

Fungal Leaf-Spotting Diseases of Wheat: Septoria Blotch, Stagonospora Blotch and Tan Spot

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Introduction

A variety of leaf spots occur every year on wheat in Arkansas. Although the most important leaf spots are caused by fungi, other leaf spots have been attributed to herbicide drift, physiological spots (spots that develop as a result of genetic heritage combined with some poorly understood environmental factors) and insect feeding. Additionally, leaf spot diseases caused by fungi can be confused with leaf spots caused by bacteria, and multiple diseases may occur at the same time on the same plants. Thus, it is important that accurate diagnosis be made before any control measure is implemented.

Three important leaf-spotting diseases caused by fungi occur in Arkansas. Septoria blotch (also called speckled leaf blotch or leaf blotch) can be found in most wheat fields every year, while Stagonospora blotch (also called glume blotch) can be common in some years. Tan spot (also called yellow leaf spot) is strongly associated with reduced tillage and wheat-after-wheat cropping sequences, and it will become a greater problem as these practices increase in Arkansas. All three diseases are favored by wet weather during the growing season.

Septoria Blotch

Cause: *Septoria tritici*

Symptoms and Signs

Symptoms of Septoria blotch occur only on leaves. In Arkansas, symptoms on the lower leaves can be found as early as late fall. By early spring,

symptoms can be found on the lowest leaves in most wheat fields throughout the state. Lesions begin as yellow flecks but enlarge into irregular tan-brown lesions. Lesions develop an ash-gray center that is at least partially confined to the leaf veins, giving it the appearance of having parallel sides in at least some part of the lesion. Numerous black structures (pycnidia), which are approximately the size of a grain of salt and visible to the naked eye at arm's length, are produced in the ash-gray areas of the lesion (Figure 1).

The presence of easily visible pycnidia on the leaves is the most reliable diagnostic character for identifying Septoria blotch and differentiating it from other leaf spots. Under moist conditions, masses of spores may be seen oozing from pycnidia like toothpaste from a tube.

Life Cycle

Septoria tritici survives as mycelium, pycnidia and perithecia in wheat residue. Both asexual spores (pycnidiospores) from pycnidia and sexual spores (ascospores) from perithecia on wheat residue can cause primary infections. Infection requires at least 6 hours of leaf wetness and is favored by cool temperatures. New pycnidiospores are produced on diseased leaves 10 to 20 days after infection, and these spores cause secondary infections that can result in serious epidemics on susceptible cultivars when environmental conditions are favorable. Disease development is fastest during rainy weather when temperatures are between 50 and 68 degrees F.

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Stagonospora Blotch

Cause: *Stagonospora nodorum*

Symptoms

Wheat leaves, stems and heads can be infected by *Stagonospora nodorum*. Although initial infections occur in the fall, early symptoms (small brown spots on leaves and stem nodes) commonly go unnoticed. Classical leaf lesions are lens-shaped with diffuse yellow borders and a brown center containing pycnidia (Figure 2). Compared to pycnidia produced by *Septoria tritici*, these pycnidia are reddish brown, embedded in the leaf tissue and are difficult to see without a hand lens. *Stagonospora* blotch develops fastest in warm temperatures during late April and May. If classical leaf lesions can be found before heading, it is likely that many more symptomless and/or nontypical infections are present on leaves and stems. In this situation, a flush of symptoms on upper leaves and heads is likely to appear suddenly at flowering stage if there is sufficient moisture for spore production in the lower canopy and for infection of upper leaves and heads. This rapid appearance of symptoms is associated with wheat plants becoming more susceptible as the plant switches from vegetative to reproductive growth, temperature becoming warmer and more favorable for disease and massive numbers of spores produced in the lower canopy.

After flowering, the disease on the heads becomes apparent and is commonly called glume blotch (the glume blotch phase of *Stagonospora* blotch). Lesions on the glumes usually begin at the tip and proceed down, covering most or all the width of the glume (Figure 3). Lesion color may be dark brown to dark purple with ash-gray areas containing embedded pycnidia that are difficult to see without a hand lens. The glume blotch phase has been confused with black chaff, but black chaff lesions are black and confined by veins in the glume, giving them a vertically striped appearance with parallel sides. Additionally, if black chaff is a problem, there usually will be some black lesions on the peduncles and no pycnidia will be present.

Incubating leaves or heads with a wet paper towel in a sealed plastic bag overnight should help make pycnidia of *Stagonospora nodorum* more visible if they are present.

Life Cycle

Stagonospora nodorum survives in infested seed and crop debris. Sexual (ascospores) and asexual (pycnidiospores) spores may be produced in the fall and early spring. In Arkansas, most primary

infections appear to arise from infested seed rather than from infested crop debris. Like *Septoria* blotch, *Stagonospora* blotch infection requires a minimum of 6 hours of wetness, and new spores are produced within 10 to 20 days. Disease development is fastest during rainy weather when temperatures are between 68 and 81 degrees F.

Tan Spot

Cause: *Pyrenophora tritici-repentis*

Symptoms and Signs

The first symptoms of tan spot are small (1/8 to 1/2 inch long and 1/16 to 1/8 inch wide), yellow to tan lesions with a well-defined (not diffuse) border on the lower leaves (Figures 4 and 5). Lesions expand into irregular, diamond- or lens-shaped tan spots with a dark brown center and a bright yellow halo surrounding the lesion. Expanding lesions merge to form large, irregular-shaped areas of dead tan tissue (Figure 6). As the disease progresses to upper leaves, severely infected lower leaves die prematurely.

After harvest small black reproductive structures called pseudothecia are produced on the wheat stems (Figure 7). Pseudothecia feel like braille dots when rubbed between the thumb and index finger. When tan spot is severe in the current wheat crop, pseudothecia on wheat stems from a previous wheat crop usually can be found nearby. Tan spot symptoms can be confused with herbicide injury (paraquat for example), so confirmation of the disease is important before any control measure is used.

Life Cycle

The tan spot fungus survives in infested wheat straw. When the weather is favorable in late winter or spring, sexual spores (ascospores) from pseudothecia and asexual spores (conidia) developed directly on wheat residue are dispersed by wind. A minimum of 6 hours of leaf wetness is necessary for infection, and rainy weather and temperatures between 64 and 82 degrees F favor disease development. Lesions appear within a week after infection. As the lesions mature, more conidia are produced in the dark centers of lesions, causing secondary infections.

Management

Several methods can be used to reduce losses from fungal leaf spotting diseases, and the best control is achieved when a combination of methods is used.

Resistance

Growing resistant varieties is the most effective method for managing leaf spotting diseases. The Arkansas wheat pathology program attempts to rate cultivars for resistance to these diseases, but lack of sufficient disease pressure in research plots limits the ability to accurately rate cultivars for resistance to all diseases in most years. The ratings in the most recent Wheat Update <www.uaex.edu> should be consulted when choosing cultivars for your farm.

Cultural

Because the fungi causing leaf spot diseases survive in wheat debris from previous crops, tillage to bury the debris and rotation out of wheat to allow the debris to decompose and the fungi to die are effective control methods. Rotation practices in Arkansas generally provide good control of tan spot but limited control of Septoria blotch and Stagonospora blotch.

Chemical

All fungicides listed in the current MP154, *Arkansas Plant Disease Control Products Guide* <www.uaex.edu>, are effective against Septoria blotch, Stagonospora blotch and tan spot. However, a positive identification should be obtained before

spending money on a fungicide application because fungicides have no effect on bacterial streak/black chaff or on leaf spots not caused by fungi. As with most foliar diseases, it is critical to protect the upper two leaves and heads from infection for as long as possible. If one or more of these diseases are present on lower leaves before heading stage (Feekes 10.3), then a fungicide application may be needed. The optimal time for a fungicide application usually is between boot and early heading stages (Feekes 10 to 10.1). Applications can be made no later than flowering (Feekes 10.5), and these later applications usually are less effective than earlier applications for protecting the upper leaves and heads. Remember that most Stagonospora blotch infections are symptomless or nontypical before flowering, so a fungicide application at boot to early heading stage may be needed, even if only a few typical symptoms are visible at this time.

Seed Treatment

Planting pathogen-free seed or seed that has been treated with certain fungicides is the most effective way to reduce Stagonospora blotch. Recommended seed treatments can be found in the most current MP154, *Arkansas Plant Disease Control Products Guide* <www.uaex.edu>. In Arkansas, seed treatments are not effective for Septoria blotch or tan spot.

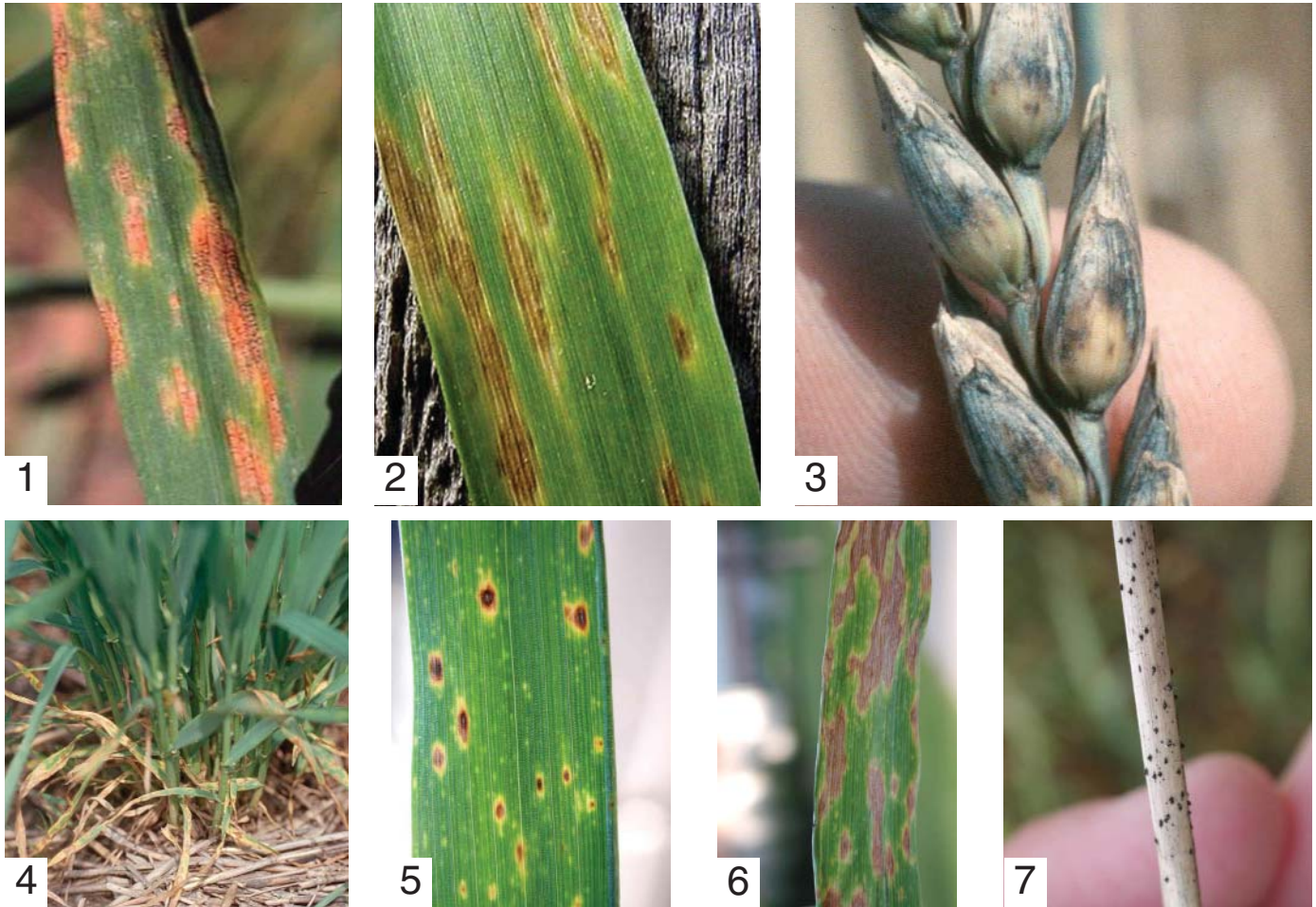


Figure 1. Septoria blotch lesions with parallel sides restricted by leaf veins and numerous, easily visible black pycnidia. **Figure 2.** Young Stagonospora blotch lesions on a leaf; note brown center and diffuse chlorotic border. **Figure 3.** Stagonospora blotch lesions on wheat spikes. **Figure 4.** Tan spot lesions first appear on lower leaves in the wheat canopy. **Figure 5.** Young tan spot lesions with darkened centers surrounded by yellow halos with well-defined borders. **Figure 6.** Tan spot lesions coalesce to form large irregular areas of dead tan tissue. **Figure 7.** Pseudothecia produced by the tan spot fungus on wheat straw. *Photo credits: Figures 1, 2, 5, 6 and 7 by Rick Cartwright; Figures 3 and 4 by Gene Milus.*

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