Biologically-Based Integrated Management of Rice Sheath Blight

Sheath blight caused by *Rhizoctonia solani* is the most important disease reducing yield and quality of rice in Texas and other southern rice-producing states. Since none of the leading high-yielding cultivars have acceptable levels of resistance, sheath blight management has been largely dependent on fungicides. Excessive use of fungicides is costly and can be harmful to the environment. Biological control has been recently considered a promising option. In this study, we are developing a microbial biocontrol strategy and incorporating this strategy into current fungicide management programs aiming to develop a low-cost, effective, integrated management of sheath blight with a significant reduction in the input of fungicides.

In vitro and greenhouse assays were conducted to screen biocontrol agents for suppression of sheath blight in rice. Seventy bacterial strains that previously demonstrated growth promotion in other plants and antibiosis against other plant pathogens were examined for their antifungal activity on mycelial growth of *R. solani*, germination of sclerotia and hyphal growth of germinated sclerotia. They were also examined for their ability to inhibit lesion development on leaf blades and sheaths of seedlings in the greenhouse. Ten out of 70 strains showed significant inhibition of mycelia growth and the hyphal growth of germinated sclerotia. Four of these 10 strains also significantly inhibited the germination of sclerotia. When tested in the greenhouse, 10 strains, most of which belong to *Bacillus subtilis*, significantly reduced the lesions on leaf blades and sheaths (Fig. 1).

The performance of selected biocontrol strains and their combined use with reduced rates of fungicides under field conditions is being evaluated at Beaumont in 2010.

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Fig. 1. Comparisons of severity of sheath blight in rice plants not treated (untreated control, left pot) or treated with antagonistic bacteria (right pot).

Biocontrol of Rice Bacterial Panicle Blight

Bacterial panicle blight, primarily caused by *Burkholderia glumae*, poses a threat to rice production in the southern U. S. Yield and quality losses depend on year and location, and estimated yield losses can be as great as 50%. The pathogen is seed-borne and causes seedling blight, sheath rot, leaf lesions and panicle blight. Most commercial varieties are susceptible. No effective chemicals have been developed or registered for use in the management of bacterial panicle blight. Currently there are no effective recommended disease management options available. We have initiated a biocontrol study with the aim of utilizing antagonistic bacteria as one of the components of an effective integrated management program for bacterial panicle blight on rice.

In vitro screening tests were conducted in 2009 to evaluate 19 strains of different bacterial species on *B. glumae*-applied medium for antimicrobial activities. All these bacterial strains have shown antagonistic ability toward other important plant pathogens including the rice sheath blight pathogen *Rhizoctonia solani* AG 1-IA in prior studies. Among 19 strains evaluated, seven strains (five *Bacillus subtilis* subsp. *subtilis* strains and two *B. amyloliquefaciens* strains) showed strong antagonistic activity against the pathogenic bacterium *B. glumae*.

Greenhouse efficacy tests were further evaluated for these seven bacterial strains that showed antagonistic activities *in vitro*. Panicles of the rice variety Cocodrie at the flowering stage were sprayed with suspensions of antagonistic bacterial cells and then spray inoculated with a cell suspension of the pathogenic bacterium isolate. Among seven antagonistic bacterial strains evaluated, two strains of *B. subtillis* subsp. *subtillis* reduced bacterial panicle blight severity by more than 57% compared to the untreated (Fig. 1).

Two field trials have been established at Beaumont in 2010 to evaluate the performance of these two *B. subtillis* subsp. *subtillis* strains under field conditions.

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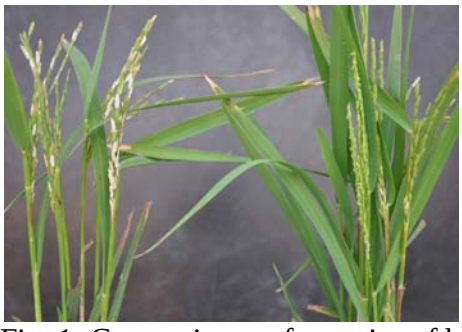

Fig. 1. Comparisons of severity of bacterial panicle blight on rice panicles not treated (left) or treated with antagonistic bacteria (right).