

# Bakanae Disease of Rice

## IDENTIFICATION GUIDE

Bakanae is one of the oldest known diseases to infect rice in Asia, but it was not observed in the United States or California until 1999. Since its introduction, bakanae has spread throughout California's rice growing regions. Current losses due to bakanae in California are minor, but in Asia, losses of up to 70% have been reported. The extent to which bakanae could effect California rice production is currently unknown.

### CAUSAL ORGANISM

Bakanae is caused by the fungus, *Fusarium fujikuroi* Nirenberg, which is an anamorph in the ascomycete species complex, *Gibberella fujikuroi* Saw. *Gibberella* is heterothallic, thus, both mating types must be present for the production of perithecia. The anamorph is the predominant stage found in the field. The teleomorph, (*Gibberella fujikuroi*) has only recently been observed in California rice fields.

### SYMPTOMS

While bakanae is generally thought of as a seedling disease it can be observed throughout the growing season. The earliest symptoms of bakanae are manifested about a month after planting (FIG 1 and 4). Infected seedlings are elongated, more slender and slightly chlorotic when compared to healthy seedlings (FIG 2).

(continued on reverse)



FIGURE 1 - Early symptoms of bakanae infection

The rapid elongation of infected plants is due to the production of Gibberellin, a plant hormone, by the fungus. Bakanae plants are often visible extending above the healthy rice plants (FIG 3 and 4). Healthy plants continue to grow, while bakanae plants usually begin to senesce, and eventually most infected plants are not visible above the healthy. As the season progresses, bakanae plants may die before reaching maturity, or if they do survive to heading, the panicles they produce are mostly empty (FIG 5 and 6). These classic symptoms, seedlings that rapidly elongate and then die without producing seed are where the disease gets its name, Bakanae, meaning 'foolish seedling'.

As the diseased plants senesce and die, mycelia of the fungus may emerge from the nodes (FIG 7), and sporulation of the pathogen may be easily visible above the water level (FIG 8 and 9). After the water is drained, the fungus sporulates profusely on the stems of diseased plants (FIG 10). This sporulation appears as a cottony mass (FIG 11) and the spores produced serve to contaminate healthy seeds during harvest. When both mating types of the fungus are present, perithecia (the perfect stage) may form.

Perithecia appear as dark blue flask shaped bodies on the on the nodes and stems of infected plants (FIG 12). Ascospores produced in perithecia may also contaminate seed and serve as inoculum the following season.

### **BAKANAЕ DISEASE CYCLE**

The bakanae pathogen is known to survive between growing seasons as spores (both conidia and ascospores) on the coats of infested seeds. Since infected plants produce mainly empty panicles, there is no evidence of internal infection of seeds.

Infested seeds are the most important source of inoculum, resulting in both infected plants in the field after planting, and also the introduction of the disease to previously non-infested fields. The fungus can over season in the soil and residue, and infection of non-infested seeds by spores in the soil has been demonstrated, although the length of time that spores can survive in the soil is unknown.

### **MANAGEMENT OF BAKANAЕ**

The most effective means to control bakanae is through the use of non-infested seed.

Also, burning the residue in fields with known infection, may help limit the disease.

---

*L. L. Anderson and R. K. Webster,  
Department of Plant Pathology  
University of California, Davis  
September, 2002*

## Bakanae - Continued



**Figure 2** - The bakanae diseased plant at right is taller, more slender and more chlorotic than the healthy.



**Figure 3** - Plants with bakanae disease



**Figure 4** - Bakanae diseased plants.



**Figure 5**



**Figure 6**

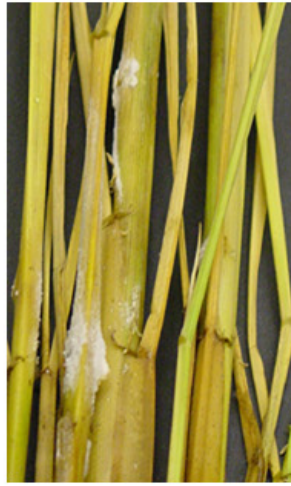
**Figures 5 and 6** - Empty panicles produced as a result of bakanae infection.



**Figure 7** - Mycelium of *G. fujikuroi* emerging from the node of an infected plant.



**Figure 10** - Cottony mass of sporulating mycelia



**Figure 11** - Stems with cottony masses of sporulation.



**Figure 12** - Dark blue perithecia forming on bakanae infected plants.



**Figure 8** - A typical late season plant infected by bakanae. Note the sporulation at water level and the empty panicles.



**Figure 9** - Masses of sporulation just above the water level on plants killed by bakanae disease.