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Shortcuts to Disease-Resistant Wheats

Gina L. Brown-Guedira
USDA-ARS, gbg@ksu.edu

John P. Fellers
USDA-ARS, jpf@alfalfa.ksu.edu

Linda McGraw
ARS

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Shortcuts to Disease-Resistant Wheats

Everyone likes to take shortcuts in time-consuming tasks. And wheat breeders are no exception. Someday, wheat breeders may be able to use new molecular tools being developed by ARS in collaboration with Kansas State University and the Kansas Wheat Commission.

These tools show promise for reducing the time it takes breeders to move important quality and resistance traits into breeding populations of wheat using conventional breeding techniques. Currently, it can take as long as 10 or more years to develop new wheat varieties.

"Using molecular (or DNA) markers may shorten the task of improving insect and disease resistance while maintaining good yield and quality characteristics," says plant geneticist Gina L. Brown-Guedira in ARS' Plant Science and Entomology Research Unit in Manhattan, Kansas.

Molecular markers are small pieces of genetic material—DNA—that can be seen on a gel and are known to be reliably linked in this case to resistance genes. They offer breeders a fast and safe way to identify wheat resistant to pathogens.

Brown-Guedira and ARS molecular biologist John P. Fellers are focusing on finding markers that will ultimately be used to incorporate longer-lasting resistance to major wheat diseases, such as leaf rust, Karnal bunt fungus, and fusarium head scab. (See "Tagging New Leaf Rust Resistance Genes in Wheat," *Agricultural Research*, May 2001, p. 19.)

One major accomplishment by scientists in this laboratory is identification of a molecular marker for a gene that holds the key to nearly 25 percent of the resistance to Karnal bunt fungus. This fungus is currently quarantined by 72 countries, making it a threat to our export markets. Besides yield losses, Karnal bunt disease lowers the quality of flour used for food.

Scientific studies on Karnal bunt are limited to geographic areas where the fungus is present. Working with the fungus in noninfected areas is restricted to guard against potential spread.

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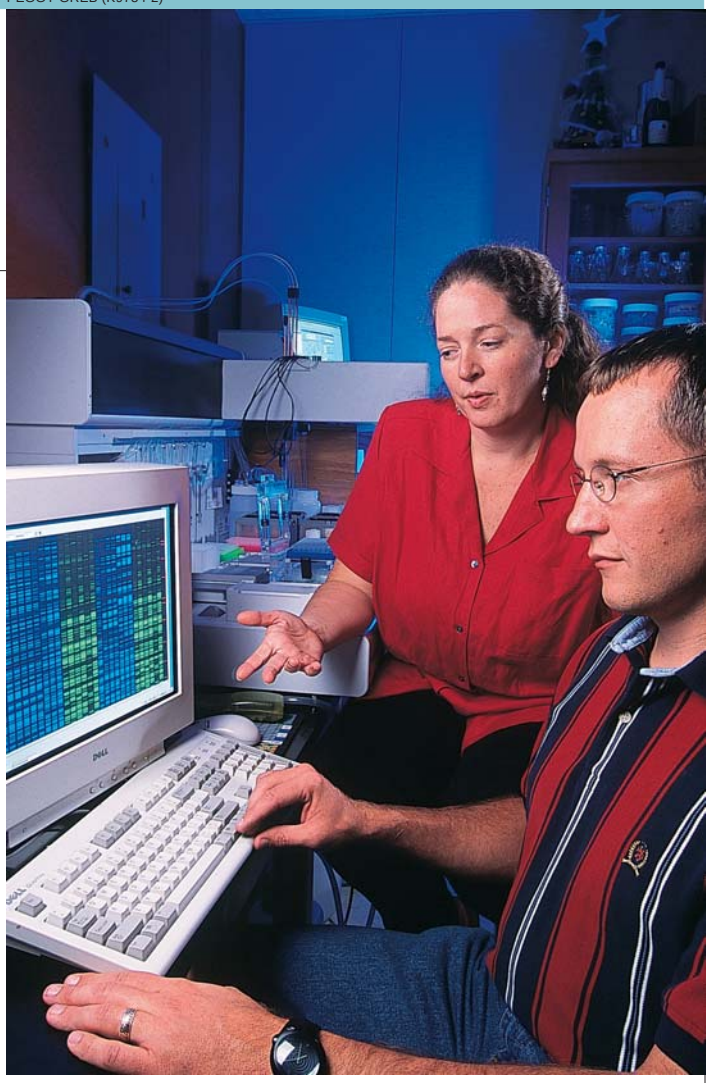

Geneticist Gina Brown-Guedira and molecular biologist John Fellers review DNA marker data from disease-resistant wheat breeding populations.

"But markers can be used at any stage of plant growth without having to infect plants with disease," says Fellers.

So far, researchers in the United States and abroad have identified markers for disease-resistance genes, insect-resistance genes, and quality and environmental stress genes in wheat that can be applied to wheat breeding programs.—By **Linda McGraw,** formerly with ARS.

This research is part of Plant, Microbial, and Insect Genetic Resources, Genomics, and Genetic Improvement (#301) and Plant Diseases (#303), two ARS National Programs described on the World Wide Web at http://www.nps.ars.usda.gov.

Gina L. Brown-Guedira and John P. Fellers are in the USDA-ARS Plant Science and Entomology Research Unit, Kansas State University, Manhattan, KS 66506; phone (785) 532-7260 [Brown-Guedira], (785) 532-2367 [Fellers], fax (785) 532-6167, e-mail jpf@alfalfa.ksu.edu, gbg@ksu.edu. ◆