College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-AG-T-07**

Target Spot & Frogeye Leaf Spot of Field-grown Tobacco

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Importance

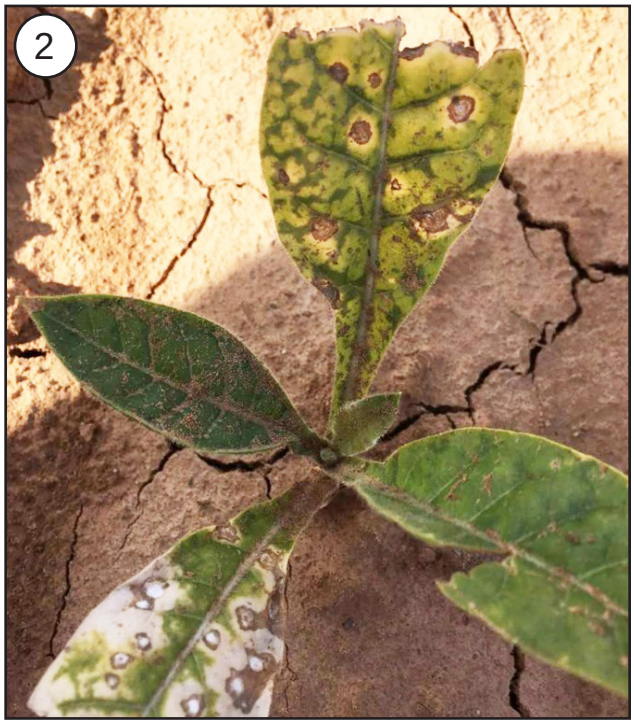
Target spot and frogeye leaf spot are the major fungal leaf spot diseases of tobacco grown in Kentucky. Burley and dark tobacco are susceptible to these leaf spot diseases; however, dark tobacco tends to be affected to a lesser extent than burley. Yield losses to target spot can exceed 50% in some years; frogeye reduces yields up to 30%, but can affect quality so severely that cured leaf may be declined. Integrated approaches, including good greenhouse production practices, crop rotation, and timely fungicide applications, will optimize management of these diseases.

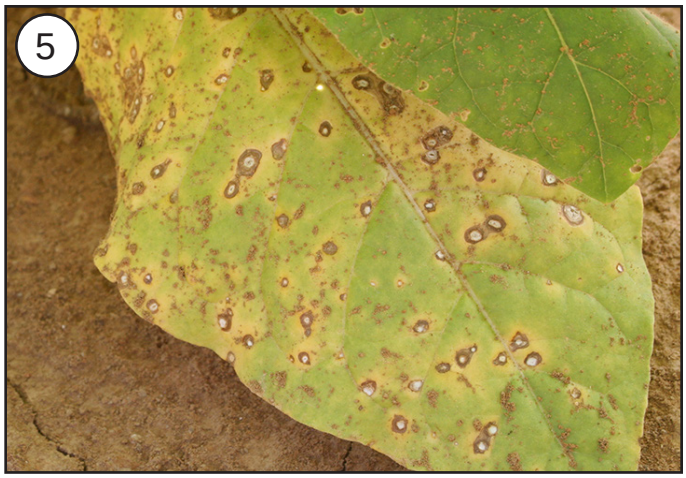
Symptoms

Target spot and frogeye leaf spot (frogeye) can cause disease in greenhouse transplants (Figures 1a & 1b; Dixon et al. 2018). Both diseases may become severe more quickly when symptomatic plants are transplanted in the field (Figure 2). While in the field, target spot and frogeye lesions occur on the lowest, oldest leaves first, then progress to upper leaves over time. Visual symptoms of these diseases differ, as described below.

Figure 1: Lesions of target spot (a) and frogeye leaf spot (b) on burley tobacco transplants in the greenhouse.

Figure 2: Frogeye leaf spot lesions on recently transplanted burley tobacco. **Figure 3:** Target spot lesion with concentric rings on a burley tobacco leaf. **Figure 4:** Leaf loss due to target spot in burley tobacco. **Figure 5:** Frogeye leaf spot on nearly mature burley tobacco leaf. **Figure 6:** Green spots (within circles) on cured burley tobacco leaf with significant frogeye leaf spot pressure (white lesions).





Target Spot

Field disease can be carried in with symptomatic greenhouse transplants, or tobacco can be infected by target spot fungus that is naturally present in and around fields. Lesions initiate as small, transparent spots with little to no yellowing (chlorosis). Over the next several weeks, lesions can expand to softball-sized or larger, and are characterized by a concentric ring pattern, giving the disease its name (Figure 3). Yields are limited when target spot centers fall out and/or when lesions occur close to the stem end (petiole) of lower leaves, resulting in total leaf loss (Figure 4).

Frogeye Leaf Spot

Lesions appear initially as chlorotic spots on older leaves that enlarge to develop the characteristic white center surrounded by a red-brown ring and encircled by a yellow halo. Typically, frogeye lesions become no larger than a U.S. quarter in diameter (approximately 25 mm) (Figure 5). Green spots in cured leaves may be present and are sometimes attributed to late-season frogeye pressure (Figure 6). In rare situations where lesions grow together (coalesce), yield reduction may occur. However, frogeye usually limits quality, sometimes resulting in the rejection of a crop by buyers.

Causes & Disease Development

Rhizoctonia solani (teleomorph *Thanatephorus cucumeris*) causes target spot and *Cercospora nicotianae* causes frogeye. These fungal pathogens are common in tobacco-producing areas worldwide. Both pathogens can overwinter on-site, and development of target spot and frogeye is benefited by seasons with frequent rains. Fungal leaf spot "hotspots" are often low-lying areas of fields that maintain high humidity and wetter soils.

Disease Management

Fungal leaf spot disease severity can be managed preventively with a combination of crop rotation and fungicide application. Variety selection appears to influence frogeye severity (see below).

Crop Rotation

The target spot pathogen, *R. solani*, has a broad host range, but only specific strains occur frequently as foliar pathogens on tobacco (Stevens Johnk et al. 1993). Other strains of *R. solani* induce root rots on a broader range of plants, including tobacco in floatbed trays. The frogeye pathogen, *C. nicotianae*, is fairly specific to tobacco and other nightshade plants, although it was recently documented from soybean (Sautua et al. 2019).

Thus, rotating fields away from tobacco for at least two seasons, managing commonly occurring weeds during the rotation, and not incorporating soybean into rotations can reduce incidence of target spot and frogeye.

Variety Selection

Variety susceptibility evaluations have not been completed for target spot. In variety trials conducted on research and grower farms, early-maturing burley cultivars tended to have more severe frogeye than medium- or late-maturing varieties.

Foliar Fungicide Applications

The primary fungicide for management of fungal leaf spots is azoxystrobin (Quadris and generics). In most years and most locations, an application of azoxystrobin timed 4 weeks post-transplant reduces target spot. In areas with severe frogeye pressure, three foliar applications in a sequence of azoxystrobin—mancozeb—azoxystrobin, timed to 3, 5, and 7 weeks post-transplant, respectively, is effective in reducing frogeye. Growers should confirm the acceptability of mancozeb for field use with their contract and field representative, as some companies do not support this usage pattern.

Resistance to Fungicides

To date, the target spot pathogen is still believed to be sensitive to azoxystrobin; however, resistance to this fungicide has been confirmed in Kentucky populations of the frogeye pathogen (Dixon et al. 2020). Resistance in the frogeye pathogen occurs at two levels, moderate and high, though moderate resistance is much more common. The three-foliar application fungicide program indicated above has been shown to reduce frogeye in fully sensitive populations as well as populations composed of mostly moderately resistant individuals. No grower populations have been identified that are primarily highly resistant to azoxystrobin. Resistance to mancozeb has not been documented in either pathogen.

Additional Resources

UK Extension Publications

- Burley and Dark Tobacco Production Guide (ID-160)
http://www2.ca.uky.edu/agcomm/pubs/id/id160/id160.pdf

- Rhizoctonia Damping-off & Target Spot Management in the Float System (PPFS-AG-T-02)
https://plantpathology.ca.uky.edu/files/ppfs-ag-t-02.pdf

Additional Resources

Research Publications

- Dixon, E., Kennedy, B., Pearce, R., and Pfeufer, E. 2018. Occurrence of Frogeye Leaf Spot, Caused by *Cercospora nicotianae*, on Greenhouse Tobacco Transplants in Kentucky. Plant Disease https://doi.org/10.1094/PDIS-10-17-1548-PDN

- Dixon, E., Barlow, W., Walles, G., Amsden, B., Hirsch, R. L., Pearce, R., and Pfeufer, E. 2020. Cytochrome b mutations F129L and G143A confer resistance to azoxystrobin in *Cercospora nicotianae*, the frogeye leaf spot pathogen of tobacco. Plant Disease https://doi.org/10.1094/PDIS-02-19-0382-RE

- Stevens Johnk, J., Jones, R. K., Shew, H.D., and Carling, D. E. 1993. Characterization of Populations of *Rhizoctonia solani* AG-3 from Potato and Tobacco. Phytopathology 83: 854-858. https://www.apsnet.org/publications/phytopathology/backissues/Documents/1993Articles/Phyto83n08_854.PDF

- Sautua, F. J., Searight, J., Doyle, V. P., Price, P. P. III, Scandiani, M. M., and Carmona, M. A. 2019. The G143A Mutation Confers Azoxystrobin Reistance to Soybean Cercospora Leaf Blight in Bolivia. Plant Health Progress. https://doi.org/10.1094/PHP-10-18-0060-BR

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