

GRAINS RESEARCHERS ON THE MARK

A new collaboration between India and Australia has been established to boost production and conquer threats to one of the world's most important food sources

BY MELISSA MARINO

Threats to the world's wheat stocks are being targeted as part of a new research collaboration uniting the top cereals scientists from Australia and India who have identified key research priorities to secure grain supply.

The priorities were established in India at a recent workshop launching a marker-assisted selection (MAS) wheat-breeding program, partnered by ACIAR and the Indian Council for Agricultural Research (ICAR).

The scientists will target their research across five themes:

- bioinformatics and molecular biology for wheat breeding;
- rust and other biotic stresses;
- water use efficiency, drought and roots;
- waterlogging and other abiotic stresses; and
- wheat quality.

MAS is a tool that allows researchers to identify specific genes, using short fragments of DNA that associate with the inheritance of certain traits. Once that gene is 'marked', or identified, generations of plants in a breeding program can be tested efficiently in the laboratory for the desirable characteristic.

Breeding for specific outcomes is accelerated with the use of markers, which track the inheritance of DNA, rather than requiring the growing of progeny to maturity to observe the expression of the trait.

In one of the first initiatives to stem from the new five-year collaborative program, researchers are screening stocks of wheat germplasm from Australia and India for resistance to the devastating rust strain Ug99.

Scientists around the world are working against the clock to thwart Ug99 by breeding resistant strains before this new race of stem rust spreads too much farther. Originating in eastern Africa there are concerns that spores could travel on prevailing winds from Yemen to Afghanistan and into the fertile Indo-Gangetic Plain—threatening the vast wheatbelts in what is the 'bread basket' of Asia.

Dr Paul Fox, research program manager

for Crop Improvement and Management at ACIAR, who is Australian coordinator of the MAS wheat-breeding program, says the partnership has enabled the enhanced cooperation in the fight against rust, which has the potential to wipe out entire crops.

Dr Fox says screening for Ug99 resistance has shown that the genetic background of potential resistant wheat lines from the two countries appear to be quite different, giving hope to the potential for boosted resistance in cross-bred specimens.

"We are mildly confident that putting those different sources of resistance from the two countries together will actually allow us to come up with something that's fairly bullet proof in the face of this new threat," he says.

Dr Fox says recent developments, including a rising wheat price and a drop in wheat supply, have made the research even more urgent. "We're really fast-tracking the work because of the potential threat not only to India, but on world food stocks as a whole," he says.

The Ug99 research is an extension of the Australian Cereal Rust Control Program partnered by the Grains Research and Development Corporation, the University of Sydney, CSIRO and the International Maize and Wheat Improvement Center (CIMMYT) in Mexico. Ug99 resistance is just one of the five themes identified at the workshop.

The other priorities are to begin a bioinformatics component within the MAS breeding program; to scope and develop a large integrated project to characterise suitable traits and markers for better crop establishment and roots; to continue the implementation of project development activities for germplasm addressing waterlogging and other associated abiotic stresses; and to scope and develop a project on quality traits. This final project will be undertaken later in the collaboration.

Dr K.V. Prabhu, head of the Indian Agricultural Research Institute (IARI) Department of Genetics, who is also on the MAS breeding program management



PHOTO: BRAD COLLIS

committee, says productivity, waterlogging and the threat of Ug99 were all key concerns for Indian growers.

"This is an opportunity for those things to be addressed in advance and be prepared so the impact will not be as disastrous. This is a frank partnership on a scientific basis, looking at the strong points that both countries have and using those on a shared basis," he says.

Dr Fox says similar conditions shared by the two countries had resulted in common problems including salinity and sodicity. "Just about all the participants in the workshop concluded that we are more united by our similarities than our differences."

In opening the 2007 workshop, ICAR director-general Dr Mangala Rai said previous collaborations between India and ACIAR had helped keep India free of major rust epidemics by deploying resistance genes.

"Molecular marker technology would now further help identify specific genes or genomic regions responsible for making the crop yield better, provide better quality product and enable the efficient and precise breeding for specific outcomes in a changing, stressful environment," Dr Rai said. ■