

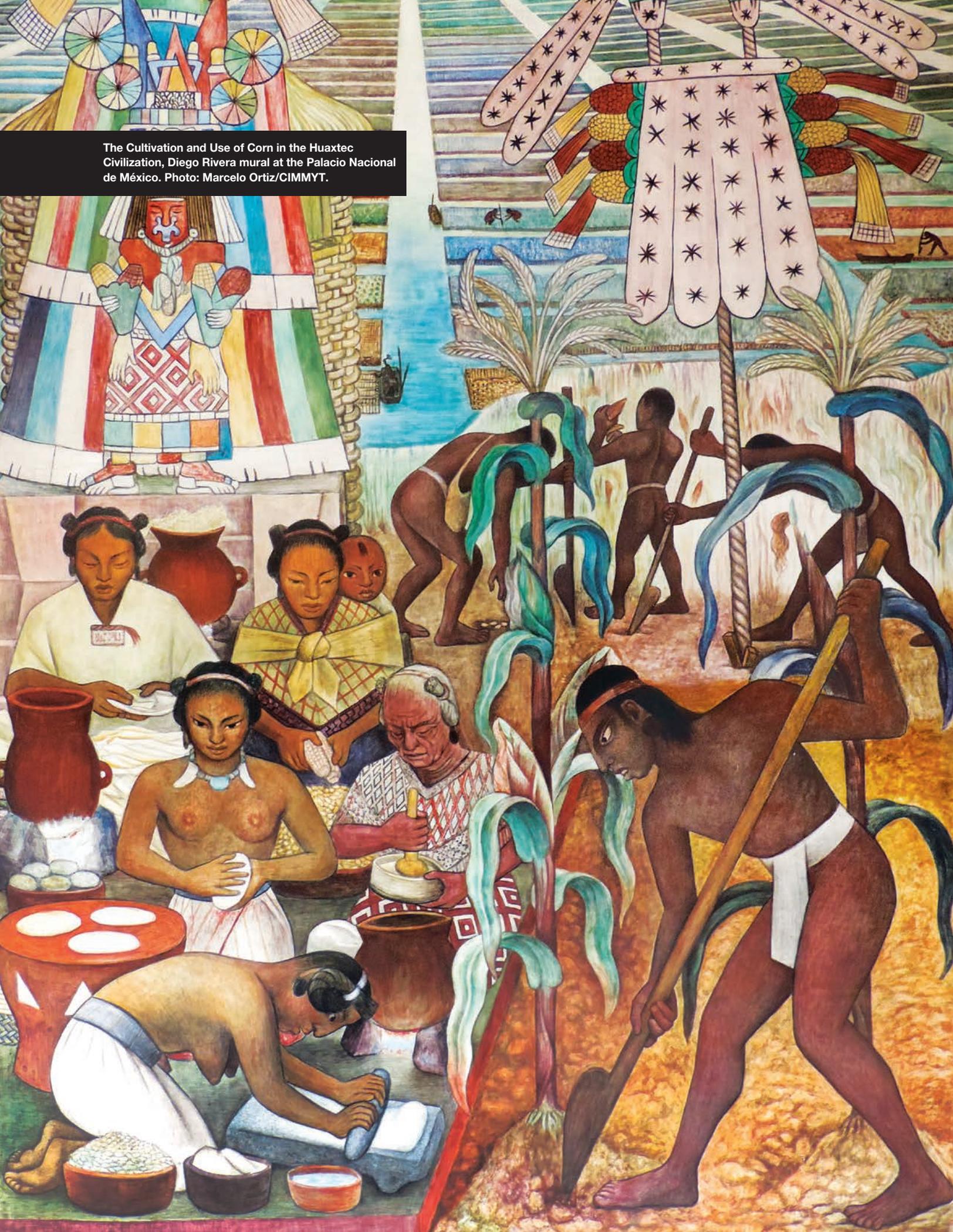


CIMMYT in **MEXICO**



The cradle
of global
agricultural
innovation

The Cultivation and Use of Corn in the Huastec Civilization, Diego Rivera mural at the Palacio Nacional de México. Photo: Marcelo Ortiz/CIMMYT.



Mexico

has been CIMMYT's host country and partner since the organization's founding in 1966, and has contributed substantively to CIMMYT work with farmers, other partners and donors across the developing world. Through partnerships like that with Mexico, CIMMYT uses research, development and training to sustainably increase the productivity of maize and wheat systems for global food and nutritional security and improved livelihoods. CIMMYT is a member of the CGIAR consortium, leads the CGIAR Research Programs on Maize and Wheat and participates in four other CGIAR Research Programs.

The History behind a Successful Partnership

CIMMYT grew out of a pilot program sponsored by the Mexican government and the Rockefeller Foundation in the 1940s-50s to raise Mexico's farm productivity. Over the next 20 years, Dr. Norman Borlaug worked with Mexican farmers and researchers to achieve wheat self-sufficiency by developing high-yielding and disease-resistant semi-dwarf varieties. These varieties were imported by India and Pakistan in the 1960s to stave off famine, soon bringing those countries record harvests. This led to the widespread adoption of improved varieties and farming practices, called the "Green Revolution."



Norman Borlaug (fourth from right) in the field showing a plot of Sonora-64. Photo: CIMMYT.

Key Facts

- CIMMYT's alumni include one Nobel Peace Prize winner and three World Food Prize winners.
- CIMMYT has five research stations in Mexico located in diverse climates: Agua Fría (lowland tropical); Ciudad Obregón (lowland desert); El Batán and Toluca (highland temperate); and Tlaltzapán, (mid-altitude subtropical).
- CIMMYT works with over 180 partners from Mexico's agricultural research system, private companies, academia, and non-governmental and farmer organizations.
- CIMMYT's germplasm bank in Mexico holds vast genetic diversity in over 28,000 maize seed collections and 160,000 wheat lines. Yearly it distributes more than 20 tons of seed for testing and use by partners in nearly 90 countries.
- More than 70% of the wheat grown in developing countries and more than 50% of improved maize varieties are based on CIMMYT's breeding materials, many of which were first developed in Mexico.

Unleashing Genetic Diversity

Resistance to Maize Tar Spot has been identified in CIMMYT's Mexican and Guatemalan landrace seed collections, benefitting farmers.

To address unprecedented challenges to crop production from climate change, growing demand and unstable markets, CIMMYT partners with the Mexican government and research institutions to analyze DNA from thousands of maize and wheat seed collections and identify novel genes underlying essential traits to accelerate crop improvement and meet impending food production challenges.

offer high-quality seed at affordable prices. This includes raising farmer awareness about beneficial products and providing foundation seed and training in seed production, seed business management and low-cost production systems.

Sales for Mexican seed companies, partnering with CIMMYT, increased 46% from 2011 to 2014.

Participatory crop improvement

Native maize landraces are closely connected to local culture, foods and traditions. Farmers and communities in Oaxaca participate in the genetic and agronomic improvement of maize landraces together with CIMMYT researchers and partners. Using a holistic approach, CIMMYT and Mexican intermediaries are also fostering profitable connections to help smallholder farmers with new markets, especially those catering for specialty products.

Cosme, one of New York's trendiest restaurants, serves single-origin tortillas originating from maize landraces grown by smallholder farmers in Oaxaca.

Maize and Wheat Research

CIMMYT's maize and wheat research provides diverse, high-yielding varieties that withstand environmental stresses and diseases. Scientists exploit the full potential of improved seed and provide training in breeding, crop management and seed business.

MAIZE

Mexico is the fourth-largest producer of maize in the world but yields are low, especially in rain-fed areas. CIMMYT is responding by developing more robust and productive varieties – both open-pollinated and hybrid. CIMMYT scales out products developed in the breeding pipeline by working with Mexican seed companies, particularly small- and medium-scale enterprises, to foster competitive markets that

Resilient crops for changing climates

Mexico is considered to be a climate change hot spot where changing rainfall patterns and rising temperatures will make farming more difficult. CIMMYT evaluates experimental lines and varieties under conditions that mimic potential climatic scenarios, including drought, heat and nitrogen-deficient conditions, to identify resilient varieties and move them forward in breeding programs.

In 2014, for example, 3 maize lines and 12 hybrids stood out for their yield and adaptation capacity to rainfed growing conditions in Mexico's tropical, subtropical and highland regions.



The Birthplace of Maize

Mexican farmers domesticated maize about 9,000 years ago, transforming teosinte – a native grass – into a high-yielding, easily harvested crop. Teosinte does not look like today's maize, but the two plant species are surprisingly alike at the DNA level, with the same number of chromosomes and a similar arrangement of genes.

Chatino women selecting maize for advancement in participatory breeding in Santiago Yaitepec, Oaxaca. Photo: Flavio Aragón.



WHEAT

Mexico is an unlikely candidate for the home of modern wheat research – 10,000 kilometers from the center of wheat’s origin. Yet it was the semi-dwarf wheat varieties that Borlaug and his colleagues bred in Mexico that literally sowed the seeds of greatly improved global food security.

The Norman E. Borlaug Experiment Station (CENEB) in northwestern Mexico is the center of CIMMYT’s wheat breeding. Borlaug first used this location as part of “shuttle breeding” – an approach still used today to grow two experimental wheat crops per year and thus speed breeding progress and broaden new varieties’ adaptation to diverse conditions.

‘You don’t know CIMMYT until you’ve been to Obregón.’

Breaking the yield barrier: Getting more grain out of the wheat plant

Gains in wheat yields are lagging behind rising consumer demand. To help address this, researchers are trying to “break the yield barrier” by improving wheat’s ability to capture and process sunlight. This work is being supported by advanced approaches for evaluating and selecting wheat lines with the greatest potential for increased yield and resilience to climate change. One example is the Mexican Precision Phenotyping Platform (MEXPLAT), hosted at CENEB and comprising laboratory and field facilities as well as shared DNA marker tools for all research partners.

Wheat Quality Lab

High-yield wheat must also meet milling and processing quality standards and satisfy consumer preferences and nutritional needs. CIMMYT’s Wheat Quality Lab and partners in Mexican industry support breeding for quality and other traits to ensure the marketability of harvests and superior food products. Up to 4,000 lines are evaluated in the Wheat Quality Lab in El Batán every year.



Bread samples in CIMMYT’s Wheat Quality Lab.
Photo: Miriam Shindler/CIMMYT.

Wheat accounts for 40% of total household spending on cereals and 10% of dietary calories in Mexico.

2,000 wheat lines have been selected for heat and drought resistance from over 70,000 lines tested in the field.

Up to 4,000 lines are evaluated in the Wheat Quality Lab in El Batán every year.

Wheat fields at the CENEB experimental station.
Photo: CIMMYT.

Innovating with Farmer Communities

Feeding the soil

Innovative cropping systems will be critical to help farmers face climate change effects. Through regional research hubs, CIMMYT and its Mexican partners are testing and promoting a suite of sustainable farming methods based on the principles of conservation agriculture: reduced or zero tillage, retaining crop residues on the soil and use of carefully-chosen crop rotations. Farmers on more than 94,000 hectares have switched to sustainable systems using CIMMYT technologies.



Contrast between maize grown in rotation with wheat, using conservation agriculture, with maize grown using conventional practices (right), at CIMMYT's headquarters during a serious drought. Photo: CIMMYT.

Engineering to enhance sustainable food production

Appropriate mechanization for smallholder farmers is crucial for supporting farming systems. To achieve this, CIMMYT focuses on building the capacity of small- and medium-scale engineering and manufacturing enterprises. As part of an international collaboration, multi-purpose, multi-crop equipment has been developed in Mexico, with consideration for its suitability for smallholders in Africa and Asia. This has led to the export for testing of a toolbar-based, two-wheel tractor implement for shaping raised soil beds, direct seeding of various crops and precise fertilizer application. The goal is to help local enterprise improve access to quality implements at reasonable prices. This open-source prototyping strategy is based on the free sharing of technical designs and machinery construction plans.

16 prototypes of agricultural machinery built or in final development, and four already completed.



CIMMYT's flagship project in Mexico, MasAgro (The Sustainable Modernization of Traditional Agriculture), is spearheaded by the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) and CIMMYT, together with over 150 partners, to strengthen food security through research and development, training and the transfer of technology, enabling small- and medium-size maize and wheat farmers to obtain high and stable yields, increase their income and mitigate the effects of climate change in Mexico. MasAgro is now being joined by Mexican states and is being used as a starting point for similar initiatives in other countries of Latin America.

CIMMYT has 50 conservation agriculture research platforms, directly impacting 1 million acres of agricultural land.

MasAgro offers access to technologies, training and post-harvest advice based on innovation networks and pioneering outreach that involve public and private partners, farmers, scientists, technicians, extension agents and other relevant actors from agro-industry.



Precision agriculture for smallholder farmers

Precision agriculture – use of technology to observe, measure and respond to plot-level conditions and crop performance – can be applied to monitor weather, crop growth and yield and to improve nutrient and irrigation management. New developments are bringing this approach within reach of smallholder farmers, potentially helping them to make profitable use of costly inputs while preserving soil, water and other resources. CIMMYT is fostering the testing and adoption of relevant tools, including interactive, mobile-phone-based services that deliver timely and relevant information to farmers in their fields.

Diffusion of GreenSeeker™ sensor technology has led to MXN \$22 million in national savings.

Building the capacity of smallholder farmers

CIMMYT studies the constraints facing smallholder farmers and applies the lessons to enhance adoption, reduce vulnerability and improve gender equity and market access. Through a network of public and private sector partners, CIMMYT bridges the last mile to support the adaptation and adoption of improved seed, good agricultural practices and labor-saving technologies. This is essential to increasing food security and nutrition in target communities.

Training the Next Generation

Training and capacity building are pillars of CIMMYT's work and key to sustaining its global network. Each year thousands of Mexican and international students, extension workers, farmers and researchers come to CIMMYT in Mexico for courses, workshops and field days. These capacity building events range from one day to an entire year.

The "Technical Certificate in Sustainable Agriculture" is a one-year intensive training course for Mexican technicians that provides theoretical and practical knowledge imparted by national and international experts. Upon graduation, the technicians are certified to provide technical advice and assistance to new farmers.

Another highlight of CIMMYT's capacity building calendar is the three-month basic wheat improvement course that brings early-career wheat researchers from all over the world to Ciudad Obregón, Sonora, Mexico, to learn about breeding methodologies, pathology, and physiology and wheat quality through lectures significant hands-on fieldwork.

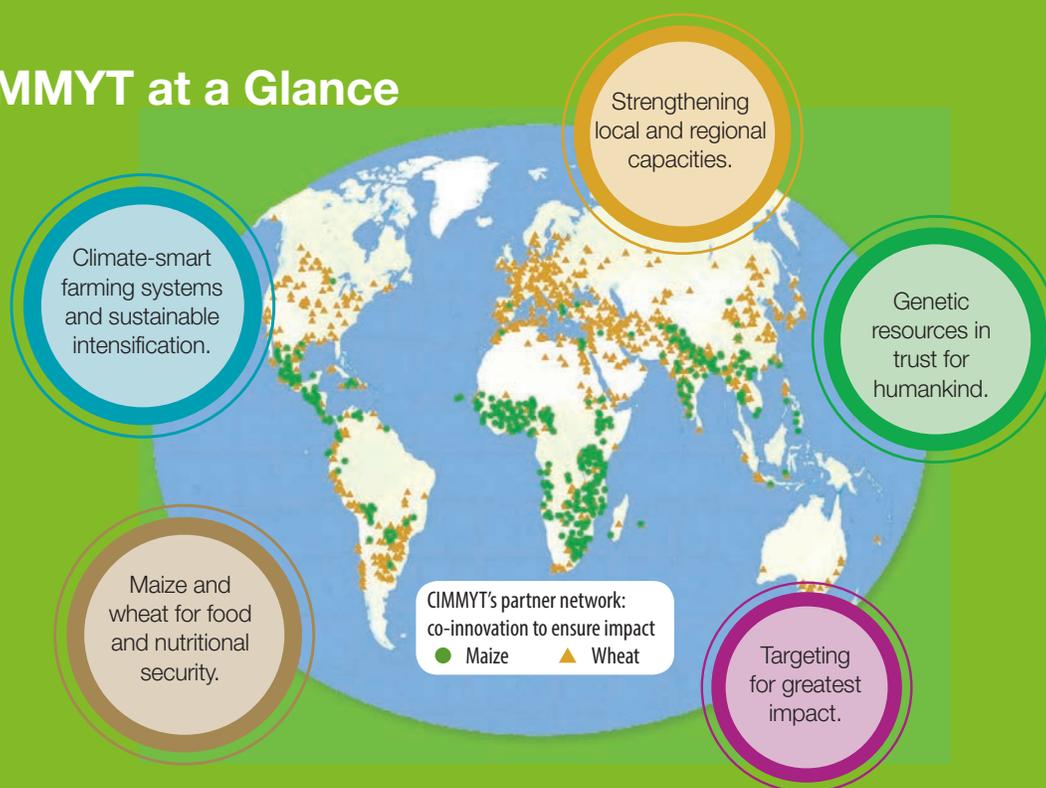
483 Mexican students and visiting scientists have received advanced training in the last 5 years (2010-2014).

In 2014, 383 training events were organized for 12,836 farmers.



Wheat trainees study seedling rust symptoms. Photo: Xochiquetzal Fonseca/CIMMYT.

CIMMYT at a Glance



CGIAR Research Programs

Led by CIMMYT, the CGIAR Research Programs on MAIZE and WHEAT unite hundreds of partners worldwide in research for a food-secure future, benefiting farmers and consumers who depend on maize- and wheat-based farming systems in developing countries.

The Programs also allocate funds through competitive grants to non-CGIAR researchers to fill research gaps and capture a wider range of innovative ideas.



RESEARCH PROGRAM ON Wheat



RESEARCH PROGRAM ON Maize

Competitive Grants Awarded to Mexican Researchers in 2013

- INIFAP- Campo Experimental Centro de Chiapas – Dr. Eduardo R. Garrido Ramirez received a grant to identify and develop Tar Spot Complex resistant maize germplasm for Central America and Colombia.
- Universidad Autónoma de Chiapas (UNACH) – Dr. Ricardo René Quiroga-Madrigal was given support to identify and optimize strategies for sustainable management of Tar Spot Complex of maize in Central America and Colombia.

Donors:

