Once Again, International Cooperation Key to Saving Wheat and Barley

Farmers in Minnesota and Canada can benefit from wheat stem rust research in Texas, Mexico, and east Africa. How?

Pathogens like the African stem rust fungus threatening wheat and barley worldwide can't survive Minnesota or Canadian winters, but microbes in Texas and the South and Mexico can survive and then spread by wind or other means back to Minnesota during the warm season when spring wheat is growing.

And if a plant disease epidemic starts in Africa—as the stem rust epidemic did—scientific resources and expertise can reduce wheat losses in the region and help prevent the rust spores from traveling around the world to Minnesota and the rest of North America.

Combating the new African rust pathogen through international collaboration is one main goal of the Global Rust Initiative, in which ARS plays a major role. As the story that begins on page 4 shows, combating a common enemy like a new stem rust requires international collaboration and makes good use of the plant disease and genetics experts and safeguarded collections that ARS can provide.

The Global Rust Initiative was launched by Nobel laureate Norman Borlaug to prevent the new mutant rust from undoing the yield gains of the so-called Green Revolution of the 1960s. At that time, the gene for stem rust resistance was put into wheat germplasm bred in the United States, Australia, and Mexico, in cooperation with ARS. Borlaug ran the international breeding program under the auspices of CIMMYT (Centro Internacional de Mejoramiento de Maíz y Trigo, or the International Maize and Wheat Improvement Center).

ARS and CIMMYT are again cooperating with Borlaug in combating stem rusts along with ICARDA (International Center for Agricultural Research in the Dry Areas) and universities throughout the United States and the world, as well as researchers from many countries, including Australia, Canada, Egypt, Ethiopia, Kenya, Pakistan, Sudan, and Uganda.

In the United States, the ARS Cereal Disease Laboratory (CDL) works with the Global Rust Initiative to characterize the new stem rust mutant and to monitor development of new rust strains. CDL researchers evaluate live pathogens on wheat seedlings in authorized, contained greenhouses and chambers in Minnesota during the dead of winter when no spores can survive outside. Wheat lines that can resist the new African strain are identified.

The rest of the year, U.S. wheat-breeding lines are exposed to stem rust in Africa. ARS disease experts travel to east Africa to identify wheat lines with good resistance and report that information back to breeders in the United States and other countries.

Collections of rust pathogens and wheat germplasm that have been maintained and regenerated by ARS over the years are also proving valuable. The rust pathogen collection maintained by CDL is being used to determine how the new mutant has evolved. As a related story on page 7 shows, the National Small Grains Collection, in Aberdeen, Idaho, has sent hundreds of accessions of wheat and wheat relatives to east Africa to provide possible new sources of protection from stem rust.

ARS's expertise and collections are essential to the work of breeding rust-resistant wheat, barley, or triticale. For example, we have four regional genotyping labs staffed with scientists skilled in developing genetic markers. Markers can help breeders find rust-resistance genes in wheat, leading to the development of rust-resistant germplasm. Areas of research include developing hard red winter wheat lines for the Great Plains region, detecting rust resistance in barley at the seedling stage, and searching for resistance in the "heirloom" wheat and barley collection at Aberdeen.

ARS cereal geneticists, plant pathologists, and breeders are teaming up with university and private-sector breeders to accelerate incorporation of genetic protection against the new African stem rust mutant. ARS partners with the breeders through the National Wheat and Barley Improvement Committees.

The cooperation among ARS scientists, U.S. breeders, universities, and researchers from other countries allows all the expertise and resources to flow freely to combat a pest that knows no borders.

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