

New wheat varieties resist global wheat threat

February 21 2012, By John Bakum

(PhysOrg.com) -- Innovative techniques in wheat breeding are necessary to meet the needs of the world's growing population and overcome environmental challenges, said Ravi Singh at the American Association for the Advancement of Science (AAAS) meeting, Feb. 16-20, in Vancouver, Canada.

Singh, Cornell plant breeding and genetics adjunct professor and distinguished wheat breeder at the International Center for Maize and Wheat Improvement in Mexico, said that enhanced breeding techniques such as shuttle breeding are helping create new durable disease-resistant varieties of wheat that will increase yields to better meet global demand.

Speaking as a panelist in the "Emerging Risks in the Global Food System" a session organized by William Fry, Cornell professor of plant pathology, Singh noted that wheat yields need to increase one ton per hectare by 2020 to keep pace with the growing population. Rising global temperatures and new, virulent diseases will decimate yields even further. These pressures are especially felt in developing countries where wheat provides 20 percent of the daily protein intake for the average person, said Singh.

Wheat diseases -- like Ug99, a [stem rust](#) -- exert particular pressures on wheat in developing countries. Ug99 destroys entire fields of wheat, overcoming the genetic resistance that protects a vast majority of the world's wheat. The fungus spreads via wind currents and accidental human transmission. It has broken out of eastern Africa and is poised at the edge of the breadbaskets of Pakistan and India.

Prompted by Norman Borlaug, Nobel Prize laureate and father of the Green Revolution, the Durable [Rust Resistance](#) in Wheat project, administered by Cornell's College of Agriculture and Life Sciences and funded by the [Bill and Melinda Gates Foundation](#) and the United Kingdom's Department for International Development, was created and mobilizes research to create new [wheat varieties](#) that are resistant to Ug99 and provide increased yields. Singh collaborates with scientists in this and other programs around the world -- including Cornell plant breeder and geneticist Mark Sorrells -- to breed new varieties of wheat that meet the threat.

Shuttle breeding, a method initiated by Borlaug, involves identifying and breeding promising varieties of wheat more quickly, Singh explained. The process starts by planting seed in the International Center for Maize and Wheat Improvement's test fields in Obregon, Mexico, and selected materials are then tested 1,000 miles to the southeast, outside Mexico City, at high altitude and high rainfall where the growing season, soils, temperatures, and environmental and disease pressures are different than in Obregon. Because of the two different growing seasons, Singh can test his seeds twice in one calendar year, cutting the breeding time in half.

The selected plants in breeding populations are then grown at screening nurseries in Njoro, Kenya, administered by the Kenya Agricultural Research Institute, for two generations under high Ug99 pressure and then brought back to Mexico. Plants are selected and tested for grain yield performance, tolerance to heat and drought stresses, bread quality and resistance to various diseases in Mexico.

The final products are varieties that are suited to varied environments around the world that offer good yield and strong disease resistance. More than 20 Ug99-resistant varieties have been released or are in advanced trials in eight countries, including India and Pakistan, he said.

"We have made great strides in identifying new varieties that will provide durable resistance to stem rusts and increase yields," said Singh, "but there is still much work to be done because of the importance of [wheat](#) and the ever-changing pressures it faces globally."

Provided by Cornell University

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