### **Priority Briefing**



# Wheat blast disease: a deadly and baffling fungal foe

Wheat is a pillar for global food security, providing 20 percent of protein and calories consumed worldwide and up to 50 percent in developing countries. However, widespread cultivation of wheat has also fostered numerous wheat parasites that can infect and lay waste to entire farming regions.

One of the most fearsome and intractable in recent decades is wheat blast, caused by the fungus *Magnaporthe oryzae.* 

First sighted in Brazil in 1985, blast is widespread in South American wheat fields, affecting as much as 3 million hectares in the early 1990s and seriously limiting the potential for wheat cropping on the region's vast savannas. It appeared in the USA in 2011.

The pathogen can be spread by seed, and also survive on crop residues. Currently, most varieties being planted are susceptible and fungicides have not been effective in controlling the disease.

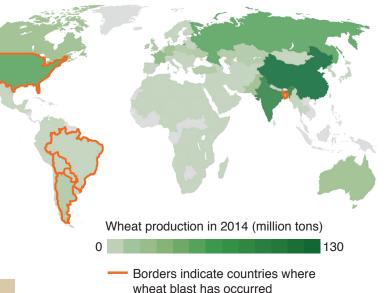
Experts had feared the possible spread of blast from Latin America to regions of Africa and Asia where conditions are similar. **A severe outbreak of blast in key wheat districts of southwestern Bangladesh** in early 2016 has confirmed the truth of these predictions.

The consequences of a wider outbreak in South Asia could be devastating to a region of 300 million undernourished people, whose inhabitants consume over 100 million tons of wheat each year.

#### How to control the spread of wheat blast disease:

- 1. Improved wheat varieties that carry genetic resistance to *M. oryzae*.
- 2. Global monitoring of disease appearances, movement, and evolution, in coordination with local governments and research agencies, as well as predictive models.
- 3. Advanced studies on potentially effective, safe, and affordable chemical control measures.
- 4. Genetic and epidemiological research to strengthen knowledge of the fungus and its interactions with wheat and other host plants.

Map: Wheat-producing countries and presence of wheat blast



To put this integrated solution into practice, in 2011 CIMMYT led the launch of a global **Wheat Blast Consortium** comprising 13 institutions from Europe and the Americas.

For more information or to participate or contribute, contact: Hans Braun, Director, CIMMYT Global Wheat Program; CGIAR Research Program WHEAT: h.braun@cgiar.org Mike Listman, Senior Communications Officer, CGIAR Research

Program WHEAT: m.listman@cgiar.org





## Wheat blast: key features

Strikes directly to shrivel and deform wheat grains, leaving farmers no time to act.

Grows on numerous other plants and crops, so rotations can only partially control it.



Fungicides provide only a partial defense, are often hard to obtain or use in blast areas, and must be applied before symptoms appear.

Outbreaks are occasional and hard to predict, making it more difficult to make preparations or breed resistant varieties.

The fungus is so physiologically and genetically complex that, after more than three decades of research, it is still not understood how it interacts with wheat or which genes confer durable resistance.

Photo credit: Kansas State University

#### Selected reading on wheat blast

Couch BC, Fudal I, Lebrun MH, Tharreau D, Valent B, van Kim P, Notteghem JL, Kohn LM (2005). Origins of host-specific populations of the blast pathogens *Magnaporthe oryzae in* crop domestication with subsequent expansion of pandemic clones on rice and weeds of rice. *Genetics* 170, 613-630.

Cruz CD, Bockus WW, Stack JP, Tang X, Valent B, Pedley KF, Peterson GL (2012). Preliminary assessment of resistance among US wheat cultivars to the Triticum pathotype of *Magnaporthe oryzae*. *Plant Disease* 96:1501-1505.

Duveiller E, He XY, Singh PK (2016). Wheat Blast: An emerging disease in South America potentially threatening wheat production. In: Bonjean A, van Ginkel M (eds) Wheat World Book, Vol 3. An History of Wheat. Lavoisier, Paris, pp 1107-1122.

Duveiller, E., Hodson, D. and von Tiedemann (2010). Wheat blast caused by *Maganaporthe oryzae*: a reality and new challenge for wheat research. The 8th International Wheat Conference, Abstracts, 1-4 June 2010, St Petersburg, Russia, VIR, N.I. Dzyubenko, Ed., 247-248.

Duveiller É, Hodson D, Sonder K, von Tiedemann, A (2011). An international perspective on wheat blast. Special Symposium, APS-IPPC Joint Meeting, August 6 – 10, Honolulu, Hawaii. *Phytopathology* 101:S220.

Ha X, Koopmann B, von Tiedeman A (2016). Wheat blast and Fusarium head blight display contrasting interaction patterns on ears of what genotypes differing in resistance. *Phytopathology* dx.doi.org/10/1094/PHYTO-09-15-0202-R.

Ha X, Wei T, Koopmann B, von Tiedemann A (2012) Microclimatic requirements for wheat blast (*Magnaporthe grisea*) and characterisation of resistance in wheat. In: Tielkes E (ed) *Resilience of agricultural systems against crises*. Cuvillier Verlag, Göttingen, p 155.

Kohli MM, Mehta YR, Guzman E, De Viedma L, Cubilla LE (2011). Pyricularia blast - a threat to wheat cultivation. *Czech Journal of Genetics and Plant Breeding* 47:S130-S134.

Maciel JLN, Ceresini PC, Castroagudin VL, Zala M, Kema GH, McDonald BA (2014). Population structure and pathotype diversity of the wheat blast pathogen *Magnaporthe oryzae* 25 years after its emergence in Brazil. *Phytopathology* 104:95-107.

Pagani APS, Dianese AC, Café-Filho AC (2014). Management of wheat blast with synthetic fungicides, partial resistance and silicate and phosphite minerals. *Phytoparasitica* (Online first), DOI 10.1007/s12600-014-0401-x

Tosa Y, Tamba H, Tanaka K, Mayama S (2006). Genetic analysis of host species specificity of *Magnaporthe oryzae isolates from rice and wheat*. *Phytopathology* 96:480-484.

Urashima AS, Igarashi S, Kato H (1993). Host range, mating type, and fertility of *Pyricularia grisea* from wheat in Brazil. *Plant Disease* 77:1211-1216.