

SEEDS OF CHANGE

ANNUAL REPORT

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On September 24, 2013, the newly formed United Nations (UN) High-level Political Forum on Sustainable Development held its first meeting. At the Rio+20 Conference, Member States also agreed to launch a process to develop a set of Sustainable Development Goals (SDGs), which were to build upon the Millennium Development Goals (MDGs) that were established in 2000 and expired in 2015.

Of the 17 individual goals, 10 relate directly to CGIAR activities and to CIMMYT's mandate. The SDGs have set the pathway for the next 15 years of agricultural, social, and economic development. Likewise, CGIAR has transformed its approach to ensure that its work aligns with the ambitious goals.

CIMMYT, through its research for development activities, is working toward a world free of poverty, hunger, and environmental degradation. CIMMYT and CGIAR efforts help bring the world closer to reaching the goals, such as the empowerment of women, the reduction of greenhouse gas emissions, and the improvement of health and nutrition for the world's poorest people.

CIMMYT's work contributes to the following SDGs:



Front cover Discover our impact. CIMMYT's work may begin with seeds, but our innovations support farmers at all stages of the value chain. This year's annual report uncovers the wide-ranging impact of our global work.

CIMMYT – the International Maize and Wheat Improvement Center – is the global leader in publicly-funded maize and wheat research and related farming systems. Headquartered near Mexico City, CIMMYT works with hundreds of partners throughout the developing world to sustainably increase the productivity of maize and wheat cropping systems, thus improving global food security and reducing poverty. CIMMYT is a member of the CGIAR System and leads the CGIAR Research Programs on Maize and Wheat and the Excellence in Breeding Platform. The Center receives support from national governments, foundations, development banks and other public and private agencies.

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Message from the Chair of the

BOARD of TRUSTEES

The year 2019 was the third of CIMMYT's Strategic Plan 2017-22 and saw the continued successful delivery of its research and partnerships outcomes for the benefit of tens of millions of smallholder farmers.

The Board of Trustees was privileged to observe multiple examples of that impact and to engage with a range of stakeholders before, during, and after its fall board meeting in Kenya.

CIMMYT's strategic priorities continue to gravitate towards improved food systems supporting healthy diets that are sustainably produced and climate change-resilient. Both national and regional policymakers are emphasizing the diversified production of stress- and disease-resistant crops on less land and with fewer inputs, with a particular focus on improving the livelihoods of women and youth. The Center's responses are being continuously adjusted to address these priorities. Its vast maize and wheat genebanks are a rich source of genetic diversity and a critical element of its solutions.

The threat of pests and diseases continued unabated in 2019. CIMMYT continued to play a key role in the transboundary coordinated response to threats such as maize lethal necrosis, fall armyworm, and wheat blast.

CIMMYT was closely involved in the debate leading to the One CGIAR recommendations that were



CIMMYT Board of Trustees in 2019 (left to right): William (Bill) Angus, Bob Semple, Harry de Roo, José Ernesto Cacho Ribeiro, Ramesh Chand, Feng Feng, Margaret Bath, Nicole Birrell, Rita Mumm, Bongwiwe Njobe and Martin Kropff. Not pictured: José Antonio Cueto Wong, José Fernando de la Torre Sánchez.

endorsed by the CGIAR System Council in November 2019 and looks forward to the implementation of this momentous change over the 2020-21 period. Aligned with the One CGIAR initiative, CIMMYT also continued to modernize and enhance its resource mobilization efforts, with pleasing success in a challenging funding environment.

The Board was also pleased to note ongoing progress in the upgrade of business processes and systems, both at headquarters and in the regional offices. In 2019 this included improved workstreams, enhanced financial management reporting, and a major overhaul of business continuity and disaster recovery planning.

Prudent stewardship of the Center's financial resources has preserved CIMMYT's strong financial position despite funding uncertainties.

CIMMYT's Board of Trustees acknowledges another year of sustained effort and strong achievements on the part of the Center's staff, management, and worldwide partners.

Nicole L. Birrell
Chair, Board of Trustees

Message from the

DIRECTOR GENERAL

In 2019, CIMMYT marked the end of a decade of achievements and the beginning of a decade of opportunities to improve peoples' livelihoods.

Groundbreaking crop research and partnerships offer opportunities for innovations in human and plant health to tackle global issues, such as COVID-19, wheat rusts, or the insatiable fall armyworm.

Many technologies are available to improve agri-food systems – and the converging challenges from climate change, population growth, environmental degradation, and persistent poverty require that humanity acts with urgency and that it integrates collective wisdom and technologies to build a better future. On behalf of the CIMMYT community, I would like to thank our funding and research partners for selecting us to work with them to improve livelihoods through maize and wheat science.

Achieving food security under current, EAT-Lancet, or a more likely intermediate diet scenario, will require new crop varieties that yield more grain per unit land area, that do so in ecologically sustainable cropping systems, and that increasingly meet desired nutritional

and end-use qualities. In a nutshell, the world needs maize and wheat science more than ever before.

All over the globe, agricultural leaders have challenged CIMMYT to help them increase maize and wheat yields. But not simply increase: improve and stabilize production by making it more sustainable and resilient with more efficient resource use, while making space for other crops in order to diversify farmers' fields and diets.

In 2019, African policymakers called for an increased use of science to achieve food security in the face of ever-increasing population and erratic climate. Bill Gates spoke about the "essential role of CGIAR research centers in feeding our future" and together with other stakeholders urged us to "do even better." In his *Gates Notes* blog, he highlighted the great example of CIMMYT's drought-tolerant maize.

In 2019, the CGIAR System decided that the new decade deserves a more united CGIAR. One that offers the opportunity for a paradigm shift and new solutions for the world's poor and food insecure as we work toward achieving the Sustainable Development Goals.

As CIMMYT moves into One CGIAR, we will build on the strengths in the systems, programs, and projects that currently provide excellence in science and impact through the CGIAR Research Programs (CRPs) and Platforms. CIMMYT is committed to contribute to defining and transitioning to a One CGIAR that integrates the collective wisdom and technologies of the 15 current CGIAR Centers and works with partners to build a better future.

I hope you enjoy reading this report and finding out more about how CIMMYT adds to the development of a world with healthier and more prosperous people and with more resilient agri-food systems. I look forward to your feedback and invite you to work with us in the new decade of opportunities.

Martin Kropff
Director General



Examples of CIMMYT'S IMPACT in 2019



1.2M website views

National partners released **82 unique CGIAR-derived maize varieties** across Africa, Asia, and Latin America



CIMMYT is the **largest depositor at the Svalbard Global Seed Vault** with 173,779 accessions from 131 countries. The most recent deposit included 15,231 samples of wheat and 332 samples of maize



CIMMYT researchers published



peer-reviewed journal articles and the CIMMYT publications repository registered more than **1.7M downloads**



National partners released **50 unique CGIAR-derived wheat varieties** across Africa, Asia, and Latin America

More than **15,000 farmers** attended field days and activities that promote sustainable agricultural practices in Mexico



CIMMYT distributes more than **1,500 maize and wheat seed shipments** annually, to as many as 800 recipients in over 100 countries. Shipments contain over **500,000 individual seed packets**



CIMMYT organized **936 trainings** and capacity development activities for **14,017 participants**



1,369 staff of 51 nationalities

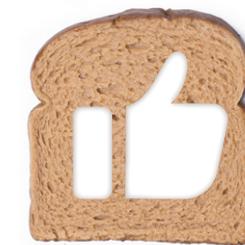


working at CIMMYT



As a result of CIMMYT's Green Initiative, staff used **39,000 fewer PET bottles at HQ** and disposable food containers are now biodegradable

579 media mentions, including *The Economist*, *The Telegraph*, and *Reforma*



More than **108.6K followers** on social media and **201.6K views** on YouTube

HIGHLIGHTS

from around the world

GUATEMALA

CIMMYT researchers have been testing alternative technologies for seed drying in the highlands of northwestern Guatemala.

In 2019 they began experimenting with the use of drying beads in community seed reserves in three maize producing communities, where humidity levels in storage areas can be as high as 100%. When stored with seed inside a hermetically-sealed flask, these marble-sized ceramic beads act as desiccators, absorbing moisture from the container.

Results from initial testing showed that seeds stored with the beads typically had a near 100% germination rate, and seedlings were more uniform. Seeds stored without the beads – whether in a traditional mesh bag or a hermetic flask – were significantly less likely to be viable, as they were exposed to outside elements or trapped humidity within the flasks.

Following the publication of results, the team hopes to scale out the use of this technology across all seed reserves in the area.

ZAMBIA

The CGIAR Research Program on Maize (MAIZE) announced the winners of the 2019 MAIZE Youth Innovators Awards – Africa at an awards ceremony in Lusaka, Zambia. These awards recognize the contributions of young women and men to innovation in African maize-based agri-food systems, including research for development, agribusiness, and sustainable intensification.

Five award recipients were invited to attend the Stress Tolerant Maize for Africa (STMA) project meeting in Lusaka, where they had the opportunity to present their work, network, and exchange experiences with MAIZE researchers and partners.

COLOMBIA

CIMMYT, the International Center for Tropical Agriculture (CIAT), and AGROSAVIA, Colombia's leading not-for-profit organization for agricultural research and technology transfer, signed a five-year agreement aiming to boost maize production.

CIMMYT is providing AGROSAVIA's breeding program with 2,000 advanced lines – developed by combining native maize from Colombia with conventionally improved maize – to support the development of varieties adapted to the country's farming conditions and promote sustainable intensification technologies and practices among Colombian farmers.

AFGHANISTAN

December 2019 saw the culmination of the project Improving Food Security by Enhancing Wheat Production and its Resilience to Climate Change through Maintaining the Diversity of Currently Grown Landraces. Funded by the International Treaty on Plant Genetic Resources for Food and Agriculture, it supported the collection, characterization and evaluation of the country's landraces.

In the northwestern provinces of Balkh and Herat, researchers collected landraces from farmer fields for testing against modern improved varieties. They were then able to remove those susceptible to disease, purify superior lines, and improve their variability and uniformity.

These landraces are now being used in breeding improvement and crossing programs, as well as being multiplied and given back to local communities to enrich regional variability.

INDIA

The Borlaug Institute for South Asia-Punjab Agricultural University (BISA-PAU) joint team received several awards in 2019 for their work on rice residue management using the Super Straw Management System (Super SMS).

Developed and recommended by researchers in 2016, the Super SMS is an attachment for self-propelled combine harvesters offering an innovative solution to paddy residue management in rice-wheat systems.

The Super SMS allows farmers to recycle residues on-site, reducing the need for residue burning and thereby reducing environmental pollution and improving soil health. It helps to spread rice residue uniformly, which is essential for the efficient use of Happy Seeder technology and maintaining soil moisture in the field.

ETHIOPIA

A new early warning system, the first of its kind to be implemented in a developing country, allowed policymakers and farmers across Ethiopia to forecast wheat rust up to a week in advance.

Developed by CIMMYT, the University of Cambridge, the UK Met Office, the Ethiopian Institute of Agricultural Research (EIAR), and the Ethiopian Agricultural Transformation Agency (ATA), the system creates advance forecast models for wheat rust spore dispersal and environmental suitability based on disease presence. These are fed into an early warning unit that receives daily updates automatically and sends weekly advisory reports to development agents, national authorities, researchers, and farmers. This early warning system puts Ethiopia at the forefront of early warning systems for wheat rust.



RICE-WHEAT FARMERS *get ready for a water-scarce future*

As hotter weather, droughts, and depleting aquifers threaten food crop yields in South Asia, scientists have successfully tested a greener and more profitable way for India's farmers to manage irrigated rice-wheat rotations.

Based on two years of field trials comparing innovative versus established practices, the best system for the rice-wheat rotation turned out to feature underground drip irrigation with fertilizer in the water, or 'fertigation,' as well as conservation agriculture practices – such as sowing both crops without tillage, keeping a crop residue mulch on the soil, and growing rice without flooding.

"A suite of these methods raised overall farm profitability by nearly 30%, while requiring 70% less irrigation water than the conventional approaches of intensive soil preparation for rice and wheat, flood irrigation, and growing rice in puddled paddies," said M.L. Jat, a cropping systems agronomist at CIMMYT and co-author of a 2019 *Nature Scientific Reports* article on the study.

Variants of the rice-wheat rotation are practiced on about 13.5 million hectares in South Asia, sustaining hundreds of millions of people but also draining water reserves, generating greenhouse gases, and churning out deadly smoke from farmers' custom of burning crop residues.

"Fertigation in our study reduced nitrogen fertilizer needs by 20% while increasing crop yields," explained Harminder S. Sidhu, a principal research engineer at

the Borlaug Institute for South Asia (BISA) and co-author of the *Nature Scientific Reports* paper. "In medium textured soils, non-flooded rice yielded about 14% less than flooded rice, but the total system productivity of the rice-wheat rotation was higher and growing rice-wheat with fertigation saved labor, time, water, and energy – all of which means costs savings for farmers," Sidhu explained. "It can also help reduce yearly paddy rice emissions of methane – a greenhouse gas with 25 times the global warming potential of carbon dioxide – which are as high as 4.9 million tons in South Asia."

Retaining crop residues as mulch, instead of burning them, improves long-term soil health and crop yields, saves water and mitigates extreme pollution in cities such as New Delhi, according to Sidhu.

Given the mounting challenges in northwest India for flooded rice production – including depletion of water tables, soils being degraded from puddling, and the shortage of labor – researchers and policymakers are exploring more sustainable alternatives. Maize, which is grown elsewhere in India and imported to the northwest to feed poultry, offers an option.

In this study, when maize was substituted for rice in rotation with wheat under sub-surface drip fertigation and the conservation agriculture suite of practices, the result was 20% higher system productivity, 49% greater farmer profits, and 85% savings in irrigation water, over the conventional rice-wheat system. "There is also space for quick-growing legumes in our system, adding to profits and

nutrition," said P.C. Sharma, Director of the Central Soil Salinity Research Institute (CSSRI) and co-author of the *Nature Scientific Reports* paper.

National and state policies in India support practices that save water and avoid residue burning, as well as promoting technologies such as sub-surface drip irrigation systems, said Balwinder Singh Sidhu, Commissioner of Agriculture in the Government of Punjab.

Partners and funders

Funding was provided by the CGIAR Research Program on Wheat (WHEAT), the Indian Council of Agricultural Research (ICAR), the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), and the Government of Punjab, India. We acknowledge the CGIAR Fund Council, the Australian Centre for International Agricultural Research (ACIAR), Irish Aid, the European Union, the International Fund for Agricultural Development (IFAD), the Netherlands, New Zealand, Switzerland, the United Kingdom, USAID, and Thailand for their funding to CCAFS. The basic infrastructure for the study provided by ICAR's Central Soil Salinity Research Institute (CSSRI) is thankfully acknowledged. BISA and CIMMYT field staff in Karnal, Haryana state, and Ludhiana, Punjab state, greatly contributed to the research.

Photo For India's vast rice-wheat cropping rotations, delivering water and fertilizer by the drop through buried tubes, together with conservation agriculture methods, can boost farmers' profits by nearly a third and save 70% of the water typically used in flood irrigation.



COME RAIN *or shine*

Stress-tolerant maize helps smallholder farmers cope with climate risks

“You’ve probably never heard of CGIAR, but they are essential to feeding our future.” In a 2019 blog discussing the essential role the CGIAR System plays in feeding the world, Bill Gates highlighted CIMMYT’s efforts to develop and spread the use of drought-tolerant and disease-resistant improved maize varieties, which he described as “a leading example of the amazing work the CGIAR System does to help smallholder farmers.”

These varieties are more necessary than ever before. Climate change is affecting food production in every corner of the globe and making it harder to meet rising global food demand.

“We will need CGIAR’s research to help supply farmers with a steady stream of climate-smart crop varieties,” said Gates, pointing to drought-tolerant maize as an example of an innovation helping smallholder farmers adapt to climate change.

Farmers are struggling to cope with increasing climate risks, such as more frequent and extreme droughts and flooding, and severe pest and disease outbreaks among crops and livestock. Rainfed, smallholder farming families in sub-Saharan Africa are disproportionately affected, as their livelihoods depend on unpredictable rainfall patterns. It is estimated that by 2030 drought and rising temperatures could render 40% of the continent’s maize-growing areas unsuitable for current varieties.

More than 200 million households in sub-Saharan Africa depend on maize for their livelihoods. However, maize productivity on the continent is currently the lowest in the world, and as weather patterns become more erratic, farmers are at greater risk of having smaller maize harvests – or sometimes no harvest at all.

In response to this challenge, CIMMYT has partnered with the International Institute for Tropical Agriculture (IITA) and national partners in 12 sub-Saharan African countries under the Stress Tolerant Maize for Africa (STMA)



A farmer shows her harvest of stress-tolerant maize in rural Zimbabwe.

project to develop over 200 new maize varieties capable of withstanding drought conditions. These varieties are expected to give farmers 25-30% greater yields under drought stress at the flowering stage, as well as help them fight devastating maize diseases.

In Zimbabwe, farmers in drought-stricken areas using drought-tolerant maize were able to harvest up to 600 kilograms more maize per hectare than those using conventional varieties

So far, more than five million farmers across the region are benefitting from CGIAR-derived stress-tolerant maize varieties.

In Zimbabwe, for example, farmers in drought-stricken areas using drought-tolerant maize were able to harvest up to 600 kilograms more maize per hectare than those using conventional varieties. The additional harvest was enough to feed a family of six for nine months. For farming families who chose to sell their harvests, it was worth US\$240 in extra income, giving them much-needed cash to send their children to school and meet other household needs.

Under the STMA project and the CGIAR Research Program on Maize (MAIZE), CIMMYT and IITA are also supporting local and regional seed companies to produce and deploy quality seed of the stress-tolerant maize cultivars on a large scale.

Partners and funders

The STMA project is funded by the Bill & Melinda Gates Foundation and USAID. The CGIAR Research Program on Maize (MAIZE) receives Windows 1 & 2 support from the governments of Australia, Belgium, Canada, China, France, India, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, the United States, and the World Bank.

KEEPING THE FALL ARMYWORM AT BAY

Asia tackles the pest from all angles

When a caterpillar munched through Muhammad Hasan Ali's maize field in 2018, he was stumped as to what it was or how he could manage the voracious pest. All this Bangladeshi farmer knew was that his harvest and family's income security were at risk.

"I had never seen this type of insect in previous seasons, but I soon learned from agricultural extension workers it was the fall armyworm," he explained.

Researchers from CIMMYT anticipated its spread from sub-Saharan Africa and had proactively begun to prepare coordinated action with public and private institutions across South Asia.

Hasan Ali joined one of the many CIMMYT-facilitated training courses for extension workers and farmers, where he learned how to identify, monitor and control the destructive pest.

The fall armyworm's preferred host is maize – a crop expanding faster than any other cereal in South Asia. The spread of the pest is a major threat to farmers' livelihoods, as many rely on maize crops for their household income by selling it as feed grain for the growing poultry and fish sectors.

"Asia's tropical climates are highly conducive for fall armyworm to be endemic almost throughout the year," explained B.M. Prasanna,

director of CIMMYT's Global Maize Program and the CGIAR Research Program on Maize (MAIZE).

"Farmers need to be made aware of the significant environmental and ecological hazards caused by indiscriminate application of highly toxic synthetic pesticides to control the pest," he said. "We are promoting an integrated pest management strategy, including low-cost agronomic practices, environmentally safer pesticides, biological control, biopesticides, and varieties with tolerance to the pest, working closely with both public and private partners."

Representing CIMMYT, Prasanna is coordinating a global research-for-development consortium to build an evidence-based response against fall armyworm in both Africa and Asia.

JOINING FORCES TO DEFEND ALL FRONTS

In early 2019, CIMMYT partnered with international research funders and nonprofits to plan a regional response to the pest. This initiative brought together over 100 agricultural decision-makers from Bangladesh, Cambodia, India, Myanmar, Nepal, Sri Lanka and Thailand.

As a result, governments created national task forces to mobilize resources, create awareness about fall armyworm, and establish pest surveillance and management protocols.



In South Asia, CIMMYT has helped national partners to address their institutional needs for an efficient response. Another key area of work has been the development of educational and training programs on integrated pest management.

"It is imperative that governmental extension agents are educated on evidence-based and sustainable ways to control the pest, and pass on these methods to farmers," said Tim Krupnik, a CIMMYT senior scientist based in Bangladesh. "CIMMYT developed fact sheets, videos and radio jingles to promote integrated pest management strategies, which have been translated into multiple local languages and distributed to farmers across the region."

tool stores the data, aggregates it and produces weekly incidence warnings, on a local, district and national scale.

"Working with farmers and agricultural agencies to collect information on pest population and crop damage helps agricultural extension agents and farmers to make data-driven pest management decisions," said Krupnik, whose research team led the app and website development.

Efforts towards establishing similar early warning systems have begun in Laos, Myanmar and Nepal, where CIMMYT researchers are working with governments, nonprofits and farmers to conduct surveys and build reliable networks.

BREEDING FOR RESISTANCE

CIMMYT researchers in Kenya have identified maize germplasm with resistance to fall armyworm and have used these traits to develop

improved maize inbred lines and hybrids that are currently being tested in field trials.

"These efforts and the resulting resistant varieties will be distributed across Africa and Asia in the fight against the pest," Prasanna said.

Biological control, including biopesticides, is another important component of integrated pest management strategies. In addition to supporting research by national partners on parasitoids, CIMMYT has engaged with the private sector to develop systems through which proven biopesticides can reach farmers in Asia quickly and effectively, Krupnik said.

Partners and funders

This work is funded by the United States Agency for International Development (USAID), Michigan State University, and the CGIAR Research Program on Maize (MAIZE).

CIMMYT researchers have also shared insights and experiences on local and national media.

"In Nepal, CIMMYT partnered with the Plant Quarantine and Pesticide Management Centre to broadcast a fall armyworm management video on national television, reaching an estimated audience of one million," said AbduRahman Beshir, CIMMYT's maize seed systems specialist based in Nepal.

PEST WATCH

CIMMYT researchers designed an online pest surveillance application which uses crowdsourced data, in collaboration with Bangladesh's Department of Agricultural Extension and the national fall armyworm task force.

Extension officers in the field enter fall armyworm information using handheld smart devices. The online



Participants of the Fighting Against Fall Armyworm trainings learn to collect field data through the Fall Armyworm Monitor web app in a farmer's field in Chauadanga, Bangladesh.

A VISION

for breeding excellence

Farmers and consumers in low- and middle-income countries can benefit from world-class breeding programs, according to a detailed vision developed by the CGIAR Excellence in Breeding Platform (EiB). Throughout 2019, the EiB team developed this vision in close contact with researchers from CGIAR and national agricultural research systems, funders, and private sector partners.

In parallel, each CGIAR breeding program developed a plan for strategic improvements to breeding, in close collaboration with EiB staff and in alignment with the EiB vision for CGIAR breeding.

EiB has also supported all CGIAR breeding programs to develop product profiles, which identify market-driven objectives. Eduardo Covarrubias joined to lead the EiB module on breeding scheme optimization to support delivery on those objectives. Initiatives underway include the production of in-depth breeding scheme optimization guidelines for publication on the EiB Toolbox and a computer simulation platform in collaboration with the Roslin Institute at the University of Edinburgh.



Participants at the EiB annual meeting in 2019

Breeding operations and phenotyping capacities were assessed at eight research stations across four CGIAR Centers. EiB also conducted a CGIAR-wide survey to identify equipment needs, preferences and areas of improvement, which will inform budgets for modernization and standardization of equipment.

A CGIAR-wide project on operational excellence was first piloted at CIMMYT. Staff in Mexico received training in Six Sigma techniques, identified bottlenecks within their areas of work and started projects to address them.

The High-Throughput Genotyping project became a self-sustaining service, brokering around US\$2 million worth of low-cost and high-quality genotyping data for CGIAR and national breeding programs to date. Its staff continues to train users and provides consultancy services to ensure genotyping is used effectively to speed up variety selection.

Connecting genotypic data from service providers with field data collection apps was a key focus of software development. The number of apps and data management services connected through the Breeding Advanced Programming Interface (BrAPI) project continues to grow.

Programmers from across CGIAR reached a key milestone in showing that the major data management software applications can be spun up in a single software solution: the Enterprise Breeding System. It will be released in 2020 for use by breeding teams at CIMMYT and the International Rice Research Institute (IRRI). In addition to workshops and trainings, EiB sponsored six sabbaticals, to support collaboration across institutions and the development of unified data management systems.

DNA fingerprinting

DNA fingerprinting is a **method used to identify individual plants** by looking at unique patterns in their genome.

It can be used to identify wheat varieties, bringing state-of-the-art research into farmers' fields.

THE RESULTING HIGHLY ACCURATE DATA HELP:

- National breeding programs **adjust their seed production** to meet demand, and national extension agents **focus on areas** that need better access to seed.
- Breeders, scientists, and development organizations **track their impact**, which affects funding, support, and the direction of future research.
- Researchers understand – **and protect** – the diversity of the varieties being grown.
- Farmers get **access to seed** that improves their production and incomes.



In Afghanistan, CIMMYT researchers went to **4 different provinces**, and selected **560 samples** from farmers' fields.



They shipped the seed to Mexico, where **CIMMYT molecular geneticist Susanne Dreisigacker** and her team DNA fingerprinted the samples.



To provide a basis for comparison, they created a **reference library of 800 genotypes** of any variety likely to be grown on those fields.



Meanwhile, research colleagues carried out the traditional farmer survey.

Dreisigacker's team found that many more **Afghan farmers** than previously reported grow modern varieties.

Most were derived from **CIMMYT lines**.



Funder

Australian Centre for International Agricultural Research (ACIAR).

CIMMYT has conducted DNA fingerprinting in **Afghanistan and Ethiopia** and plans to continue in **Egypt, India, and Kyrgyzstan**.

PIONEER DATA SYSTEMS DRIVE CHANGE

to sustainable farming in Mexico

CIMMYT is using data from nearly 200,000 plots to offer Mexican farmers site-specific recommendations to make their farming systems more productive, resilient, and sustainable. In 2019, 483 field technicians and farmer leaders collected data from 632 demonstration modules and 2,437 extension areas, covering more than 26,000 hectares across the country. This initiative is part of MasAgro, Mexico's integrated development partnership with CIMMYT, funded by the Secretariat of Agriculture and Rural Development (SADER).

Data collectors can register up to 500 data variables from each plot monitored, describing management practices and important moments of the crop cycle. These records are fed into the MasAgro Electronic Field Book, a monitoring system that CIMMYT and its partners developed in 2012 to standardize data collection and management practices in Mexico. Since then, more than 218,000 logs have been entered into the system. To complement this information, CIMMYT-trained extension agents and field technicians load geographic information onto an open data collection system called ODK Collect.

CIMMYT collaborates with the International Center for Tropical Agriculture (CIAT) and the International Institute for Applied Systems Analysis (IIASA) to look for correlations and patterns in the datasets, to identify possible limiting factors and best management practices for each plot monitored. The resulting analytics feed a multi-platform application called AgroTutor that assists farmers' decisions by offering recommended agricultural practices, ideal periods or windows of opportunity for performing specific activities, historic yield potential records, commodity price forecasts, and historical data for local benchmarks.

The use of machine learning algorithms for data analysis is common in different fields, including agriculture, but has rarely been accessible to small and medium-sized farmers. For that reason, the tools developed by CIMMYT for the MasAgro project have been acknowledged for producing predictive and prescriptive site-specific analytics for the benefit of resource-constrained farmers.

In addition to increased productivity and profitability for farmers, applying these insights has contributed to the sustainable use of natural resources and has led to more informed and effective public policies and projects.

The United Nations (UN)-sponsored Counting on the World to Act report by the Sustainable Development Solutions Network (SDSN) and the Thematic Research Network on Data and Statistics (TReNDS) describes CIMMYT's data management systems and tools as examples of "frontier technologies" that effectively contribute to sustainable farming in Mexico and respond to the Sustainable Development Goals. "As part of the data revolution, efficiencies are being derived from lower-tech approaches such as using citizen-generated data and smartphones to speed up existing survey-based approaches," reads the introduction to CIMMYT's sidebar story in Chapter 4 of the report, Incentives for Innovation, presented in September 2019 during the 74th Session of the UN General Assembly.

PLOT ACTIVITIES AVAILABLE IN AGROTUTOR

- Application of soil improvers
- Sowing
- Ground preparation
- Fertilization
- Irrigation
- Weed control



THE CEREALS IMPERATIVE *of* *future food systems*

Pioneering research on our three most important cereal grains – maize, rice, and wheat – has contributed enormously to global food security over the last half century, chiefly by boosting yields and making these crops more resilient in the face of drought, floods, pests and diseases. But with more than 800 million people living in chronic hunger and many more suffering from inadequate diets, much remains to be done.

The importance of transforming food systems is the message of the 2019 EAT-Lancet Commission report, which defines specific actions to achieve a “planetary health diet” enhancing human nutrition and keeping resource use of food systems within planetary boundaries. With major cereals still supplying about one-third of calories required in the proposed diet, the way they are produced, processed, and consumed must be a central focus of global efforts to transform food systems. There are three main reasons for this imperative.

1. SCALE AND ECONOMIC IMPORTANCE

The critical importance of these crops in global food systems can be seen in the sheer extent of major cereal production and its value. According to 2017 figures, maize is grown on 197 million hectares

and rice on more than 167 million hectares, mainly in Asia and Africa. Wheat covers 218 million hectares worldwide, and the total annual harvest of these three crops amounts to about 2.5 billion tons of grain.

Global production had an estimated annual value averaging more than US\$500 billion in 2014-2016. The prices of the major cereals are especially important for poor consumers. In recent years, the rising cost of bread in North Africa and tortillas in Mexico, as well as the rice price crisis in Southeast Asia, imposed great hardship on urban populations in particular, triggering major demonstrations and social unrest. Reducing dependence on cereal imports to avoid such troubles, many countries in Africa, Asia, and

Latin America have made staple crop self-sufficiency a central element of national agriculture policy.

2. CRITICAL ROLE IN HUMAN DIETS

In developing countries, maize, rice, and wheat together provide 48% of total calories consumed and 42% of total protein. As staple foods, maize and wheat make up close to two thirds of the world's food energy intake. In every developing region except Latin America, cereals provide people with more protein than meat, fish, milk, and eggs combined, making them an important protein source for over half the world's population.

These cereals also serve as a rich source of dietary fiber and nutrients. CGIAR research has documented the important contribution of wheat to healthy diets, linking the crop to reduced risk of Type 2 diabetes, cardiovascular disease, and colorectal cancer.

3. ENCOURAGING PROGRESS TOWARD BETTER NUTRITIONAL QUALITY

In recent years, cereals have improved in nutritional quality through a conventional crop breeding approach called 'biofortification,' which boosts the content of essential vitamins or micronutrients. Dietary deficiencies of this kind harm children's physical and cognitive

development, and leave them more vulnerable to disease. This is believed to cause about one-third of the 3.1 million annual child deaths attributed to malnutrition. Diverse diets are the preferred remedy, but the world's poorest consumers often cannot afford more nutritious foods.

While not a replacement for diverse diets, 'biofortified' crop varieties developed by CGIAR help address hidden hunger by providing higher levels of zinc, iron and provitamin A carotenoids as well as better protein quality. These offer an immediate solution for the many subsistence farmers and rural consumers who depend on locally produced foods and lack access to industrially fortified products.

TOWARD A SUSTAINABLE DIETARY REVOLUTION

Compared to other crops, cereal production has relatively low environmental impact. However, it is both necessary and feasible to further enhance the sustainability of cereal cropping systems. Any improvement in resource use efficiency will have a major impact on greenhouse gas emissions and water conservation, while also freeing up vast amounts of land for natural vegetation and other crops to allow for diversified diets and farmer incomes.

Future-proofing global food security requires bold steps. Policy and research need to support a double transformation centered on nutrition and sustainability, and this requires greater investment in cereals as well as smaller crops. Agriculture, from farm to fork, creates more than 25% of global GDP but attracts less than 5% of global investments in research and development (R&D).

The impact of our work depends on the growing resolve of countries to promote these themes through strong policies and programs, as well as global investments in R&D. If agriculture is not prioritized, it is unlikely that future demand for sustainable, affordable, and more diversified diets will be met.





MORE OPTIONS FOR FARMERS

Blue maize varieties with improved yield and nutrition

While many consumers are only familiar with white or yellow maize, native maize from Mexico and Latin America can come in a dazzling array of colors, including blue, red, or purple colored kernels. These deeper-hued varieties are gaining popularity around the world for their delicious taste and added health benefits, but are cultivated mainly by smallholder farmers on small plots of land, making it difficult to meet large-scale consumer demand.

Unlike white and yellow maize, which have many high-yielding hybrid varieties, most of the blue maize planted by farmers today are landraces, or native maize varieties passed down from generation to generation. These varieties contain important genetic diversity and play an important role in local culture and cuisine, but have lower yields compared to modern varieties.

Moreover, these varieties have greater variation in grain types between farmers, making it undesirable for large-scale market use. As native maize varieties were selected by indigenous people for local adaptation over thousands of years, they are still grown throughout Mexico but often perform poorly when moved to another region.

Researchers at CIMMYT are now working to develop the Center's first subtropical blue maize hybrids and improved open-pollinated varieties (OPVs), a move that will provide more options for Mexican farmers and contribute to better nutrition for consumers.

"These blue maize hybrids and OPVs will give farmers and consumers more choices on what they can plant and what they can eat, while also preserving the cultural diversity of Mexico and improving health and nutritional benefits," said Terence Molnar, a maize breeder at CIMMYT leading this project. "We're also bringing in and preserving a lot of new genetic diversity, as all of these hybrids and OPVs are derived from traditional landraces from Guatemala, Mexico, and Peru."

Trials have shown that the new blue maize hybrids can potentially yield over 12 tons per hectare under optimum conditions – triple the average yield of landrace varieties. They are also resistant to leaf diseases and ear rots, and thus show significant reduction in the accumulation of harmful

mycotoxins such as fumonisins. Additionally, some of the grain quality parameters such as texture and kernel size are being monitored for farmer and end-user preferences.

Blue maize derives its rich hue from its high content of anthocyanin, a pigment with powerful antioxidant properties and many reported health benefits. Studies have claimed that anthocyanin can contribute to reduced cardiovascular disease by lowering cholesterol. Some blue maize landraces have also shown higher amounts of resistant starch, which preliminary studies have associated with their pigments and phenolic content.

“Resistant starch is a form of fiber that does not immediately become glucose in the body and breaks down more slowly,” says Natalia Palacios, CIMMYT maize quality specialist. “This reaction occurs in the colon rather than earlier in the digestive process, causing you to feel satiated for longer, and in the long run can help to prevent obesity, in addition to many other factors, although more research is needed.”

“**These blue maize hybrids and OPVs will give farmers and consumers more choices on what they can plant and what they can eat, while also preserving the cultural diversity of Mexico and improving health and nutritional benefits**”

Terence Molnar, maize breeder at CIMMYT

This added nutritional benefit could be extremely important in Mexico, among many other dietary interventions, as 65% of the population is overweight, 30% of the population is obese, and the

country has one of the highest rates of deaths attributable to diabetes. “These blue maize varieties would have additional nutritional benefits to white maize hybrids currently in the market,” Palacios affirmed.

Blue maize work at CIMMYT has an intermittent 20-year history, according to Jose Luis Torres, a highland maize breeder at CIMMYT who has spent the past decade working on developing blue maize hybrids for high altitudes in Mexico. His hard work paid off in 2019, with the development of several hybrids and OPVs that are currently being tested by a large network of collaborators and will soon be available to farmers.



Source of anthocyanins

Source of resistant starch

Available in landrace, hybrid and OPV

End-user kernel preferences

PLENTY OF CHOICE

For farmers who want to continue planting their native maize varieties, CIMMYT's maize landrace improvement coordinator Martha Willcox has worked to help facilitate the creation of a new civil association, ProMaíz Nativo, and a collective trademark, Milpaiz, to help farmers demonstrate the authenticity of their native landrace maize and receive fair prices for their work.

“We are trying to get a fair price for these farmers, as these native maize seeds are their inheritance, their own variety passed down through generations,” she said.

Willcox has found that smallholder farmers' incomes have increased substantially under the fair-trade pricing scheme, allowing farmers to continue preserving the invaluable genetic diversity in their heirloom maize varieties.

“In addition to improving nutrition and increasing yields, CIMMYT's work in blue maize is about giving

farmers choices – so that they can choose to keep growing their native maize variety, or move to an OPV for greater stability, while other farmers may want hybrids. This is about giving farmers options that suit their needs,” said Molnar.

A field day for farmers, seed companies and end users was held in November 2019 in Jalisco, Mexico, to introduce the subtropical blue maize hybrids under development. The participants were very impressed with the varieties on display and expressed their interest in planting them as soon as they are available. “I think there will be a lot of demand. It is hard to get blue maize in this region and it tends to sell out quickly,” said Marta

Christina Velazquez Enciso, a local maize farmer. “I personally would be very interested in planting these blue maize hybrids, not just for their beautiful color but also because of the health benefits. I am glad CIMMYT is doing this work, because I think that the existence of blue maize hybrids would be beneficial to preserve the cultural and genetic diversity of maize in the region.”

Partners and funders

This work is funded by Mexico's Secretariat of Agriculture and Rural Development (SADER), through the MasAgro initiative, and the Kellogg Company.



HIDDEN TREASURE IN FARMER FIELDS



In the Fertile Crescent – what is now Afghanistan, Iran, and Turkey – farmers have been breeding wheat for more than 8,000 years. The work of countless generations of farmers resulted in traditional wheat varieties, or landraces, with unique traits suited for local conditions and for baking nutritious foods.

When agriculture became more intensified, most farmers switched to modern, higher-yielding varieties. But some landraces still survive, carefully cultivated by farmers in remote communities.

Realizing the value and potential of this genetic diversity, a team of CIMMYT scientists and wheat breeders embarked on a treasure hunt for these 'lost' varieties, with support from the UN Food and Agriculture Organization's

International Treaty on Plant Genetic Resources for Food and Agriculture.

In partnership with the Bahri Dagdas International Agricultural Research Institute in Turkey and the Agricultural Research Institute of Afghanistan, the CIMMYT team collected 162 landraces in Turkey and 25 in Afghanistan. They planted the seeds in research fields and selected the best performing varieties, with input from local farmers. Researchers found that some Afghan landraces were resistant to prevalent rusts and could yield up to 90% as much as modern commercial varieties.

Now CIMMYT is completing the cycle, returning the best landrace seeds to the original farming communities and providing training on sustainable cultivation. By conserving this valuable diversity in farmers' fields – and using it in breeders' greenhouses – future generations of wheat farmers and consumers can benefit from more resilient wheat production, not to mention delicious bread.

Partners and funders

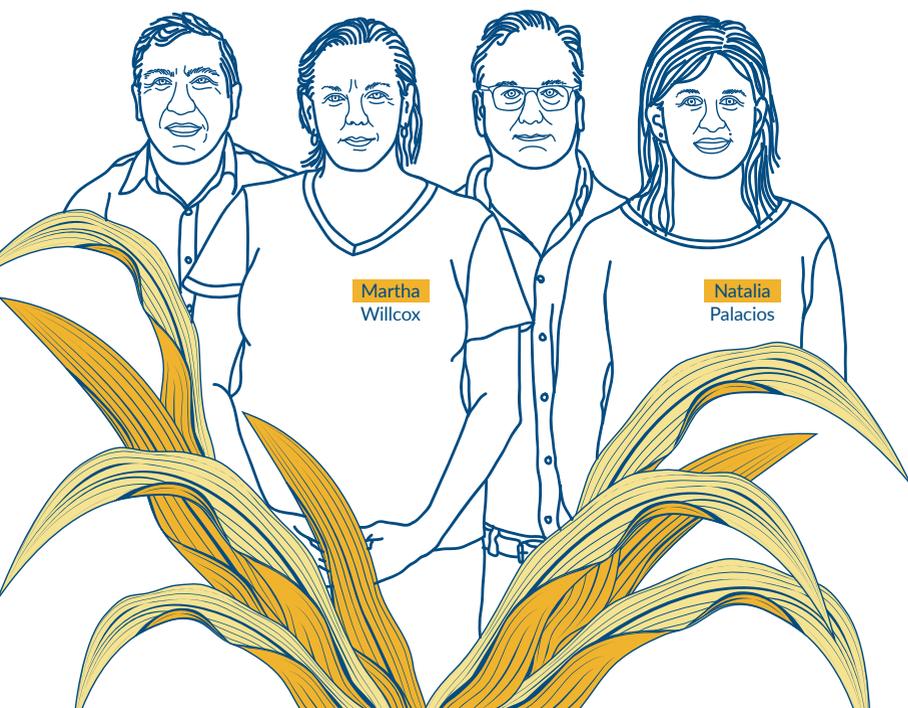
This work is funded by the UN Food and Agriculture Organization's International Treaty on Plant Genetic Resources for Food and Agriculture Benefit Sharing Fund, and carried out in partnership with Bahri Dagdas International Agricultural Research Institute, Turkey, and the Agricultural Research Institute of Afghanistan.

Jose Luis Torres

Terence Molnar

Martha Willcox

Natalia Palacios



FOUR WAYS

to strengthen gender equality in agriculture in the MENA region

When it comes to labor markets, the Middle East and North Africa (MENA) is one of the most gender-unequal regions in the world. Although agriculture is the largest employer of women in the region, they still face significant challenges accessing land, benefitting from technologies, and enjoying equitable labor conditions.

Drawing on research in Egypt and Morocco funded by the CGIAR Research Program on Wheat, we present four ways of strengthening gender equality in agriculture in the MENA region.



1 Recognize women as workers, not helpers

In Egypt, research shows that women in agriculture are widely categorized as 'helpers' to male workers rather than workers in their own right. Listed as 'housewives' on their national ID cards, while men are listed as 'agricultural workers,' women farmers are often marginalized from social protection and development programs.

Legally and socially recognizing women as workers is therefore a key first step towards gender equality.

2 Change perceptions of land ownership

The MENA region has the lowest share of women landholders in the world, at just 5%. Research in Egypt shows that women tend to identify land officially owned solely by themselves as belonging to themselves and their husbands – although more recently land distribution quotas have been introduced to encourage land ownership among women.

Policy change on its own is not enough to tackle these low landownership rates – changing perceptions of land ownership must be part of the solution.

3 Enforce legislation for equal pay and zero tolerance for sexual harassment

In Egypt and Morocco, women are designated lower paid and more time-consuming tasks, and are systemically paid less than men, even for the same tasks. Women agricultural workers face high levels of sexual harassment and have limited bargaining power.

Moroccan legislation includes equal pay and zero tolerance for sexual harassment, but enforcement remains weak. Enforcing existing proactive legislation must be a priority.

4 Revitalize agriculture as a valuable and necessary occupation in society

Much of the world sees agriculture as an occupation of last resort. When surveyed, men and women in Morocco complained about agricultural work being an unstable and unreliable way of making a living. In both Egypt and Morocco, women who worked as wage workers were associated with a tarnished reputation and had difficulty marrying.

To shift how agriculture is viewed and rebrand it as an important and respected occupation, it needs to be reformed as a safer, more equal and respectful space for both women and men.

Partners and funders

Funders of this work include the CGIAR Research Program on Wheat (WHEAT), the International Center for Agricultural Research in the Dry Areas (ICARDA), the Food and Agricultural Organization of the United Nations (FAO) and the CGIAR Research Program on Policies, Institutions, and Markets (PIM).

WOMEN FIND BUSINESS OPPORTUNITIES with mechanization

Tools make it easier to operate farm machinery and inspire entrepreneurial women

Social norms and the physical effort required to operate heavy farm machinery can exclude women from agriculture and related business opportunities.

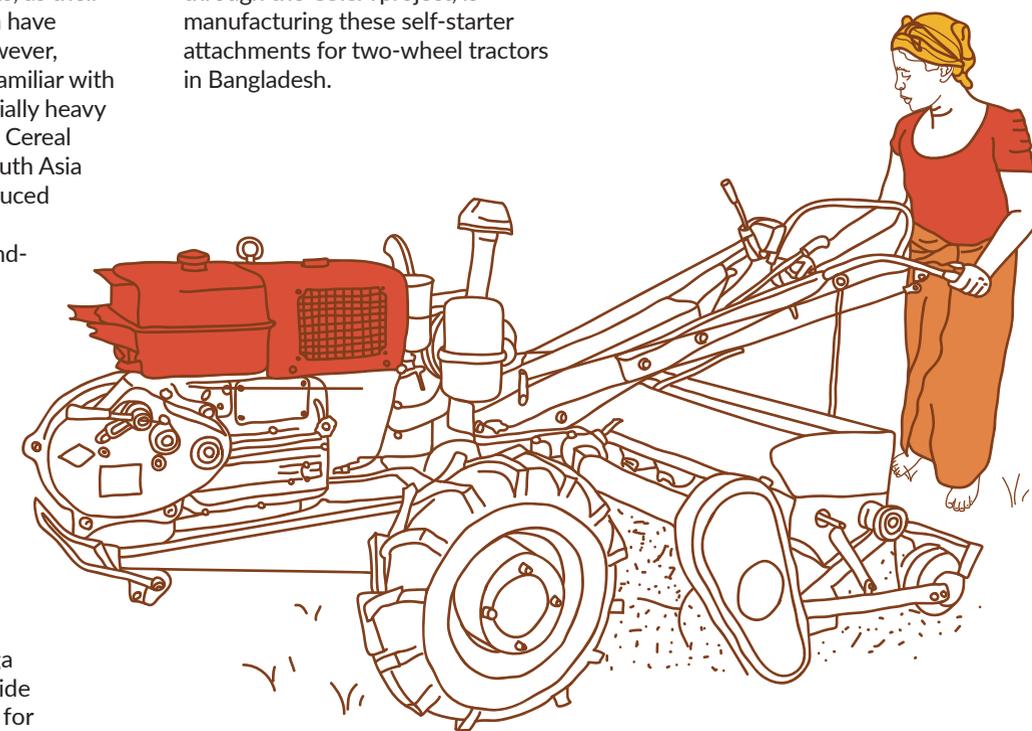
Through mechanization solutions, CIMMYT is helping women to overcome these challenges and become successful entrepreneurs.

In Nepal, women head more and more farming households, as their partners and young men have left to work abroad. However, women are not always familiar with farming practices, especially heavy equipment. Through the Cereal Systems Initiative for South Asia (CSISA), CIMMYT introduced farmers in Nepal to the precision spreader, a hand-operated device that is easy and convenient to use for all. It also distributes fertilizer evenly, so farmers use the right amount and save money.

Starting two-wheel tractors can also pose a challenge for women entrepreneurs. Halima Begum, a farmer in Bangladesh's Chuadanga district, wanted to provide mechanization services for other farmers in the area,

to increase her income. However, cranking to start up the tractor required a lot of strength and she had to rely on others for help.

Now, using an electronic self-starter, she can start the tractor with the flick of a lever. This device reduces the risk of accidents and encourages women and youth to become entrepreneurs of agricultural mechanization services. CIMMYT, through the CSISA project, is manufacturing these self-starter attachments for two-wheel tractors in Bangladesh.



Similarly, in Zimbabwe, Agatha Dzvengwe and Marianne Jaji have become successful entrepreneurs as two-wheel tractor service providers. One of the key outcomes of the Farm Mechanization and Conservation Agriculture for Sustainable Intensification (FACASI) project, funded by the Australian Centre for International Agricultural Research (ACIAR), is to increase awareness among women and youth of the business opportunities related to small-scale mechanization.

"We have been freed from the burden of toiling in the field. Now that I own a two-wheel tractor, the society respects me more," said Jaji.

Partners and funders

Australian Centre for International Agricultural Research (ACIAR), Bill & Melinda Gates Foundation, International Food Policy Research Institute (IFPRI), International Rice Research Institute (IRRI), United States Agency for International Development (USAID).



STRESS-TOLERANT MAIZE, *sustainable intensification and integrated pest management to improve food security*

The CGIAR Research Program on Maize (MAIZE) is an international collaboration led by CIMMYT and the International Institute of Tropical Agriculture (IITA) that seeks to mobilize global resources in maize research for development to achieve greater impact on maize-based farming systems.

In 2019, MAIZE made great advances in the development of improved, stress-tolerant maize varieties with enhanced genetic gain, and novel genetic diversity and tools. National partners released 82 unique CGIAR-derived maize varieties across Africa, Asia and Latin America. In addition to high yield, these varieties are stacked with multiple traits needed by smallholder farmers to protect their

crops from drought and diseases. These MAIZE varieties also included nine nutritionally enriched varieties with improved protein quality, provitamin A, and high zinc.

MAIZE and partners have continued the battle against fall armyworm in Africa and Asia on several fronts, including stakeholder workshops and capacity development on integrated pest management, besides intensive research on developing maize varieties with native genetic resistance to the pest.

From research on value chains and improved nutrition to conservation agriculture and scale-appropriate mechanization, MAIZE in 2019 continued to focus on sustainable intensification of maize-based

cropping systems in Latin America, South Asia, and sub-Saharan Africa, where maize plays a critical role in the food and nutritional security and livelihoods of millions of resource-constrained consumers.

For more information, visit maize.org

Partners and funders

The CGIAR Research Program on Maize (MAIZE) receives Windows 1 & 2 support from the governments of Australia, Belgium, Canada, China, France, India, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, the United States, and the World Bank.

FUNDERS

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TOP FUNDERS

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Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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FINANCIAL OVERVIEW

CIMMYT concluded the 2019 financial year with an overall deficit of US\$1.8 million, compared to a surplus of US\$0.9 million in 2018. Total grant income decreased by 11.6%, from US\$119.7 million in 2018 to US\$105.8 million in 2019.

In 2019, a reduction in bilateral funding and cautious research spending led to lower indirect cost recovery than expected. This lower indirect recovery, in combination with several crucial investments in institutional functions, the effect of actuarial losses as a result of lower interest rates, and financing costs related to employee termination provisions, were large contributing factors to this deficit. However, through mitigation and adaptation to major funding cuts, CIMMYT has successfully limited the operating loss to only US\$1.1 million.

For 2019, CIMMYT maintained a strong CGIAR Research Program Windows 1, 2 & 3 funding portfolio within a complex environment. At the time of preparing this report, COVID-19 is impacting the global landscape in which CIMMYT operates. Working within these boundaries, CIMMYT and its

partners will continue to deliver on research-for-development commitments, while closely monitoring the financial impact of the crisis throughout 2020, as part of the risk management framework.

CIMMYT's 2020 grant portfolio is strong and increasing, and funders have been outspoken in their ongoing support and acknowledgment of CIMMYT's impact and its support to the One CGIAR transformation process.

Strong financial health, built up conservatively over previous years, will support CIMMYT to overcome this challenging period and will allow the organization to continue operating to support the 500 million smallholder farmers worldwide with incomes of less than two dollars a day.

To download the full financial report for 2019, visit cimmyt.org/about/funders



INNOVATIONS AND HIGH-TECH TOOLS *help farmers battle climate change, pest and disease challenges*

In 2019, the CIMMYT-led CGIAR Research Program on Wheat (WHEAT) capitalized on advanced technology to deliver improved wheat varieties and support to wheat farmers worldwide.

Many of the world's more than 2.5 billion wheat consumers are benefiting from added climate resilience and genetic diversity, thanks to CIMMYT's breeding strategy incorporating traits from wild wheat relatives. Using the wheat genome map, this year WHEAT scientists and partners identified new chromosomal regions that will further speed progress.

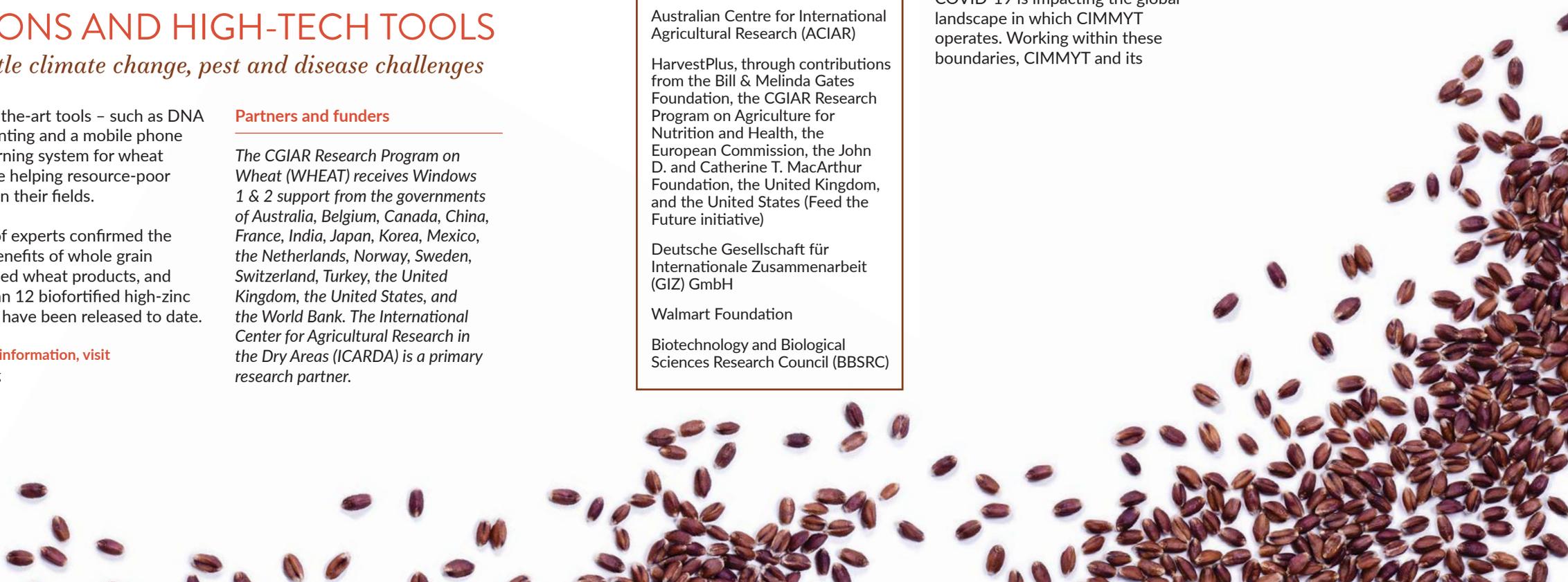
State-of-the-art tools – such as DNA fingerprinting and a mobile phone early warning system for wheat rust – are helping resource-poor farmers in their fields.

A team of experts confirmed the health benefits of whole grain and refined wheat products, and more than 12 biofortified high-zinc varieties have been released to date.

For more information, visit wheat.org

Partners and funders

The CGIAR Research Program on Wheat (WHEAT) receives Windows 1 & 2 support from the governments of Australia, Belgium, Canada, China, France, India, Japan, Korea, Mexico, the Netherlands, Norway, Sweden, Switzerland, Turkey, the United Kingdom, the United States, and the World Bank. The International Center for Agricultural Research in the Dry Areas (ICARDA) is a primary research partner.



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ACRONYMS

ACIAR	Australian Centre for International Agricultural Research	EiB	CGIAR Excellence in Breeding Platform	MDGs	Millennium Development Goals
AGROSAVIA	Colombian Agricultural Research Corporation (Corporación Colombiana de Investigación Agropecuaria)	FACASI	Farm Mechanization and Conservation Agriculture for Sustainable Intensification	ODK	Open Data Kit
ATA	Agricultural Transformation Agency	FAO	Food and Agricultural Organization of the United Nations	OPV	Open-pollinated variety
BISA	Borlaug Institute in South Asia	ICAR	Indian Council of Agricultural Research	PET	Polyethylene terephthalate
BrAPI	Breeding Advanced Programming Interface	ICARDA	International Center for Agricultural Research in the Dry Areas	PIM	CGIAR Research Program on Policies, Institutions, and Markets
CCAFS	CGIAR Research Program on Climate Change, Agriculture, and Food Security	IFPRI	International Food Policy Research Institute	R&D	Research and Development
CIAT	International Center for Tropical Agriculture	IIASA	International Institute for Applied Systems Analysis	SADER	Mexico's Secretariat of Agriculture and Rural Development (Secretaría de Agricultura y Desarrollo Rural)
CIMMYT	International Maize and Wheat Improvement Center	IITA	International Institute for Tropical Agriculture	SDGs	Sustainable Development Goals
CRP	CGIAR Research Program	INIFAP	Mexico's National Forestry, Crops and Livestock Research Institute (Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias)	SDSN	Sustainable Development Solutions Network
CSISA	Cereal Systems Initiative for South Asia	IRRI	International Rice Research Institute	SMS	Straw Management System
CSSRI	Central Soil Salinity Research Institute	MAIZE	CGIAR Research Program on Maize	STMA	Stress Tolerant Maize for Africa
EIAR	Ethiopian Institute of Agricultural Research	MENA	Middle East and North Africa	TReNDS	Thematic Research Network on Data and Statistics
				UN	United Nations
				USAID	United States Agency for International Development
				WHEAT	CGIAR Research Program on Wheat

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Hand-made ceramic representations of Mexican dishes, part of the world food displays at the Genetic Resources Visitors Center at CIMMYT's global headquarters in Mexico.



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