

Controlling Kernel Smut And False Smut Disease

Researchers May Have Found Promise

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In 2006, Dr. Steven Brooks, Geneticist, USDA-ARS-DB-NRRC, and Dr. Merle Anders, Systems Agronomist, UA-RREC began working on false smut and kernel smut diseases of rice. Three years later, advances have been made.

"We began in 2006 mainly focusing on Dr. Anders experiment in cropping systems," said Brooks, "we were looking at the affects of crop rotation, tillage, and fertility on rice yield and the severity of these two diseases on the crop."

"Dr. Anders also has a row rice experiment in the works," said Brooks, "which is growing rice using a furrow irrigation system like soybeans."

"We have taken the results of that ongoing work and designed two disease nurseries around it for both false smut and kernel smut. In these experiments, we are looking for genetic sources of resistance," said Brooks.

"Our objectives are two fold," said Brooks, "the primary objective is to find true genetic sources of resistance to these diseases. Resistant rice varieties are always the best means to achieve disease control. The other objective is to find crop management practices that mitigate disease severity on highly susceptible varieties because the main varieties now grown are susceptible to one or both of these two diseases."

According to Brooks, kernel smut has been around for a long time in Arkansas and has been considered a minor disease in terms of yield loss, but rare epidemics causing significant losses have occurred in the past.

The University of California's Agriculture Department's website states that kernel smut is a black mass of chlamydo spores that replace all or part of individual kernels of rice near or at maturity. Completely smutted kernels may be slightly swollen while others may break open exposing the dark spores. If the disease is severe, a dark cloud of spores may be observed coming from the harvester during harvest.

"There is very low threshold for kernel smut in rice used for parboiling. In the parboiling process the black spores are released and they get coated onto the grain discoloring the finished product," said Brooks.

"With kernel smut we have found good genetic resistance with the RiceTec hybrids Clearfield XL 729 and Clearfield XL 730 as well. Both are immune to the disease and XL 723 is very close to resistant," said Brooks.

"The important thing to remember is that when we increase fertility on a hybrid, the yield goes up but kernel smut severity does not. We believe that true resistance or at least field resistance to disease is responsible for the stability of resistance across fertility treatments," said Brooks.

"On conventional cultivars that are kernel smut susceptible, high nitrogen fertilizer levels dramatically increase disease severity," said Brooks, "in this case, we have found that reduced fertility is critical for disease management."

False smut has been considered a moderate disease in the past according to Brooks, but is now gaining worldwide importance.

"First identified in Arkansas in 1997, it is very commonly found in rice fields of the Grand Prairie," said Brooks, "on a worldwide scale, there are parts of China where it has replaced blast as the most important disease of rice."

"We are worried," said Brooks, "about false smut becoming a more and more important disease. Current releases from both private and public rice breeding programs have improved blast resistance."

"What worries us is that the same varieties are all susceptible to false smut," said Brooks, "we believe that a loss of indirect false smut control from the recent halt in fungicide use is in part responsible for the recent increase in false smut prevalence."

"The results that we have from focusing on false smut is the identification of a potential candidate for resistance to the disease," said Brooks, "it is an older variety called Kaybonnet that came from the Arkansas program and showed very good resistance last year against the disease."

"Kaybonnet was only tested in one nursery year," said Brooks, "but we saw the trends we expected in controls, so we decided that this particular variety was worth looking at again and put it our into our 2008 nursery."



Dr. Steven Brooks, Geneticist, USDA-ARS-DB-NRRC, explains a three year study on false smut and kernel smut diseases of rice. Photo by John LaRose, Jr.

"More importantly, in the last two years we have found crop management strategies that can nearly eliminate false smut on susceptible cultivars," said Brooks, "the common use of a rice-soybean rotation on tilled soil with high fertility levels in Arkansas promotes false smut."

"With all available rice varieties susceptible to the disease, this is a potentially bad combination, said Brooks, "by switching to continuous rice, or no-till, or reducing fertilizer inputs individually or in combination will reduce false smut severity."

"Even more dramatic is the switch from flood irrigated to furrow irrigated rice. RiceTec hybrids perform well in the row rice system, and under those growth conditions we see no false smut at all," said Brooks, "it is a very interesting phenomenon."

"It has been known for some time that if we reduce fertility we can manage the disease," said Brooks, "the trick is to do it with minimal, if any, monetary loss at the farm gate. It is a calculated risk, balancing the yield penalties with the benefits of disease control and savings from reduced input costs."

"It is hard to get people to look past a yield reduction and calculate the savings in fuel, water, fertilizer and time. This work is designed to err on the side of caution to prevent disease outbreaks, without taking a hit in the pocket book," said Brooks.

"One of the important things to remember here is that we are the only people in the country working on this that have disease nurseries dedicated to these diseases," said Brooks.

"We have a very unique site that has enabled us to do more research on these diseases in just three years," said Brooks, "we hope that as the word gets out, we can interest other researchers to take advantage of our nurseries and the data that we generate."

"We are only in our third year and we have already identified potential sources of disease resistance but the majority of our success is with the cultural management side of things," said Brooks, "we have short term answers and long term goals." Δ