevalent in Kentucky plantings. All three diseases can significantly impact tomato yields in commercial plantings and residential gardens; they are less common in greenhouses and high tunnels.

SYMPTOMS & SIGNS

Early Blight

Leaves

Early blight lesions first appear on older leaves of established plants, especially leaves close to the ground. Spots are small, brown-black, circular-to-elliptical; concentric rings within spots give them a target-like appearance (FIGURE 1A). Lesions enlarge rapidly, and individual spots can increase to ½ inch in diameter. Leaf tissue surrounding spots may become chlorotic (yellow) and/or necrotic (brown). Affected leaves wither and die, giving plants a blighted appearance (FIGURE 2). Defoliation may eventually occur.



FIGURE 1. EARLY BLIGHT (A) AND SEPTORIA LEAF SPOT (B) ARE COMMON TOMATO DISEASES OCCURRING IN COMMERCIAL AND RESIDENTIAL PLANTINGS. TARGET SPOT (C) IS A NEWLY IDENTIFIED DISEASE FOR KENTUCKY THAT RESEMBLES EARLY BLIGHT, MAKING DIAGNOSIS A CHALLENGE.



FIGURE 2. EARLY BLIGHT FOLIAR LESIONS ARE CHARACTERIZED BY TARGET-LIKE CONCENTRIC RINGS. AS DISEASE PROGRESSES, EXTENSIVE BLIGHTING AND DEFOLIATION OCCUR.

FIGURE 3. FRUIT INFECTIONS ALSO RESULT IN TARGET-LIKE LESIONS, SIMILAR IN APPEARANCE TO FOLIAR LESIONS.

FIGURE 4. DARK-BROWN TARGET-LIKE LESIONS CAN DEVELOP ON STEMS AND PETIOLES AS A RESULT OF EARLY BLIGHT INFECTIONS.



Fruit

Fruit may become infected at any stage of development. Similar to leaf spot symptoms, fruit lesions have a target-like appearance (FIGURE 3). Diseased areas, which often begin at the stem end, can encompass large portions of the fruit. Lesions become sunken and leathery with age. Under humid conditions, a thick mass of black spores develops on the lesion surface giving it a velvety appearance. As a secondary effect, healthy fruit can be damaged by sunscald when plants are defoliated by disease.

Stems & Petioles

Lesions developing on stems and petioles are elliptical and have the same target-like appearance characteristic of early blight on leaves and fruit (FIGURE 4). As lesions expand, they encircle stems and petioles, resulting in death of distal leaves/leaflets.

Septoria Leaf Spot

Leaves

Septoria leaf spot symptoms generally develop after the first fruit set, initially beginning on lower leaves. Spots are small, circular to semi-circular with tan-to-gray centers and dark margins (FIGURE 5). Lesions become dotted with black spore-producing structures (pycnidia); foliar spots are often surrounded by a yellow halo (FIGURE 6). While individual spots are less than $\frac{1}{4}$ inch in diameter, spots coalesce when disease is severe. This leads to blighting or necrosis of leaves, often followed by defoliation.

Stems & Fruit

Spots similar to those appearing on leaves can also appear on stems. Infections on fruit are rare; however, sunscald damage to fruit can occur on defoliated plants.



FIGURE 5. SEPTORIA LEAF SPOT LESIONS ARE ROUGHLY CIRCULAR WITH LIGHT CENTERS AND DARK MARGINS. SPOTS CAN APPEAR ON TOMATO STEMS, AS WELL AS FOLIAGE.

FIGURE 6. THE LIGHT TAN-GRAY CENTERS OF SEPTORIA LEAF SPOT LESIONS BECOME DOTTED WITH FUNGAL FRUITING BODIES (PYCNIDIA). SPOTS MAY BE SURROUNDED BY A YELLOW HALO.

Target Spot

Leaves

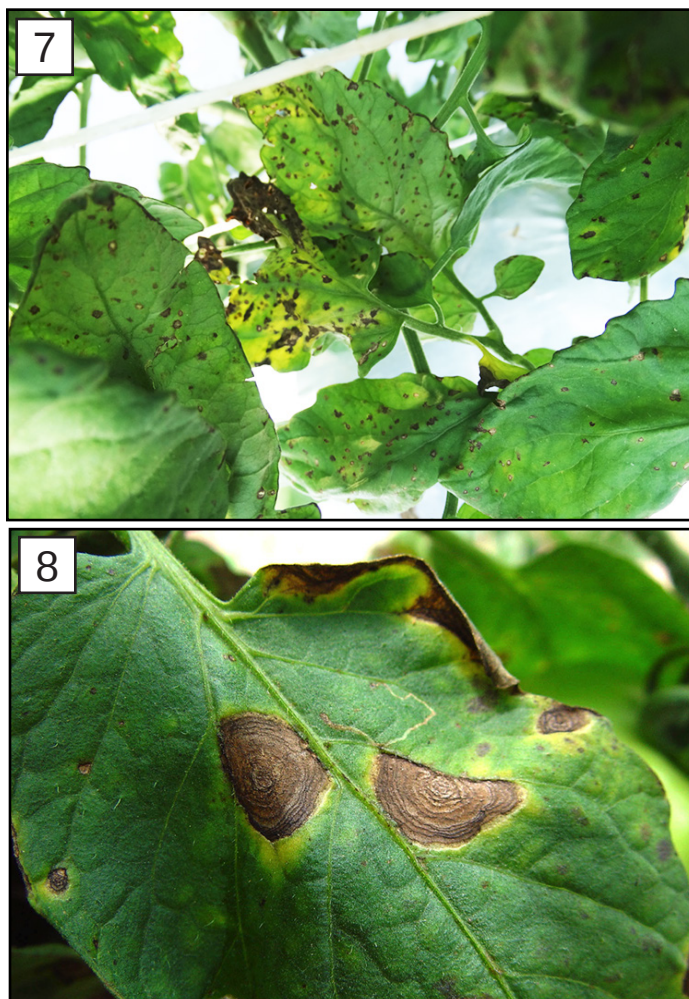
Target spot first appears on older leaves within the leaf canopy. Spots are initially pinpoint-sized and water-soaked, later becoming dark brown (FIGURE 7). At this stage, symptoms can be mistaken for bacterial spot. However, lesions continue to enlarge, and centers become light brown or gray with dark margins. Expanding lesions are round and develop dark concentric rings that give them a target-like appearance (FIGURE 8). At this stage, symptoms are so similar to early blight that it can require microscopic examination to differentiate between the two diseases. Yellow halos may develop around spots on some cultivars. Coalescing lesions result in blighting, often followed by leaf drop.

Stems & Fruit

Symptoms similar to the leaf spots can appear on infected stems and fruit. Pinpoint fruit lesions enlarge, become sunken, and eventually crack. Lesions on stems can contribute to plant collapse and death.

FIGURE 7. TARGET SPOT LESIONS ARE INITIALLY VERY SMALL AND WATERSOAKED, LATER BECOMING DARK IN COLOR. THESE EARLY SYMPTOMS CAN EASILY BE CONFUSED WITH BACTERIAL SPOT.

FIGURE 8. TARGET SPOT LESIONS DEVELOP DARK CONCENTRIC CIRCLES, OFTEN VISUALLY INDISTINGUISHABLE FROM EARLY BLIGHT.



CAUSES & DISEASE DEVELOPMENT

Early blight, Septoria leaf spot, and target spot are caused by unrelated fungi. Infections are initiated when spores (conidia) land on susceptible tissues during warm, wet weather. Once tissues become infected, these fungi produce additional conidia, which continue to infect healthy tissues as long as pathogen-favorable conditions continue.

Early blight is caused by one or more fungal species in the genus *Alternaria*, which can also affect a wide range of other plants (such as ornamentals and weeds) across many plant families. *Alternaria* spp. overwinter as conidia and mycelia on infected plant debris, on seeds, and in common weeds. Infections can occur at temperatures as low as 60°F, but 82°F to 86°F is optimal. Depending on environmental conditions, spots can be visible about 7 days after infection. Conidia are disseminated short distances by wind and rain splash; however, human contact and equipment can also aid in pathogen spread. Fruit infected in the field can develop symptoms in storage and shorten shelf-life.

Septoria leaf spot results from infections by *Septoria lycopersici*. This pathogen overwinters as fungal survival structures (pycnidia) in infected plant debris and weeds. Infections can occur at temperatures as low as 60°F; however, 77°F is optimal. Symptoms can be visible within 6 days of infection. The pathogen can be spread by workers, equipment, and insects moving through wet foliage, as well as rain splashing spores from leaf to leaf.

Target spot, caused by the fungus *Corynespora cassiicola*, overwinters in non-hosts and as a saprophyte on crop debris. While the pathogen can infect over 500 plant species (including soybean, cucumber, and tobacco) some isolates may be host-specific, while others may infect multiple crops. Infections require continuous periods of leaf wetness (16 or more hours), which can come from rain, irrigation, and/or high humidity. Temperatures above 68°F are conducive to infection, although 77°F to 86°F is optimal. Spores are disseminated by wind or rain.

DISEASE MANAGEMENT

Distinguishing between each of these foliar diseases can be a challenge, especially since early blight and target spot lesions can be similar in appearance. In addition, two or more of these diseases often occur at the same time on the same plant. Fortunately, similar management practices can be followed for all three diseases.

Cultural practices

- Practice crop rotation. Avoid planting tomatoes on the same site for 2 to 3 years. In the case of early blight, also avoid planting potato or eggplant during the 3-year crop rotation, as they are also hosts.
- Plant tomato cultivars with disease tolerance or resistance whenever possible. Several cultivars are available with resistance to early blight; resistance to Septoria leaf spot is also available but less common. Generally, cherry or grape types and hybrid cultivars tend to be more tolerant to these two diseases than slicer or heirloom cultivars. Cultivars resistant or tolerant to target spot are not yet available.
 - Commercial growers can refer to *Vegetable Production Guide for Commercial Growers* (ID-36), *Southeastern U.S. Vegetable Crop Handbook* (SEVEW), and seed company websites for information on tolerant cultivars.
 - Residential growers can usually find disease resistance information listed in seed catalogs, on seed packets, and/or on plant labels.
- Manage weeds that may serve as secondary hosts for the pathogens. Weeds can also reduce air circulation and result in increased humidity within plantings, thus promoting disease development.
- Provide conditions that will facilitate leaf drying and minimize a favorable environment for disease.
 - Choose a planting site in full sun with good air circulation.
 - Orient rows in the direction of prevailing winds.
 - Consider the size of plants at maturity when planting and provide sufficient spacing.
 - Avoid use of overhead irrigation.
 - Prune lower, older leaves to remove diseased tissue. For indeterminate cultivars, prune leaves below the oldest fruit cluster.

- Provide support for plants to keep them off the ground. Remove lower leaves that might come into contact with soil.

- Apply mulch under plants to reduce contact between foliage and the soil, as well as rain splash of fungal spores.

- Follow good sanitation practices in order to minimize the amount of overwintering inoculum (e.g., fungal spores) for the following season. Discard plants and plant parts as soon as possible after the final harvest. Till after harvest to remove smaller debris.

Fungicides

Apply a fungicide that lists these specific diseases for tomato on the product label. Regular application intervals are critical to adequate disease management. When developing a fungicide program, commercial growers should alternate products with different FRAC codes.

For current fungicide recommendations, commercial growers can consult *Vegetable Production Guide for Commercial Growers* (ID-36) and *Southeastern U.S. Vegetable Crop Handbook* (SEVEW), while residential growers will find this information in *Home Vegetable Gardening in Kentucky* (ID-128). Organic growers can refer to *Organic Commercial Spray Schedule for Field Production of Tomatoes* (PPFS-VG-43) for products compliant with their certification. A local Cooperative Extension Service office can also be contacted for assistance.

ADDITIONAL RESOURCES

UK Plant Pathology Extension Publications

<https://plantpathology.ca.uky.edu/extension/publications>

- Homeowner's Guide to Fungicides (PPFS-GEN-07)
- Home Vegetable Gardening in Kentucky (ID-128)
- IPM Scouting Guide for Common Pests of Solanaceous Crops in Kentucky (ID-172)
- Organic Commercial Spray Schedule for Field Production of Tomatoes (PPFS-VG-43)
- Post-harvest Disease Losses in Fruit & Vegetable Crops (PPFS-GEN-24)
- Southeastern U.S. Vegetable Crop Handbook (SEVIEW)
- Tomato & Pepper IPM Guide for Small Acreage & Backyard Production (PPFS-VG-21)
- Vegetable Production Guide for Commercial Growers (ID-36)

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Replaces *Early Blight & Septoria Leaf Spot of Tomato (Commercial Growers)* PPFS-VG-25 by Erica Fealko and Emily Pfeufer and *Early Blight & Septoria Leaf Spot of Tomato (Residential Growers)* PPFS-VG-26 by Erica Fealko, Nicole Gauthier, and Heather Graham
