

History of impact, future of promise



Scientists interact with Australian farmers during a visit to CIMMYT.

Australia and CIMMYT's nearly five-decade research partnership and the generous funding of Australian institutions have contributed enormously to global efforts to ensure food security, reduce hunger, and advance sustainable agriculture, as well as greatly profiting Australian wheat farmers.



Australian collaboration and support include the development and spread of:

- High-yielding, disease resistant wheat varieties and drought tolerant maize varieties.
- Resource-efficient, profitable conservation agriculture cropping systems, including appropriate mechanization, for South Asia.
- Sustainable intensification of maize-based cropping systems in eastern and southern Africa.

Durable rust resistance in wheat: Cost-free crop insurance for farmers. Scientists at Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) have played a critical role in the identification and characterization of genes for resistance to wheat stem rust, one of the crops most damaging diseases since biblical times. The genes have been used by CIMMYT and partners to develop and spread resistant wheat varieties and, particularly in the last two decades, to replace widely grown wheat varieties susceptible to the deadly Ug99 strains of stem rust. By conservative estimates, global research to control wheat stem rust disease saves wheat farmers the equivalent of at least \$1.12 billion each year in added grain.

The Australian Center of International Agricultural Research (ACIAR), which has provided financial support for diverse and impactful CIMMYT initiatives over many years, has funded research to identify and use genes for resistance to wheat blast, a terrifying and little understood disease that appeared for the first time in Bangladesh in 2016 and poses a threat for wheat crops throughout South Asia.

As part of the ACIAR-funded project "Sustainable Wheat and Maize Production in Afghanistan," CIMMYT pioneered use of DNA fingerprinting to assess the adoption of improved wheat varieties in the country, finding that, across the four provinces, more than 75% of farmers were growing wheat varieties that had been released since 2000.

Sustainable cropping on rainfed smallholder farms in Africa.

For nearly a decade, ACIAR brokered and invested in an ambitious, multidisciplinary applied research program called “The Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa” (SIMLESA), which among other things demonstrated to farmers, business persons, policymakers and ministers, the promise and opportunity of conservation agriculture-based sustainable intensification. As one outcome, by 2019, nearly half a million farmers had benefited from adoption of the related practices.

Transforming South Asia’s rice-wheat systems.

CSIRO and ACIAR have supported CIMMYT and partners’ work to study and promote resource-conserving, climate-smart solutions for South Asia’s extensive and diverse rice-wheat cropping systems that underpin the food security and livelihoods of 300 million people in the region. Innovations include the direct seeding of wheat into unplowed fields (zero-tillage), the precise and efficient use of water and fertilizer, and a transition to growing rice in unflooded fields. Australian support has been invaluable for the design, testing, and refinement of a tractor-drawn seeder able to plant wheat seed with fertilizer into unplowed soils covered with heavy residues from a previous rice crop.

Large benefits for Australia.

Australian breeders’ use of CIMMYT wheat genetic resources and breeding lines, including those from the Center’s enormous seed bank collections and its international nurseries, has had a significant impact on Australia’s wheat sector. Around **90 percent** of Western Australia’s wheat varieties carry CIMMYT genetics in their pedigrees. According to



The CAIGE team in Mexico at the Norman E. Borlaug Experiment Station in Sonora. From left to right: Richard Trethowan, Dan Mullan, Ian Edwards, Marie Appleby, Fernanda Dreccer, Allan Ratty and Tom Kapcejevs. Photo: CAIGE

Australia’s government-funded Grains Research and Development Corporation (GRDC), the value of those genetic resources is **nearly US \$150 million a year**.

The GRDC-funded project CIMMYT-Australian-ICARDA Germplasm Evaluation (CAIGE), operating since 2005, evaluates bread and durum wheat and barley genetic resources from CIMMYT and ICARDA for potential introgression into Australian breeding programs. Over the past 10 years, some 5,700 bread wheat, 2,600 durum wheat, and 2,000 barley genotypes have been tested and used in breeding programs in Australia, with a reported benefit:cost ratio of 20:1 and annual benefits equivalent to US \$18 million.

Ongoing CIMMYT collaborations with partners such as the University of Sydney, Rebel Seeds, Intergrain, and Queensland University are dedicated to enhancing the genetic traits of maize and wheat for Australia and the world. These joint efforts encompass improving

disease resistance, nutritional content, yield potential, and climate resilience.

In addition to CIMMYT funding from the World Bank Trust Fund, to which Australia contributes, current direct annual funding to CIMMYT from ACIAR alone exceeds US \$1 million.

Future collaboration opportunities

Climate resilience. Together, we can tackle climate change challenges through research on resilient crops and innovative farming. Australia’s extensive experience and CIMMYT’s expertise in breeding climate-resilient wheat and triticale varieties position us well to jointly develop crops capable of thriving in evolving climate conditions. We also anticipate the valuable input of CIMMYT’s partners and the potential engagement of donor networks from industries like beer and others to bolster our efforts in climate-resilient agriculture.

Digital agriculture. Leveraging Australia's tech and data analytics expertise can align with CIMMYT's digital agriculture focus and enhance the digitalization of dryland crop management, within CIMMYT's new Dryland Crops initiative. Leveraging CIMMYT's extensive network of partners and donors from diverse industries, including those with interests in agriculture, will be instrumental.

Dryland crops. Australia's knowledge in triticale breeding and its experience managing dryland agriculture mesh perfectly with CIMMYT's efforts to improve yields and resilience in dryland crop production. Exploring joint research projects in this area could yield significant benefits for global food security.

CGIAR network collaboration. CIMMYT's involvement in the CGIAR network offers a unique platform for collaboration and

can extend to centers such as ICARDA, with expertise in dryland crops. Together, we can link to CGIAR's extensive resources and global reach to address challenges beyond maize and wheat, potentially including crops like barley, broadening the scope of our collaborative efforts.

Continuing efforts to exchange knowledge, build capacity in agricultural research and development, and expand our collaborative network within CIMMYT's broader initiatives and the CGIAR network will strengthen our partnership and empower more countries to address food security challenges comprehensively.

In illustrious company. Many former or present CIMMYT staff who are Australian or have studied in Australia have made significant contributions to the Center's work.

- The late **Sanjaya Rajaram**, a former CIMMYT wheat program director, Distinguished Scientist, and 2014 World Food Prize recipient, completed PhD (1968) studies in plant breeding at the University of Sydney.
- **Timothy Reeves**, a former CIMMYT director general and a member of the Order of Australia.
- **Tony Fischer**, a former CIMMYT wheat program director, retired program manager of ACIAR, member of the Order of Australia, and a Farrer Memorial Medal recipient.
- **Derek Byerlee**, a former CIMMYT economics program director and a member of the Order of Australia.
- **Ravi Singh**, a retired CIMMYT Distinguished Scientist and head of global wheat improvement, completed PhD studies (1983) in Agricultural Genetics and Biometry at the University of Sydney.





Yellow rust screening activities under high disease pressure at Toluca station are an important component of the CIMMYT Global Wheat strategy to deliver durable resistance. Sridhar Bhavani & Naeela Qureshi are assessing advanced breeding lines. Photo: Alison Bentley

- **Sridhar Bhavani**, CIMMYT head of rust pathology and molecular genetics, completed a PhD (2006) in genetics, molecular biology and genomics-rust resistance in wheat at the University of Sydney.
- **Balwinder Singh**, CIMMYT cropping system simulation modeler, completed a PhD in agricultural science at Charles Sturt University, Wagga Wagga, and was recognized in 2021 as CSU Alumnus of the Year.
- **Richard Trethowan**, former CIMMYT wheat breeder who is now a professor of Plant Breeding at the University of Sydney.

CIMMYT is a cutting edge, non-profit, international organization dedicated to solving tomorrow's problems today. It is entrusted with fostering improved quantity, quality, and dependability of production systems and basic cereals such as maize, wheat, triticale, sorghum, millets, and associated crops through applied agricultural science, particularly in the Global South, through building strong partnerships. This combination enhances the livelihood trajectories and resilience of millions of resource-poor farmers, while working towards a more productive, inclusive, and resilient agrifood system within planetary boundaries.

CIMMYT is a core CGIAR Research Center, a global research partnership for a food-secure future, dedicated to reducing poverty, enhancing food and nutrition security and improving natural resources.