

Diagnosis and Management of Foliar Diseases of Cotton in the United States

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Name: Ascochyta Blight (Wet Weather Blight)

Caused by: *Ascochyta gossypii* (*Phoma exigua*)

Foliar Symptoms: Ascochyta Blight forms lesions on cotyledons, leaves, stems, and bolls. Lesions on the cotyledons and leaves approach 2 mm (<0.1 in) in diameter, are white to light brown and circular in shape. Elongated cankers on the stem are reddish-purple to black or ash gray in color. Small, black fruiting structures are likely to be embedded in symptomatic tissue.



Early-season symptoms of Ascochyta Blight on cotyledons of cotton. (Photo credit: S.M. Brown).

Management: Use fungicide treated seed, avoid planting in cool wet weather, and incorporate cotton residue to encourage decomposition, which helps in fields with a history of Ascochyta Blight.

Diagnostic Note: Margins of necrotic regions on leaves and cotyledons will have dark borders. Spots may have a target-like appearance. However, Ascochyta Blight typically occurs early in the season, and small black fruiting structures are observed in the lesions.

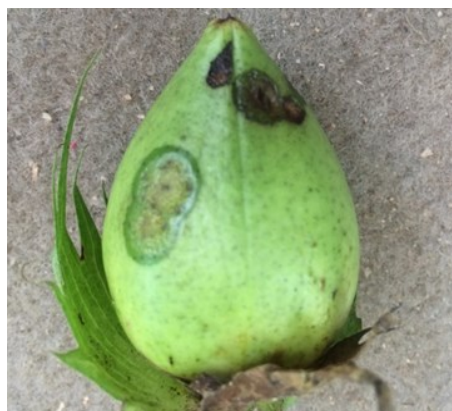
Range and Yield Loss: Ascochyta Blight has been reported in most major cotton producing regions. Yield loss is rarely reported, but is possible under conditions such as prolonged cloudy weather with cooler temperatures and rainfall.



Symptoms of Ascochyta Blight on cotton leaf. Note dark border and small, embedded fruiting structures in the spots.



Dark-brown angular lesions and 'black arm' of petioles of Bacterial Blight.



Sunken lesions resulting from Bacterial Blight.

Name: Bacterial Blight (Angular Leaf Spot, Black Arm)

Caused by: *Xanthomonas citri* pv. *malvacearum*

Foliar Symptoms: Symptoms of Bacterial Blight start as tiny water-soaked spots, and progress into characteristically angular shapes due to leaf veins limiting bacterial movement. Lesions appear on the upper side of the leaf, turn black as they expand, and defoliation may occur. Systemic infections follow the main veins as black streaks;

symptoms on the bolls are characteristically sunken, water-soaked lesions.

Management: Resistant cultivars are the most economical option to minimize yield loss. Incorporation of infected residue into the soil will help with decomposition of infected debris and reduce inoculum in the soil.

Diagnostic Note: Lesions are typically dark brown (darker than many other pathogens) and can be "shot-holed" in appearance when necrotic tissue falls away. Observe the underside of the leaf for water-soaking around the lesions.

Range and Yield Loss: Bacterial Blight is a major disease of cotton. Since acid delinting of cottonseed in the U.S., Bacterial Blight has been rare, except in OK and TX; however, there is a recent resurgence in additional states. Yield loss can be severe, up to 20%, depending on variety and pathogen race.



Close-up of lesions of Bacterial Blight. (Photo credit: Tom Allen).



Typical spores of *Corynespora cassiicola*, causal agent of Target Spot.



Typical symptomatic lesion of Target Spot.

Name: Target Spot

Caused by: *Corynespora cassiicola*

Foliar Symptoms: Characteristic symptoms of Target Spot include brown lesions, sometimes approaching 2 cm (~1 inch) in diameter, exhibiting a series of concentric rings. Unlike Stemphylium and Alternaria Leaf Spot, the spots are typically not bordered by a dark band. Leaf spots and premature defoliation are generally confined to the interior canopy (unlike that found in Stemphylium and Alternaria diseases.)

Management: Management of Target Spot with fungicides is made difficult by the dense canopy which obstructs placement of fungicides in the interior of the canopy. Some success in managing Target Spot has been achieved by applying fungicides during both the 1st and 3rd weeks of bloom.

Diagnostic Note: Target Spot can be quickly differentiated from Stemphylium Leaf Spot by location in the canopy. Also, defoliation from Target Spot typically begins at the bottom of the plant and progresses upwards. Lesions may occur in the upper canopy, but defoliation of the upper 20% has not been observed.

Range and Yield Loss: Target Spot has become progressively more widespread in the Southeast and Mid-South regions of the Cotton Belt, but is most severe in Florida, Alabama and Georgia. In severe cases, yield losses exceeding 200 lbs lint/A have been documented.



Interior defoliation commonly observed with Target Spot.



Cercospora lesions on cotton leaf.



Tapered cylindrical spores of *Cercospora gossypina*.

Name: Cercospora Leaf Spot

Caused by: *Cercospora gossypina*,
Mycosphaerella gossypina

Foliar Symptoms: Reddish lesions will occur during the early stages. As the disease progresses, the lesions enlarge and turn white to light brown in the center. The lesions are circular and vary in size. Concentric zones are often present with a red color at the margins.

Management: Maintaining plant vigor by having proper fertility and preventing drought stress through irrigation helps delay primary infections and reduce the severity of disease outbreaks.

Diagnostic Note: In the field it is often difficult to differentiate Cercospora Leaf Spot from other foliar diseases.

The spots appear concentric, like those of Target Spot, and the general distribution of spots on the plant may be the same as Stemphylium and Alternaria Leaf Spots. Correct diagnosis often requires viewing the long, thin whip-like, septate spores. Caution should be taken as *C. cassiicola* spores can appear similar to Target Spot, but typically are broader and may have a basal scar.

Range and Yield Loss: Cercospora Leaf Spot occurs in all cotton producing areas within the U.S. When Cercospora Leaf Spot occurs while plants are under stress, or in a disease complex with Alternaria or Stemphylium Leaf Spot, premature defoliation, reduced yield, and lower fiber quality have been documented.



Foliar symptoms of Cercospora Leaf Spot. (Photo credit: J. Brock).

Name: Alternaria Leaf Spot

Caused by: *A. macrospora*, *A. alternata*

Foliar Symptoms: Alternaria Leaf Spot forms lesions on senescing leaves that are brown with purple margins. As lesions expand they typically exhibit concentric zonation and the necrotic tissue will overlap with other lesions. As the disease progresses the lesions will become gray and dry with some of the necrotic tissue falling out giving it a “shot-holed” appearance.

Management: Reducing plant stress and insuring proper soil fertility, especially with potassium, can reduce disease severity.

Diagnostic Note: Symptoms of Alternaria and Stemphylium Leaf Spots are similar; however, Alternaria Leaf Spot is more commonly observed in Texas and the Mid-South and Stemphylium Leaf Spot in the Southeast. Lesions with concentric rings may appear similar to Target Spot; however, spots from Alternaria Leaf Spot will occur throughout the canopy and are also associated with reddening and yellowing leaves.



Cotton field in Texas severely affected by Alternaria leaf spot. (Photo credit: J.E. Woodward).



Foliar symptoms of Alternaria leaf spot. (Photo credit: J.E. Woodward).

Spot is more commonly observed in Texas and the Mid-South and Stemphylium Leaf Spot in the Southeast. Lesions with concentric rings may appear similar to Target Spot; however, spots from Alternaria Leaf Spot will occur throughout the canopy and are also associated with reddening and yellowing leaves.

Range and Yield Loss: Alternaria is one of the most common cotton diseases and is associated with late season cotton development. (Note: Alternaria and Stemphylium Leaf Spots are similar in that both are most severe when cotton plants have insufficient potassium, either from inadequate fertilization or during periods of drought.) Yield loss is not considered a problem with Alternaria Leaf Spot if symptoms and defoliation occur late in the season.

Name: Stemphylium Leaf Spot

Caused by: *Stemphylium solani*

Foliar Symptoms: Stemphylium Leaf Spot lesions are 2 cm in diameter (~1 inch), circular in shape and brown in color with concentric zones. As lesions mature they will develop a whitish center that may crack and fall out producing a “shot-holed” appearance. The lesions normally form on the upper leaves in the canopy and start at the leaf margin and move inward. Fields where Stemphylium Leaf Spot is severe also typically demonstrate symptoms of nutrient deficiency.



Shot-hole appearance often associated with Stemphylium leaf spot on cotton.



Spores of *Stemphylium solani*, causal agent of Stemphylium leaf spot. (Photo credit: Rome Ethredge).



Foliar symptoms of Stemphylium leaf spot. Note the “ashy” centers of the spots and the reddening of the leaf associated with stress on the plant.

Management: Managing for vigorous crop growth by irrigating to avoid drought stress, proper fertilization, and reducing pest pressure will help reduce the incidence of disease outbreaks. Fungicides are available, but are not normally economical for the control of Stemphylium Leaf Spot.

Diagnostic Note: Stemphylium Leaf Spot can be differentiated from Target Spot by position on the plant (Stemphylium typically is found at the top of the plant first, Target Spot is within the canopy). Also, leaves affected by Stemphylium Leaf Spot often show nutrient deficiencies (yellow and red) while leaves affected by Target Spot often appear green, unless approaching senescence.

Range and Yield Loss: Stemphylium Leaf Spot has been found in all the cotton producing areas of the U.S. Since this disease is normally associated with other plant stress factors (drought, nutrient deficiencies, nematode and insect pressure) yield loss can be severe from the stress complex.



Symptoms of Areolate Mildew. Note brown necrotic lesions and powdery white sporulation on underside of leaf. (Appling County Georgia).

Name: Areolate Mildew

Caused by: *Ramularia gossypii*

Foliar Symptoms: Small lesions appear on leaves in the lower canopy late in the growing season. The lesions, 3-4 mm (~0.15 in) wide and restricted by a major leaf vein, are slightly chlorotic on the upper leaf surface with a white mildew growth on the lower surface. Lesions may become necrotic and resemble bacterial blight. In severe cases, premature defoliation will occur.

Management: Use of resistant varieties is the best control strategy for Areolate Mildew. Incorporating crop residue and crop rotation will help reduce inoculum for next season. Fungicides (e.g. azoxystrobin and pyraclostrobin) were effective in managing this disease in Georgia.

Diagnostic Note: No other cotton disease commonly observed will have the white, powdery growth on the underside of the leaf.

Range and Yield Loss: Areolate Mildew is observed in most countries where cotton is produced, but not commonly observed in the U.S. In Georgia, the disease is typically restricted to the extreme southeastern counties. This disease normally appears late in the season and usually causes little yield loss.



Premature defoliation from Areolate Mildew in Appling County, GA. Plant on left was not treated. Plant on right was treated twice with a strobilurin fungicide.

Key to differentiating spots in the cotton fields:

1A. Borders of spots often defined by leaf veins, creating angular or geometric appearance: **Go to 2**

1B. Border of spots not defined by leaf veins and approximately circular in shape: **Go to 3**

2A. Typically observed late in season; often a white sporulation is found on the underside of spots: Areolate Mildew.

2B. Spots dark in color, may appear early in the season and often have a "water-soaked" appearance: Bacterial Blight/Angular Leaf Spot.

3A. Spots affect foliage throughout the plant, especially on upper leaves. Spots typically associated with plants affected by nutrient deficiencies or stress: Stemphylium, Alternaria or Cercospora Leaf Spots. Submit to disease diagnostic clinic for further diagnosis.

3B. Spots often with concentric rings and not associated with symptoms of nutrient deficiencies or stress: **Go to 4**

4A. Spots found typically on young plants and with dark, pepper grain-like sunken structures: Ascochyta Leaf Spot.

4B. Spots with concentric rings on older plants: **Go to 5**

5A. Spots with concentric rings, typically found on leaves within the canopy of foliage: Target Spot.

5B. Spots with concentric rings possibly surrounded by a yellow halo: Identification requires additional diagnosis and a sample should be submitted to a plant disease diagnostic lab for confirmation.

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