Australian Government
Australian Centre for International Agricultural Research

Crops

Identification of sources of resistance to wheat blast and their deployment in wheat varieties adapted to Bangladesh

Overview

With over 160 million people, Bangladesh is one of the world's most densely populated countries. Wheat is the country's second most important staple food after rice, with an annual production of around 1.35 million tonnes and consumption of 4.5 million tonnes.

In February 2016, scientists from the Bangladesh Agriculture Research Institute notified the Government of Bangladesh of an outbreak of wheat blast (WB), a wheat disease caused by fungal pathogen *Magnaporthe oryzae Triticum* (MoT). The outbreak, the first outside of South America, was rapid and large scale, causing significant crop losses to small-scale farmers.

Most importantly, this first appearance of a highly-virulent form of *MoT* in South Asia represented a serious potential threat for the entire region, which is home to 300 million undernourished people and whose inhabitants consume over 100 million tonnes of wheat each year. Bangladesh shares more than 2,200 km of border with India. Certain wheat-growing areas of India, Nepal and Pakistan have rainfall and temperature patterns similar to those of Bangladesh, so WB could spread and seriously threaten food security and livelihoods in South Asia.

KEY FACTS

ACIAR Project No. CIM/2016/219
Duration: July 2017 – June 2021 (4 years)
Target areas: Bangladesh
Budget: A$1,500,001

Project Leader
Pawan Kumar Singh, International Maize and Wheat Improvement Center (CIMMYT)

Key partners
- International Maize and Wheat Improvement Center, Mexico and Bangladesh
- Bangladesh Agriculture Research Institute (BARI)
- National Institute of Agricultural and Forestry Innovation (INIAF), Bolivia
- Leading research laboratories in the United States
- University of Queensland

ACIAR Research Program Manager
Dr Eric Huttner

Objective

Address the threat to wheat production caused by WB in Bangladesh and South Asia by deploying resistant wheat varieties.

The project has established a high-throughput phenotyping platform where wheat lines from all over the world can be screened for their response to WB (resistance or susceptibility). Genetic analysis of potential resistant lines will map resistance genes and identify markers to facilitate the breeding of WB resistant varieties appropriate for Bangladesh. To ensure adaptation to Bangladesh conditions, selection will focus on high yields, heat tolerance, early maturity and resistance to rusts and spot blotch.

Specifically, the research aims to:

- Identify durable sources of WB resistance that can be used by breeders, pathologists and geneticists in germplasm characterization and enhancement.
- Determine the genetics of WB resistance, identify molecular markers linked to resistance and develop the molecular tools for the rapid transfer of resistance traits into elite wheat lines.
- Develop agronomically superior WB resistant varieties with appropriate maturity and other traits (heat tolerance, spot blotch resistance) critical for Bangladesh.
- Release improved varieties.

Expected scientific results

- Precision phenotyping platforms (PPP) for WB genetic and breeding screening activities developed for Bangladesh and improved for Bolivia.
- Cultivars or advanced breeding lines of South Asian origin with acceptable WB resistance identified.
- Knowledge generated of the genetic architecture of WB resistance traits.
- Resistant lines characterised for presence or absence of 2NS translocation.
- New genes and genomic regions contributing to WB resistance identified.
- Agronomically superior WB resistant lines with other traits critical to Bangladesh developed.
- Sufficient seed of superior WB tolerant lines available.
- Results shared on web-based platforms and in scientific publications.
- Known or potential sources of resistance from WB endemic regions of South America and other genetic resources screened and evaluated.
- Elite cultivars and breeding lines from Bangladesh, India, Nepal and Pakistan regularly evaluated in the PPPs for steadily improving resistance to WB, an important control measure in Bangladesh and a preventative approach for the other three countries facing potential WB outbreaks.

Expected outcomes

Wheat production in Bangladesh will become more resilient to blast incidence through widespread adoption of blast resistant cultivars. Germplasm development is targeted for Bangladesh, but elite breeding lines are likely suitable to other South Asian countries, especially for areas vulnerable to WB, as they tend to have similar environmental conditions.

Resistant germplasm, genes and markers, and genetic information developed through this project will be shared with all South Asian national wheat breeding programs and others, thereby enhancing the impact of this project. Researchers and farmers will gain a better understanding of disease control strategies through the example of blast, enhancing their capacity to cope with diseases and strengthening human capacity and scientific infrastructure to deal with disease epidemics.

Equipment and facilities from this project will prove helpful for future wheat breeding, research and training activities.

Adoption by farmers of superior WB resistant varieties will make wheat production more stable, reduce farmers' risks and reliance on fungicides and improve food security. This, in turn, could contribute to an increase in wheat production, as prioritised by the Government of Bangladesh.

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