



the global research coordination platform for wheat improvement

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## EXPERT WORKING GROUP TOPIC PROPOSAL

*Expert Working Groups (EWGs) are established where there would be benefit from bringing together experts with a specific focus on a particular topic of direct relevance to the Wheat Initiative's wider aims and objectives as set out in the Vision Document and Strategic Research Agenda. The Wheat Initiative provides EWGs with a platform for discussion, information sharing and interaction to consider specific challenges, opportunities and the identification of research gaps and priorities.*

*Each EWG is established for a defined initial duration. EWGs should have clear objectives and these could include (but not be limited to) specific activities such as contributing to the development of the Wheat Initiative Strategic Research Agenda through regular gap analysis and recommendations, producing position papers for publication, stimulate and facilitate knowledge sharing within a scientific community or addressing a particular challenge through a research programme. The minimum output should be an annual report for dissemination to the Wheat Initiative Research Committee (RC), Institutions' Coordination Committee (ICC) and the wheat research community through the Wheat Initiative website.*

*The international prioritisation of topics in the area of each EWG, together with research priorities from other EWGs, will constitute a portfolio that will be used by the Wheat Initiative ICC to inform its approach to tackling priorities by coordination of efforts and alignment of Wheat Initiative members' research strategies, and in some cases by launching international research calls.*

Topic title		
<b>Control of Wheat Pathogens and Pests</b>		
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Summary		
<p>There are a plethora of diseases and pests that target wheat causing significant losses in yield and/or quality on a yearly basis making it imperative that wheat researchers are astute in the development of resistant varieties. Epidemics caused by some of these diseases and pests vary from local to regional zones and in a number of cases extend to wider international wheat growing zones. While sustained increases in wheat yields are needed to meet future demands,</p>		

the remarkable ability of pathogens to mutate, produce novel toxins, or otherwise adapt to overcome resistance makes this goal a considerable challenge. Therefore, global coordination of efforts facilitated by the Wheat Initiative biotic stress expert working group is needed to develop management and gene stewardship deployment strategies. Whereas coordination of research on the three rust pathogens will build on the framework of the Borlaug Global Rust Initiative, the facilitation of networks and interactions among key labs conducting research on host-selective toxin-producing necrotrophic pathogens, Fusarium head blight, powdery mildew, wheat blast, pathogenic nematodes, virus diseases, and insect pests is needed to encourage the sharing of information and coordination of efforts. These activities will lead to reductions in yield losses due to diseases and pests, and therefore contribute to the enhancement of global food security.

### Detailed description (5 pages maximum)

#### Rationale

Without exception all major wheat breeding programs have, as a primary objective, the requirement to increase wheat yields. This is further accentuated by expectations of increased demands for wheat with current population growth predictions. To achieve this goal, protecting yield losses caused by biotic stresses represent key constraints that need to be minimised. A combination of genetic solutions and integrated disease and pest management strategies are foundational to strategies aimed at protecting yield loss.

Issues such as the rapidly evolving nature of biotrophic pathogens due to mutations in virulence genes, the production of novel host-selective toxins/necrotrophic effectors in necrotrophic pathogens, and the continued devastation of mycotoxin-producing hemi-biotrophic pathogens such as Fusarium formulate a continuous threat to wheat production and food safety. Furthermore, global climate change will likely lead to shifts in pathogen prominence and importance. These factors coupled with the fact that pathogens and pests do not recognize national boundaries make it imperative that regional and international initiatives are fostered in monitoring and surveillance programs to inform strategies in gene stewardship and deployment. The ultimate goal will be to achieve more durable resistance in wheat with sustained yield increases.

#### Description of the EWG aims

To build on the existing framework of the Borlaug Global Rust Initiative (BGRI) in accelerating international collaboration towards durable resistance against all three rust pathogen species in wheat.

To establish and foster an active network of researchers studying the necrotrophic and/or host-selective toxin-producing pathogens that cause the Stagonospora, Septoria, and tan spot diseases (the leaf blotch disease complex) of wheat with a common goal of advancing the knowledge base of host-pathogen toxin interactions to enable effective control strategies for minimising wheat yield losses from these pathosystems.

To promote interactions among scientists conducting research regarding wheat resistance to Fusarium head blight with an overall goal of providing knowledge, tools, and resources that will enable the limitation of yield losses and mycotoxin contamination of wheat grain.

To enable effective interaction among researchers engaged in host-nematode interactions and other below ground biotic stress constraints to establish an international platform to deliver on combined genetic approaches and management of the wheat rhizosphere in improving and stabilizing yields.

To facilitate a network of researchers with a focus on insect pests and viruses in wheat in furthering knowledge in this field and strategies aimed at reducing the impact of these pests to wheat crop loss.

<p>To provide a forum for researchers on powdery mildew resistance and fungicide development/application to work towards integrated genetic solutions and management strategies aimed at sustainable wheat production in regions prone to powdery mildew epidemics.</p>
<p><b>Expected deliverables/outputs of the EWG</b></p>
<p>Consolidating efforts towards achieving durable rust resistance in wheat, in particular increased scope of stripe rust resistance research to levels near current support for stem rust under the auspices of BGRI.</p> <p>Coordinated efforts among key laboratories working on resistance of wheat to necrotrophic pathogens reporting on progress towards establishing a global wheat-necrotrophic pathogen initiative.</p> <p>Coordinated efforts among leading scientists in the Fusarium research community toward obtaining key research goals.</p> <p>Engage a team of researchers led by Brazilian wheat pathologists/breeders in partnership with interested scientists to work towards a position paper for publication on the epidemiology of wheat blast disease, modelling potential impact of climate change, what is known about resistance in current wheat gene pool.</p>
<p><b>Timeline of Activities</b></p>
<p>With rust diseases, liaise with the Borlaug Global Rust Initiative, about milestone timelines on key objectives towards achieving durable resistance to stem, stripe and leaf rust</p> <p>Over the next two years, establish a group of experts to facilitate the coordination of an international coalition on wheat-necrotrophic pathogen research to dissect the genetic bases of the interactions and elucidate the mechanisms associated with virulence and resistance/susceptibility to the pathogens of the leaf blotch disease complex.</p> <p>Over the next two years, identify an expert panel to facilitate the coordination of global Fusarium research involving members of the Fusarium research community to further characterize virulence mechanisms, mycotoxins, host-pathogen interactions, mechanisms of host resistance, and methods and strategies for managing the disease and improving varietal resistance.</p> <p>Over the next two years to establish an expert panel to coordinate insect pest and viral diseases research in wheat.</p> <p>Over the next two years identify and establish a group dedicated to below ground challenges with nematodes and teams exploring management and novel approaches dealing with diseases for which there are no known effective resistance genes, e.g. Rhizoctonia, take all disease</p>
<p><b>Alignment with the Wheat Initiative objectives</b></p>
<p>Project activities aimed at protecting yield losses through reducing the impact of diseases are contributing to food security, and thus represent an objective that is at the core of what the wheat initiative seeks to achieve.</p> <p>In dealing with biotic constraints caused by rapidly evolving pathogens that have no limits in terms of potential geographic movements, it necessitates regional and international collaboration activities and therefore the role of the wheat initiative in fostering such cross-</p>

national research efforts will be in fulfilment of the WI <i>raison d'être</i> .
In each of the aims of the biotic stress EWG, there is a strong requirement for a collective effort in sharing resources and expertise; a role that the WI is best placed to facilitate.
<b>Potential links with other Wheat Initiative activities</b>
At the core of the genetic solutions towards reducing the impact of biotic stresses in wheat is the identification and isolation of genetic factors underlying the wheat plants immune recognition, QTLs, and as yet to be fully characterised genes contributing to durable resistance. Activities in the area of deciphering the wheat genome through the WI affiliation with the international wheat genome sequencing consortium (IWGSC), are key areas that will facilitate achieving objectives in the biotic stress area.
It is necessary and essential for new and improved wheat breeding methods and strategies towards yield improvement to account for the role of disease resistance genes/susceptibility factors in achieving success, hence the intricate linkages in these research activities.
<b>Supporting countries/institutes</b>
CIMMYT, ICARDA, FAO, Universities in EU, USA, Australia, Canada, India, FRANCE, CHINA, USA, UK, GERMANY, AUSTRALIA, INDIA, BRAZIL, RUSSIA, ARGENTINA, URUGUAY
<b>Potential participating countries<sup>1</sup></b>
DENMARK, SOUTH AFRICA, KENYA, ETHIOPIA, GERMANY, FRANCE, UK, CHINA, INDIA, AUSTRALIA, MEXICO, BRAZIL, CANADA
<b>Resources (budget requirement, potential funders, etc.)</b>
Specific details of budget will be developed after expert working groups for the biotic stress aims have been established.
Potential funders: BBSRC, DFID, GIZ, SDC, USAID, USDA, EU, CIDA, GRDC, ACIAR, FAO, ICAR, India DBT
<b>Planned duration of EWG (in years)</b>
We anticipate an initial phase of 3-5 years.
<b>Other comments</b>
<b>Date of submission to the International Scientific Coordinator</b>
01/03/2014

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<sup>1</sup> Not limited to current members of the Wheat Initiative

## Process of establishment for a new Wheat Initiative Expert Working Group

