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Leaf and Neck Blast of Rice

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Blast, caused by the fungus *Pyricularia oryzae*, is a major disease in rice cultivation. The terms "leaf blast" and "neck blast" refer to the specific areas of the rice plant that are affected, the leaves and panicles, respectively. Blast poses a significant threat to rice production worldwide, leading to substantial yield losses under favorable environmental conditions. In Arkansas, it is a persistent concern on susceptible rice hybrids and varieties, as severe outbreaks can greatly reduce crop yields and farm profit.

Causal Agent

The fungus is named according to its life stage: *Magnaporthe oryzae* for the sexual stage (teleomorph) and *Pyricularia oryzae* for the asexual stage (anamorph). In the United States, the causal agent of rice blast is typically referred to by its teleomorphic phase, *Magnaporthe oryzae*. Both names are correct.

Symptoms

Leaf blast and neck blast are the two main phases of blast disease infected by the same pathogen *Pyricularia oryzae* (teleomorph: *Magnaporthe oryzae*). Symptoms can occur during both the vegetative (leaf formation) and reproductive physiological stages (panicle formation) of plant development during the season, resulting in visual foliar and panicle damages. Below is the breakdown of each phase: Leaf Blast and Neck or Panicle Blast.

Leaf Blast

During the leaf blast phase, lesions are small, white, gray, or bluish spots that expand into a diamond shape with white to tan centers and brown borders (Fig. 1).

Severe infections can result in extensive leaf damage and plant death. Within the lesions, spores (called conidia) are produced. These spores serve as inoculum that can be spread from the lesion to nearby healthy rice

Figure 1. Symptoms of leaf blast show diamond-shaped lesions with gray centers (A) and brown margins (B) on rice leaves.

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Figure 2. Spore germination of *Pyricularia oryzae* within lesions on rice leaves under moist conditions

Figure 3. Pear-shaped conidia of *Pyricularia oryzae*, with 3-celled structure.

plants or plant parts and infect, causing more lesions to form. When conidia of *Pyricularia oryzae* are isolated from lesions (Fig. 2), they can be identified by their distinct pear-shaped form (pyriform), typically septate (3-celled), and measuring about 20–25 micrometers in length (Fig. 3). These conidia have a pointed tip and are formed on branched, septate conidiophores. These key morphological traits make *P. oryzae* distinguishable under a microscope, aiding in the correct diagnosis of rice blast disease. Leaf blast damages leaves which reduces the plant's photosynthetic ability, leading to stunted growth, defoliation, lower yield potential, and poor grain quality.

Neck or Panicle Blast

At the heading stage, the most destructive form of the disease, known as neck blast, occurs. It causes darkening and wilting at the base of the panicle and necrotic lesions that girdle the tissue, resulting in poor grain filling, panicle breakage, or complete panicle collapse (Fig. 4). The fungus can also infect stem nodes and leaf collars, leading to plant death under favorable conditions such as prolonged moisture. Neck blast can cause significant yield losses as affected grain fails to mature.

Conditions Favoring Disease Development

The rice blast fungus thrives in environments with high humidity and prolonged leaf wetness, which are ideal for spore germination and infection. The optimal temperature range for the fungus is between 77°F and 86°F. Frequent rain, fog, or heavy dew that keeps leaves moist, promotes disease spread (Fig. 5). Dense rice canopies that limit airflow and sunlight also maintain high humidity, encouraging fungal growth, infection, and disease spread.

Disease Cycle

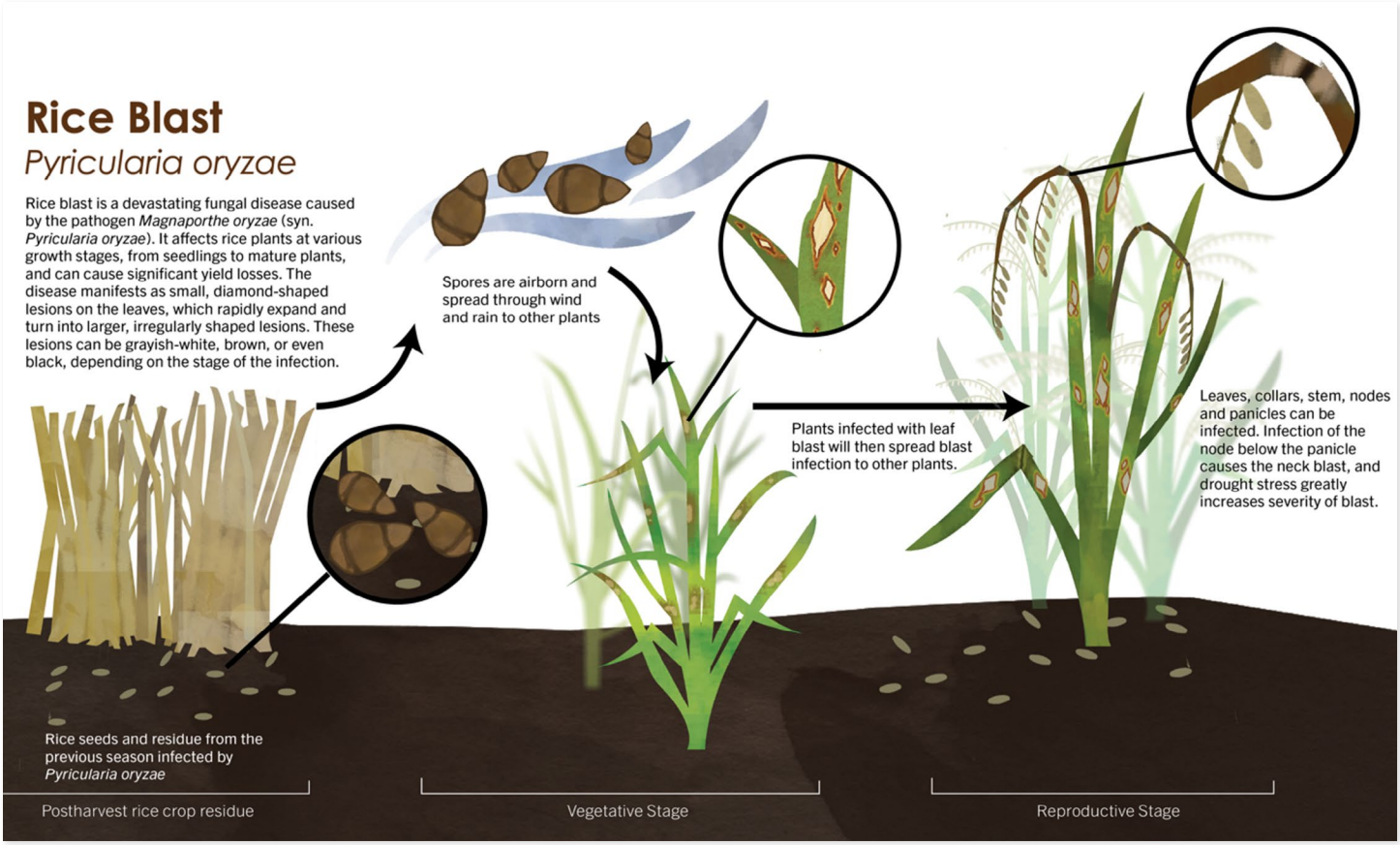
The pathogen survives between seasons on infected straw or seeds (Fig. 5). During favorable conditions, spores (conidia) form on rice residue and are spread through wind and splashing of water. These spores are the primary means initiating rice blast disease and are the cause of rapid spread within and between fields. Wet conditions, particularly in shaded areas, facilitate infection, while drought-stressed and poorly irrigated areas are more susceptible to disease development. Cooler, cloudy, and rainy weather further increases the likelihood of more severe disease epidemics.

Figure 4. Symptoms of neck blast. The base of the panicle has dark necrotic lesions that girdle the tissue, resulting in poor grain filling, panicle breakage, or complete panicle collapse.

Managing Rice Blast

Managing leaf blast and neck blast disease requires integrated strategies, including the use of resistant hybrids or varieties, proper irrigation, and timely fungicide application if scouting indicates disease development and spread. It's advisable to plant resistant cultivars, especially in fields with a history of blast or those where it is a challenge to maintain a consistent flood. Clean, fungicide-treated seed, maintaining consistent water levels (≥4 inches), and early planting help reduce

Figure 5. Schematic diagram of the disease cycle for leaf and neck blast in rice, illustrating infection, symptom development, and spore dissemination [Crop Protection Network]. Copyrights for the image to Crop Protection Network.



disease pressure. Regular field scouting for early symptoms is crucial. It's important to note that changes in production systems can affect disease development. Managing blast in row rice systems is a bit more challenging as the absence of the 4-inch water layer makes the crop more vulnerable to the disease. In these systems, careful irrigation management and frequent scouting become even more important to detect early symptoms of the disease.

There is no minimum disease threshold to determine when a fungicide application should be made for blast. When low levels of disease are present, increasing the flood depth (4-inch water depth) can suppress disease development. If blast lesions are observed on leaves prior to heading, a single fungicide application should be made at late boot (when at least 50% of the main tillers are splitting the boot or have the very tips of the panicles beginning to emerge). An additional application should be made if conditions favor blast or blast pressure is severe. This second application should be made when at least 50% of the main tillers have the panicles about 3/4 of the way out of the boot. Remember that leaf blast and neck blast are caused by the same pathogen, occurring on different parts of the plant and at different stages of development. Additionally, one feeds into the other as infections on the leaves become a source of inoculum for infections on the panicle. An integrated management approach, combining resistant varieties, optimal cultural practices, timely fungicide applications, and proper fertilization, will be the most effective strategy against both leaf and neck blast.

What Fungicide to Apply?

The active ingredients effective for controlling leaf and neck blast in rice are azoxystrobin (e.g., Quadris 2.08 SC at 12.3 fl oz/ac) and trifloxystrobin (e.g., Flint Extra at 3.1 – 4.7 fl oz/ac). These active ingredients are also available in combination with propiconazole (Quilt Xcel 2.2 SE, Stratego 2.08 EC) and difenoconazole (Amistar Top 2.72 SC).

How to Decide Which Product to Apply

If your field is dealing solely with blast issues, it's best to use Quadris or Flint Extra. Quilt Xcel and Amistar Top contain propiconazole and difenoconazole, respectively—triazoles that do not control blast. However, if you're also facing problems with false smut, kernel smut, or Cercospora, Quilt Xcel or Amistar Top would be more appropriate for broader disease control.

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Diagram/Chart Credit: Crop Protection Network [https://cropprotectionnetwork.org/].

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