



# Wheat - Resistance to Stem Rust Race Ug99

Borlaug Global Rust Initiative and its collaborators around the world

The appearance of a new virulent race of stem rust in the late 1990s set off alarms for wheat and barley producers worldwide. Most wheat cultivars that relied on a single gene for stem rust resistance were not protected from Ug99. The threat of a potentially devastating epidemic provoked a global response, coordinated by the Borlaug Global Rust Initiative (BGRI). This initiative spurred robust pathogen monitoring and research, evaluated tens of thousands of wheat accessions, identified genetic sources of disease resistance, and rapidly incorporated resistance into new wheat cultivars.



Photo by David Hansen, University of Minnesota

USDA plant pathologist inspecting wheat in Njoro, Kenya.

## PROJECT GOALS

- ✓ Monitor stem rust populations
- ✓ Improve resistance screening
- ✓ Identify and map genes providing Ug99 resistance
- ✓ Deploy combined resistance genes in wheat cultivars

## Problems Addressed

Stem rust is a fungal disease that has plagued wheat (*Triticum aestivum*) growing regions since ancient times. Infestations can weaken stems, shrivel grains, and cause up to 100% yield loss. Plant breeders typically protect cultivars from stem rust by incorporating single major resistance genes. These are effective for several years until the pathogen evolves. In Uganda's 1998-99 growing season, an especially virulent race of the pathogen, Ug99, was able to overcome existing resistance in most wheat cultivars. This wind-dispersed pathogen posed a significant risk to important wheat producing regions of the world.

## Solutions Developed

BGRI was established to coordinate and fund the international response to the threat from Ug99 and emergent stem rusts. The multidisciplinary effort included disease monitoring, resistance screening, and gene mapping to ultimately develop cultivars with robust resistance from multiple sources. Among several breakthroughs, wheat landrace PI 374670 notably led to the discovery of a major resistance gene on chromosome 7A. Another effective resistance gene was found in a wild wheat species from Israel; this was used to generate wheat lines resistant to all known strains of stem rust.



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