

Wheat blast is a devastating disease currently present in South America, southern Asia, and southern Africa. The disease is caused by the fungus *Magnaporthe oryzae Triticum*, (this fungus is also known as *Pyricularia oryzae Triticum*). The disease has not yet been reported in the United States, but preliminary climate suitability and forecasting analyses indicate all U.S. soft red winter wheat and half of U.S. hard red winter wheat are at risk.

## Identifying Wheat Blast

Wheat blast can affect all aboveground parts of the plant, but head bleaching is the most common symptom (Figure 1a). Infected awns have brown to whitish discoloration, while infected glumes show elliptical lesions with reddish-brown to dark-gray margins (Figure 1b). Lesions on leaves are often elongated ovals with pointed ends and may have reddish



## Quick Facts

- Wheat blast affects South America, southern Asia, and southern Africa and it has not been detected in the United States.
- Wheat blast introduction in the United States could occur by the introduction of *Magnaporthe oryzae Triticum* strains from exotic strains or through the host adaptation of U.S. native *Magnaporthe oryzae Lolium* strains.
- Wheat blast can affect all aboveground parts of the plant, but symptoms in the wheat head are the most common.
- Symptoms of wheat blast resemble those caused by Fusarium head blight; however, wheat blast produces gray masses of spores, while Fusarium head blight produces pink sporulation.
- Integrated disease management is recommended, including genetic resistance, fungicide seed treatment and foliar fungicide, and crop rotation with nonhosts.



**Figure 1.** *Wheat blast symptoms. (a) Spike bleaching is the most common and visible symptom in the field (photo: G. Barea). (b) Elliptical lesions with reddish-brown margins (photo: C. Cruz). (c) Gray sporulating lesions with yellow chlorotic halos (photo: G. Barea). (d) Grains from blast-infected heads are often small, shriveled, and deformed (photo: G. Cruppe).*

brown margins and yellow chlorotic halos (Figure 1c). Symptoms during the seedling stage may be apparent during epidemic years. Lesions on both heads and leaves have gray centers during sporulation and tan centers after spore release.

Seed infected by *Magnaporthe oryzae* *Triticum* are often small and shriveled (Figure 1d); however, under low disease pressure or when infection occurs late in the wheat cycle, infected seeds may be asymptomatic.

Blast symptoms on heads closely resemble symptoms of Fusarium head blight, which is common in eastern and central Kansas, with rare outbreaks in irrigated fields in western Kansas. A key difference is that wheat blast produces dark gray sporulation, while Fusarium head blight produces pink to orange masses of spores (Figure 2). Additionally, wheat blast symptoms can appear as early as heading, whereas Fusarium head blight symptoms usually first appear 10 to 14 days after anthesis.

### Favorable Conditions and Potential Yield Losses

The disease is highly dependent on conducive conditions. There is a high year-to-year variability in disease development and consequently, yield losses. Under the optimal weather conditions, yield losses up to 100% have been reported for susceptible varieties.

The combination of warm temperatures (77 to 84 degrees Fahrenheit) and high relative humidity (greater than 90%), with long periods of leaf wetness (longer than 10 hours) promotes wheat blast infection and development. Experiments in controlled environments indicate infection can occur with temperatures ranging from 50 to 90 degrees Fahrenheit. Greater yield and quality losses generally occur when infection occurs at early stages of heading; from initial heading (Feekes 10.1) to flowering (Feekes 10.5.3).



## Definitions

- **Strains:** An individual or a group of fungal organisms with shared characteristics. For instance, “The recently isolated strains from Brazil are more aggressive than strains isolated in the 90s.”
- **Lineage:** A defined group of strains based on genetic similarity and host specificity. For instance, “Wheat blast is caused by a distinct lineage of the fungus that causes blast on rice.”

### Host Specificity and Alternative Hosts

The fungus *Magnaporthe oryzae* is divided into host-specialized lineages that can cause disease in more than 50 grass species, including important food crops such as rice and wheat, and economically important forage and turf crops. Unlike the wheat pathogen, lineages causing blast diseases in rice (*Magnaporthe oryzae* *Oryza*) and annual ryegrass and tall fescue (*Magnaporthe oryzae* *Lolium*) are already established in the United States.

### Detection Methods

Specific molecular diagnostic tools have been developed and validated that can differentiate the various *Magnaporthe oryzae* lineages. In hopes of minimizing further spread, researchers at Kansas State University and international collaborators are working on diagnostic protocols to detect wheat blast on seeds and in grain lots.

### Disease Management

Because no single management method provides high levels of wheat blast control, an integrated disease



**Figure 2.** *Fusarium* head blight (a) produces pink/orange masses of spores (photo: E. DeWolf), while wheat blast (b) produces dark gray sporulation (photo: G. Barea).

management strategy is recommended to reduce the chances of yield losses from the disease.

### ***Selection of resistant varieties***

No commercially available wheat varieties are highly resistant to wheat blast, but moderately resistant varieties are available and are the most common and effective tool for disease control. Preliminary data have shown that new pathogen strains are decreasing the level of resistance of some varieties previously classified as resistant.

For more information about resistance of U.S. genotypes, visit: [www.ars.usda.gov/plains-area/lincoln-ne/wheat-sorghum-and-forage-research/docs/hard-winter-wheat-regional-nursery-program/research/](http://www.ars.usda.gov/plains-area/lincoln-ne/wheat-sorghum-and-forage-research/docs/hard-winter-wheat-regional-nursery-program/research/).

### ***Planting disease-free seeds and fungicide seed treatments***

Wheat blast is seedborne and *Magnaporthe oryzae Triticum*-infected seeds can be asymptomatic; thus, the use of healthy seeds and fungicide seed treatment is highly recommended. Seed treatment can reduce initial inoculum and spread; however, its effectiveness is limited. Recommendations vary by location.

### ***Foliar fungicide applications***

The efficacy and economic benefit of fungicide applications to control wheat blast are uncertain. Specific recommendations vary according to country and disease pressure. Recent findings show that mancozeb-based and quinone outside inhibitors combined with sterol demethylation inhibitors fungicides provide acceptable levels of wheat blast control and yield benefits in Brazil and Bolivia.

Multiple fungicides may be required to provide acceptable disease suppression in highly favorable environments. Producers should be aware that fungicide resistance has already been reported in Brazil;

thus, rotating the active ingredient and using a mixed mode of action is highly recommended.

### ***Removal of infected crop residue***

The fungus that causes the disease requires a living host to reproduce, but it can survive on residue from a previous wheat crop. Removal of infested wheat residue through tillage often reduces the local population of the fungus and the risk of disease. Crop rotation to soybeans or another nonhost crop after wheat also reduces disease risk.

### ***Adjustment of sowing date***

Adjusting the sowing date is a common practice in areas affected by wheat blast to avoid wheat heading under warm and rainy conditions, but specific recommendations will vary according to the region. Because the currently affected areas cultivate mostly spring wheat, which has no vernalization requirement, the effects of sowing date on heading date are much more straightforward than in the winter wheat systems in Kansas. While sowing date can affect heading date in Kansas, its actual benefits against wheat blast have not been evaluated here.

## **Risk of Wheat Blast Introduction in the United States**

Wheat blast could become established in the United States through either the introduction of *Magnaporthe oryzae Triticum* strains from South America or southern Asia, or through a “host jump” where a fungus develops the ability to infect a new crop. For example, it is possible that the fungus causing blast on perennial and annual ryegrass, tall fescue, popular turf grass, and forages (i.e. *Magnaporthe oryzae Lolium* population) could infect wheat. In most situations, the *Magnaporthe oryzae Lolium* population of the fungus is less aggressive on wheat than strains isolated from wheat.

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Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of K-State Research and Extension, Kansas State University, County Extension Councils, Extension Districts.

MF3583 | September 2021