Management of Small Grain Diseases

This project has improved monitoring and management of diseases of small grains, thus preventing millions of dollars in losses due to poor grain yield and quality and assuring an ample supply of grain for consumption and other uses.

Who cares and why?

Small grain crops, such as wheat, barley, oats, and rye, are used for human consumption, in malting and brewing, as livestock feed, as hay and straw, and in biofuel production. Despite many uses, small grains are often less economical for farmers than crops such as corn and soybeans, and production of small grains in the U.S. has declined significantly over the past 20 years. Profitability has declined partly because diseases have impacted grain yield and quality. Various blights and rust diseases have devastated small grain crops across the U.S., resulting in lost bushels of grain, economic hardship on farms, and disruption of entire rural communities. These diseases have wide geographic ranges and often require complicated management strategies. To manage these diseases, strategies must be comprehensive, cost-effective, and well-coordinated. Furthermore, scientists need to collaborate across states and disciplines so that they can provide up-to-date, pertinent information to farmers. Better disease management will help small grains farmers remain competitive in international markets and assure an ample supply of high-quality grain for people around the world.

Protecting small grains from diseases helps assure a steady supply of high-quality grain for products like whole grain breads (above, photo courtesy of National Cancer Institute.

What has the project done so far?

Over the last five years, the NCERA-184 project has promoted the exchange of information, techniques, and study results among small grains researchers, leading to improved disease management strategies. More specifically, scientists have determined how different varieties of small grains react to various diseases and have guided efforts to breed disease-resistant varieties of small grains. They have also conducted trials to test fungicides, seed treatments, and biological control agents. From these studies, scientists have determined the most effective time to apply fungicides and minimize disease-related yield losses. NCERA-184 researchers have also created an informative table comparing the efficacy of the most widely used fungicides based on data from studies and test trials. Other researchers have focused on how soil and water conservation practices and crop rotation affect disease development. Across the region, NCERA-184 researchers have been surveying for diseases, screening plants for resistance to threatening pathogens, and determining the potential harmfulness of new disease strains. For example, NCERA-184 participants helped set in motion a surveillance plan for stem rust prior to the arrival of threatening strains in the U.S. Additionally, NCERA-184 researchers have helped design tools for predicting disease risk and reporting disease observations. The web-based risk prediction system for FHB, which provides daily information and commentary to farmers in 30 states, was

Bleached seed spikelets (above, photo by Erick De Wolf, Kansas State University) are early signs of fusarium head blight (FHB). FHB is caused by a fungus and leads to discolored, shrunken, and wrinkled grain kernels. The fungus also produces a mold toxin that can be dangerous to animal and human health. NCERA-184 FHB projects are supported by the U.S. Wheat and Barley Scab Initiative through the USDA-ARS.

visited over 10,000 times during the 2012 growing season. Committee members from several states have coordinated trainings on how to use these tools for disease management. To share study results and recommendations, NCERA-184 members have co-authored reports in numerous journals and delivered 200,000 extension outreach materials across the region.

Impact Statements

Fostered communication among scientists, providing real-time information about diseases, driving efficient, useful research, and harmonizing disease management across the region.

Provided daily information about FHB risk to thousands of farmers in 30 states, helping prevent serious outbreaks. The estimated net value of the disease prediction system to U.S. wheat growers exceeds $47 million per year.

Reduced the impact of diseases on small grains, assuring ample supplies of high-quality small grains.

Reduced unnecessary fungicide use and cut disease management costs by informing farmers which fungicides are most effective and how to use them properly.

Educated the public on important diseases, thus increasing the adoption of integrated management practices among farmers.

Prompted more farmers to use small grains as profitable part of their crop production. More diverse crop production reduces the impacts of pests and diseases on all crops.

Want to know more?

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Compiled and designed by Sara Delheimer

What research is needed?

Because disease-causing fungi are always adapting, continued research is needed to guide the development of new disease-resistant crop varieties. Scientists also need to continue to test new fungicides and evaluate optimum timing for applying them. Monitoring programs are necessary in order to detect populations of fungi that are resistant to fungicides before these fungi become widespread. Furthermore, additional research is needed to develop the next generation of disease prediction models and communication tools. For example, in order to address wheat blast, a new disease of wheat that recently emerged in South America and could make its way into the U.S., researchers need to screen current wheat varieties for possible sources of genetic resistance, develop disease prediction models, and provide educational materials that will help farmers identify and manage this disease.

Ug99 is a type of wheat stem rust that can cause severe crop damage (above, photo by Erick De Wolf, Kansas State University), sometimes resulting in total crop loss. Though this strain has not been detected in the U.S., NCERA-184 researchers are working on ways to prevent and manage the spread of this strain, including identifying resistant wheat varieties. The NCERA-184 Ug99 stem rust projects are supported by USDA-NIFA.