Bakanae Disease in Rice

Background

Bakanae was first found in California in 1999. Since its introduction, the disease has spread through all the rice growing regions of the State. Initially, the disease posed a threat to the industry, causing yield reductions in heavily infected fields. After the adoption of the sodium hypochlorite (bleach) seed treatment, the importance of the disease declined, rarely causing losses. However, in recent years, the disease has regained importance as use of the sodium hypochlorite seed treatment decreased.

The Pathogen

Bakanae is caused by the fungus *Fusarium fujikuroi*. The fungus produces the plant hormones gibberellin and fusaric acid, causing infected plants to elongate or become stunted. Infected seedlings look elongated, spindly, and chlorotic (Fig. 1). In mature plants, leaves turn yellow and are easily

Figure 1. Heatlhy (left) and bakanae infected (right) seedlings. Infected seedlings are elongated, spindly, and chlorotic.

Figure 2. Bakanae rots the crown in mature plants. Infected (left) and healthy (right) plants.

seen above the canopy. In these plants, the crown rots (Fig. 2) and most die before producing a panicle. If a panicle is produced, kernels do not fill.

At maturity, the pathogen produces pink sporulation on dying tillers (Fig. 3). These spores can infest seeds during harvest, including nearby fields.

Bakanae is considered a seed-born disease, meaning that the main way the disease is spread is via seed. The pathogen can survive in crop residue in the soil; however, this is not thought to be an important source of inoculum. Some species of watergrass can act as hosts of the disease.

Management

The best way to prevent bakanae is to use seed free of the pathogen. Avoid using infected fields as seed fields. The use of sodium hypochlorite as seed treatment is the most effective way to eliminate bakanae spores from the seed. Dilute sodium hypochlorite in water to prepare a 3,000 ppm chlorine solution, soak seed for 2 hours, drain, and then soak in fresh water until ready for seeding. Alternatively, seed can be soaked in a 1,500

Figure 3. At maturity, the pathogen produces pink sporulation on dying tillers. The spores can infest seeds during harvest.

ppm chlorine solution for at least 24 hours without the need to drain and soak in fresh water before seeding.

To prepare the chlorine solution, use only registered sodium hypochlorite products and follow the instructions on the label. Products have different concentrations of sodium hypochlorite and therefore the amount of product needed to reach the right chlorine concentration varies. An example of registered products as of the writing of this Fact Sheet is shown in Table 1.

Seed should be sown within 12 to 24 hours of draining. When seed is held for longer, temperature in the holding tank increases and any surviving bakanae spores will germinate and produce more spores, resulting in seed that is infested even though it was treated.

Currently, no effective seed treatments against bakanae exist for organic, dry, or drill seeded rice. Given that most of the acreage in California is conventionally grown and water seeded, wide adoption of the sodium hypochlorite seed treatment can reduce the areawide bakanae inoculum and reduce the risk of infection and contamination of seed for organic, dry, and drill seeded rice.

Table 1. Example of products registered for bakanae seed treatment and dilution rates.

Product	Sodium hypochlorite concentration (%)	Dilution to reach 3,000 ppm chlorine solution	Dilution to reach 1,500 ppm chlorine solution
Clorox Germicidal Bleach	8.25	4 gal/96 gal of water	2 gal/98 gal of water
Aqua Chlor	12.5	2.5 gal/100 gal of water	1.3 gal/100 gal of water
Sunny Sol Sodium Hypochlorite 12.5%	12.5	2.64 gal/110 gal of water	1.32 gal/110 gal of water
Multi-Chlor 15.5	15.5	2 gal/100 gal of water	1 gal/100 gal of water

For more on this topic:

✓ Integrated Pest Management for Rice, Third Edition. UC Agriculture and Natural Resources.
✓ UC IPM for Rice: ipm.ucanr.edu
✓ Compendium of Rice Diseases and Pests. Second Edition. 2018. American Phytopathological Society Press.

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