

# Enhancing and protecting wheat productivity in Pakistan through national and international collaboration

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Wheat is grown on 9 million hectares in Pakistan, accounting for more than 70% of total food grain production, contributing 27% of the crop sector share of the country's agricultural GDP, and providing nearly 60% of the average calories consumed by humans. During the last 1.5 decades wheat production in Pakistan has increased at 2.3% p.a. and the expected national wheat harvest for 2016-17 will be more than 26 million tons. Pakistan's increasing population, urbanization, and resource scarcities mean the country must produce more wheat using less land and irrigation water.

This poster reports achievements of the Pakistan Wheat Production Enhancement Program (<http://wpepforpakistan.org/>, WPEP), an outcome-driven science collaboration involving

USDA, CIMMYT, ICARDA, and 20 Pakistani scientific organizations working in all provinces to enhance and protect the productivity of wheat by increasing the capacity of Pakistani scientific institutions to minimize adverse effects of wheat rusts, including Ug99 strains of stem rust.

WPEP was launched in 2010-11 through the formation of a consortium of national and international partners to pursue six research objectives leading to the identification, adoption, and optimal agronomic management of new, high-yielding, and disease-resistant wheat varieties, as well as building the capacity of national wheat scientists. The objectives and specific achievements are listed below.

## Rust pathogen surveillance

- A world-class wheat rust research facility was established at the Cereal Disease Institute in Murree, with year-round operational capacity.
- 60 yellow, leaf and stem rust races (39, 14 and 6, respectively) have been identified and the most virulent rust isolates used to screen breeder's genetic stocks; a new *Pgt* race QRTTF in addition to RRTTF were also identified.
- A stem rust field screening facility with a sprinkler irrigation/misting system was established at Karachi.
- Pakistan's wheat rust surveillance capacity was strengthened through use of RustTracker.org, a global wheat rust monitoring system developed by CIMMYT and other partners as part of the Borlaug Global Rust Initiative (BGRI).



CDRI-Murree- work on the genetics of rust resistance in wheat.



CDRI Karachi- SR artificial inoculation facility for germplasm screening.

## Pre-breeding

- Pakistan's access to the sophisticated and diverse set of genetic and laboratory technologies based in USDA-ARS and the stem rust screening facility at Njoro, Kenya, was enhanced.
- Knowledge about the distribution of rust resistance genes and other characteristics of Pakistani germplasm was enhanced through the screening of 2,000 advanced wheat breeding lines for resistance to the three rusts at Njoro, resulting among other things in an increased percentage of Pakistani wheat germplasm resistant to Ug99/TTKSK (15% in 2010 vs 49% in 2016).



WPEP provided national partners with advanced tools for agricultural research.

## Accelerated breeding

- Equipment acquired through WPEP included planters, threshers, data recorders, computer hardware and software and training, increasing the precision and extent of quality data from varietal trials.
- New experimental designs increased the number of test entries in the National Uniform Wheat Yield Trial, which is grown at 39 locations, from 30 in 2012-13 to 60 in 2016-17.
- The number of improved varieties grown in farmers' fields increased from 21 varieties in 2006-2011 to over 30 in 2011-16.

## Faster delivery of varieties to farmers

- The practice of multiplying seed of candidate varieties prior to their release was introduced, ensuring adequate supplies of seed to farmers once a variety was finally released.
- Advances were made in reducing the time from the identification of potential varieties to their release to farmers through accelerated seed multiplication/dissemination and replacement of outdated commercial varieties vulnerable to current wheat rust disease races, as well as the parallel popularization and demonstration of new varieties to create awareness among farmers, in partnership with national research programs and seed systems. About 1,600 tons of quality seed of 9 newly-released varieties was made available to farmers for sowing in 2016-17.

## Coordination and capacity building

- The annual national travelling wheat seminar was revived, offering a forum for scientists to travel throughout wheat areas and document wheat production constraints.
- Annual national wheat planning to review and develop work-plans was revived and improved.
- Access to wheat germplasm from CIMMYT and ICARDA was increased, with the screening of some 10,000 breeding lines in more than 25 nurseries/trials each year.
- Training events and arrangements involving more than 500 Pakistani wheat research and extension experts as well as farmers and students were offered in Ethiopia, Kenya, Mexico, Nepal, Pakistan, Russia, Syria, and Turkey.
- USDA-ARS and other international researchers worked directly with Pakistani wheat scientists/breeders to learn from each other in the field.

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