



## Feed the Future Country Fact Sheet

Online Version: <https://feedthefuture.gov/article/wheat-genome-sequenced-breakthrough-global-food-security>

# Wheat Genome Sequenced in Breakthrough for Global Food Security

The journal [Nature](#) today published a paper reporting that scientists from USDA's Agricultural Research Service (ARS), as part of an international team, have completed a shotgun sequencing of the wheat genome. The achievement is expected to increase wheat yields, help feed the world and speed up development of wheat varieties with enhanced nutritional value. Wheat is one of the world's "big three" crops, along with rice and corn, upon which the world's growing population depends for nutrition.

Sequencing the genome of wheat was unusually daunting because the wheat genome is **five times the size of the human genome**, and has 94,000 to 96,000 genes. This sequencing effort involved the identification of essentially all of those genes and mapping their relationship to other genes. Previously, the size and complexity of the wheat genome had been significant barriers to performing a complete analysis, but the scientists overcame that problem by developing a new strategy that compared wheat genetic sequences to known grass genes, such as from rice and barley.

Unlocking the genetic secrets of wheat gives researchers vital new information and tools with which to develop new varieties that not only have higher yields, but also address the worldwide threats of crop pests, plant diseases and a changing world climate. The world's wheat crop is facing one of its biggest threats ever in the form of [a fungal disease called Ug99](#).

First discovered in Uganda in 1999, the fungus (known as a stem rust) has spread across Africa, Asia and the Middle East. Ug99 has been able to overcome most of the stem-rust-resistant wheat varieties developed during the past several decades. While other rusts only partially affect crop yields, Ug99 can wipe out entire wheat fields, resulting in 100 percent crop loss.

As the world's largest agricultural research institute, USDA is focused on reducing global hunger by increasing global cooperation and collaboration on research strategies and their implementation. For example, through the U.S. government's Feed the Future initiative, USDA and the U.S. Agency for International Development (USAID) [are coordinating their research portfolio](#) with ongoing work of other donors, multilateral institutions, and government and non-government entities at the country level to effectively improve agricultural productivity, reduce food insecurity and generate economic opportunity.

In 2010, ARS and international cooperators established the first-ever [Winter Wheat Stem Rust Resistance Nursery](#), located in Ankara, Turkey. This nursery is the first of its kind for winter wheats, and is a joint effort to distribute 100 lines that have been identified by international scientists as having resistance to the deadly Ug99. Thirty of the 100 lines in the nursery were developed by ARS scientists and contain resistance to stem rust races in Kenya and the United States.

The lines developed by ARS focus on the use of four or five resistance genes that have been incorporated into various combinations in winter wheat lines. Multiple genes for resistance will slow the pathogen's ability to readily overcome the new wheat varieties that breeders develop. The amount of time these genes can remain effective is key to maintaining resistance to stem rust in the United States.

Additionally, ARS scientists have identified a number of stem rust-resistant wheat varieties. The ARS scientists screened more than 3,000 wheat landraces—a "landrace" is a local variety of a domesticated plant species—from the National Small Grains Collection against new races of the stem rust pathogen found in wheat fields in Kenya. Landraces with confirmed resistance are being crossed with susceptible wheat to determine the genetic basis of the resistance.

*This post originally [appeared](#) on the USDA Blog. Wheat is one of four focus areas of USDA [research](#) under Feed the Future.*