

ANNUAL REPORT 2015

Building resilience to risk

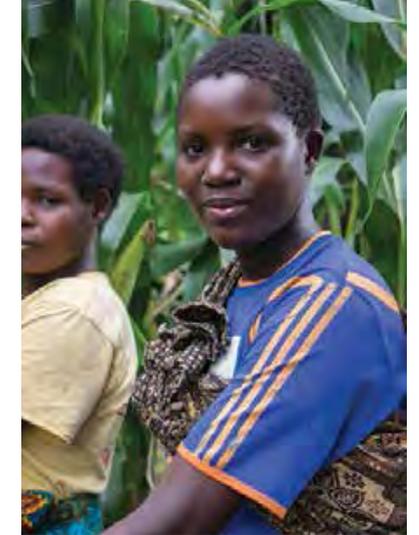


CIMMYT - the International Maize and Wheat Improvement Center - is the global leader on publicly-funded maize and wheat research and related farming systems. Headquartered near Mexico City, CIMMYT works with hundreds of partners throughout the developing world to sustainably increase the productivity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



Contents

- 02** Message from the Director General
- 04** CIMMYT at a glance
- 06** CIMMYT events and awards
- 08** CGIAR Research Programs on Maize and Wheat
- 10** Maize seed: Origin of agricultural development and food systems
- 14** Billions in benefits from CIMMYT wheat breeding
- 18** Maize Lethal Necrosis (MLN) in Africa: Consolidating collective action
- 22** Climate-resilient wheat farming for food security in South Asia
- 26** Genetic bridges to the future
- 30** Affordable maize seed and varieties for Pakistan
- 34** Investments in resilience help farmers recover from disasters
- 38** Overcoming challenges in gender research
- 42** CIMMYT staff
- 44** Financial highlights
- 47** Contact information
- 48** Acronyms and credits





Message from the Director General

Resilience to address farmers' risks, fragile food markets, natural disasters

2015 was a remarkable year for CIMMYT with scientific innovations that respond to the needs of the poorest and most vulnerable. I am proud of the achievements of our 1,300 colleagues around the world whose devoted work contributes to the global effort to tackle poverty, hunger and major nutrition imbalances, and environmental degradation.

2016 brings new and complex challenges. Nearly 60 million people are expected to require food aid due to droughts and other extreme weather from the "El Niño" climate effect. A study by Lloyd's of London shows that the global food system is under significant pressure, and that coinciding shocks in any given year will elevate maize and wheat prices four-fold.

Research and action to respond

Farming is inherently risky; shifting markets and climates, coupled with increasing demand, land degradation and scarcity of critical resources, pose mounting challenges. To address them, CIMMYT has redoubled decades-long efforts to develop, test and promote innovative, productive, and resource-conserving technologies and cropping practices in collaboration with partner organizations and farmers.

A pioneering new study carried out across 135 rural communities in 26 countries provides "bottom-up" insights on how social rules influence men, women and youth to adopt innovation in agriculture and natural resource management.

30 years ago – before climate change became a global concern – CIMMYT began to develop climate-resilient maize which is bearing fruit in Asia, Africa and Central America. Today, farmers are able to harvest more grain in a dry year using CIMMYT maize varieties.

A new study on the impact of wheat breeding during 1994-2004 showed that nearly half of the world's wheat area is sown to varieties derived from CGIAR breeding lines, providing annual benefits of \$2-3 billion in enhanced productivity. These varieties are often strongly preferred because they withstand stresses like high temperatures and provide reliable yields under varying conditions, reducing farmers' risk.

Innovative agriculture practices aimed at capturing and retaining soil moisture are boosting yields in dry years in southern Africa and highland Mexico. In South Asia, direct seeding of wheat after rice harvest raises wheat yields while reducing water and fuel costs. Precision leveling of fields improves irrigation, enabling farmers to save up to 30 percent more water, use less fertilizer and produce more grain yield. Specialized smallholder farm machinery is crucial for such practices, including suitable designs for women and support for local manufacturers.

» **"...coinciding shocks in any given year will elevate maize and wheat prices four-fold."**

Prepared to weather storms

In 2015, CIMMYT also provided direct disaster support; the earthquake in Nepal left smallholder farmers without the ability to plant and harvest crops. In Ethiopia, farmers experienced the worst drought in 30 years. CIMMYT responded to these disasters with drought tolerant seed and modern agricultural power tools.

Long-term investments in agricultural research help prepare for future shocks and ensure that crops and livelihoods can withstand natural disasters.

In 2016, CIMMYT will celebrate 50 years of improving food security and livelihoods. In particular I would like to thank Thomas Lumpkin who served as DG until 1 June 2015 for his commitment, wise counsel and support. I would also like to thank the many donors who have generously funded CIMMYT's work, as well as the many partners and stakeholders without whom we would never achieve impact. Please continue helping us to offer productive, resource conserving options for farmers.



Martin Kropff and Joseph Mabe, Zimbabwe Minister of Agriculture, meet the press.

CIMMYT at a glance

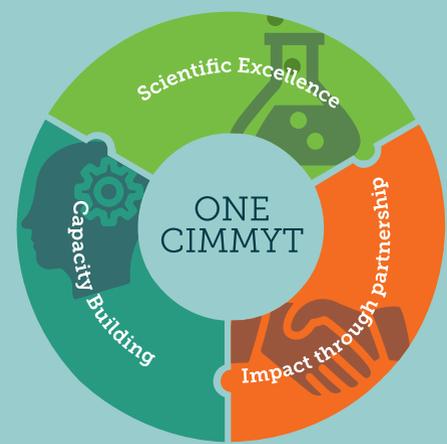
Mission

Maize and wheat science for improved livelihoods

Vision

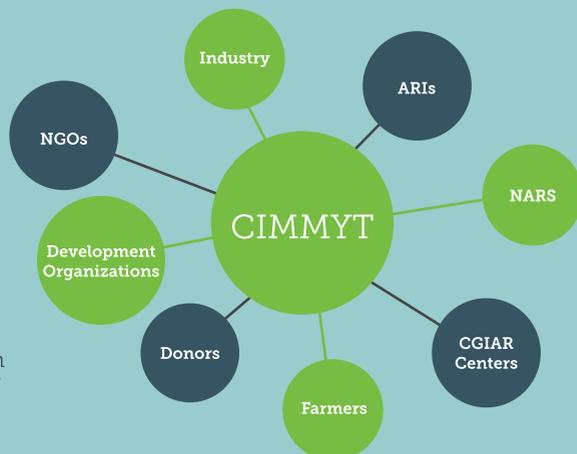
CIMMYT contributes to the development of a world with less poverty, healthier and more prosperous people, more resilient ecosystems and fewer global crises.

HOW DO WE CONDUCT OUR WORK?

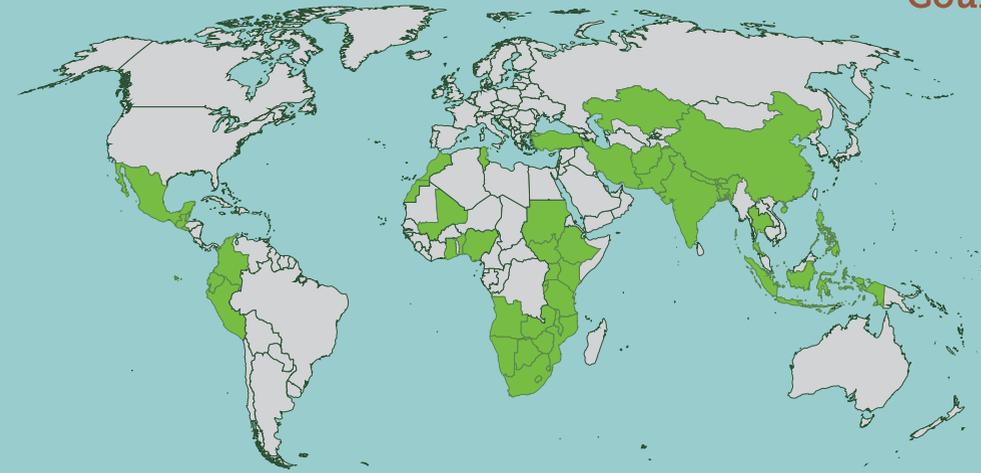


CIMMYT links scientific excellence, impact through partnerships and capacity building. "One CIMMYT" integrates these domains.

CIMMYT transforms research into large-scale farm-level impacts through strong, long-established partnerships.



CIMMYT AROUND THE WORLD



Countries with offices:

- Afghanistan
- Bangladesh
- China
- Colombia
- Ethiopia
- Guatemala
- India
- Iran
- Kazakhstan
- Kenya
- Mexico
- Nepal
- Pakistan
- Turkey
- Zimbabwe

Projects in over 40 countries

THE BIG IMPACT



CIMMYT GENERATES BENEFITS of **\$3.5-4.0 BILLION** annually

50% OF MAIZE AND WHEAT grown in the developing world IS BASED ON CIMMYT VARIETIES

More than **10,000** AGRICULTURAL EXPERTS AND SCIENTISTS have trained at CIMMYT



CIMMYT Event & Awards

Director General Thomas Lumpkin passes the torch

CIMMYT said goodbye to former Director General Thomas Lumpkin, who retired in June after seven years of dedicated service. "The entire team has worked hard to build up CIMMYT," said Lumpkin on announcing his departure. "We've trusted each other; we've taken on challenges and risks. We rebuilt this institution, and we brought its reputation back to what it was."

Under Lumpkin's leadership during 2008-15, CIMMYT greatly expanded its partnerships, funding, reputation and impacts. As part of this, India and CIMMYT strengthened their longstanding partnership and, through the Indian Council of Agricultural Research (ICAR), established in 2011 the Borlaug Institute for South Asia (BISA).



Thomas Lumpkin receives the Borlaug Award from John Snape, Chair of CIMMYT's Board of Trustees.



Thomas Lumpkin and new Director General, Martin Kropff.

German investment helps secure CIMMYT's germplasm bank

On 4 September, 2015, the Ambassador of the Federal Republic of Germany to Mexico, Victor Elbing, inaugurated a photovoltaic solar power system at CIMMYT headquarters. Installed under the supervision of the German Agency for International Development (GIZ) with funding from the Federal

Government of Germany, the 920 solar panels represent an investment of 750,000 euros, generate up to 34,750 kWh per month and serve as a reliable and sustainable energy source for the cold rooms holding 28,000 maize and 150,000 wheat seed collections in the CIMMYT germplasm bank.



Martin Kropff and Victor Elbing, Germany's Ambassador to Mexico, activate CIMMYT's solar panel system.

Staff gathers for Science Week

Held at CIMMYT headquarters in Mexico during 15-18 June, 2015 Science Week brought scientists from CIMMYT offices worldwide to report on successes and challenges, review activities and jointly plan future work to attain CIMMYT's mission. CIMMYT staff from around the world came together to discuss key points and identify new opportunities for improving work quality, institutional learning, work plans for coming decades and CIMMYT's role in science and development. During the week, Director General Martin Kropff presented a draft of the

CIMMYT strategy for comment and discussion. The new strategy will be set in place to guide the organization until 2020. Also proposed during Science Week by Philip Pardey, professor of Science and Technology Policy at University of Minnesota, was the need to develop and apply the new "International Agricultural Prospects" model that projects global agricultural consumption and production to 2050. He expressed the need to increase sustainable agricultural productivity growth, including attention to research that maintains past productivity gains.



A roundtable discussion draws a crowd during Science Week.

The International Wheat Conference



CIMMYT scientist Gemma Molero gives a presentation at IWC.

The 9th International Wheat Conference (IWC) was held in Sydney, Australia, in late September. The conference, which is held every five years, dissected topics ranging from the intricate inner workings of the wheat genome to nutritional misrepresentations of wheat in the popular media. Keynote speakers included CIMMYT Director General Martin Kropff; director of the CIMMYT

global wheat program (GWP), Hans Braun; and 2014 World Food Prize Laureate and former director of GWP, Sanjaya Rajaram. Preceded by a four-day workshop hosted by the Borlaug Global Rust Initiative (BGRI) focusing on Ug99 wheat rust disease, the event resulted in extensive media coverage of the longstanding and enormously successful Australia-CIMMYT wheat research partnership.

Ravi Singh wins China Friendship Award

Ravi Singh, wheat breeder and CIMMYT distinguished scientist, was awarded the China Friendship Award along with 50 foreigners from 21 countries working in China. The Friendship Award is China's highest prize for foreign experts who have made outstanding contributions to the country's economic and social progress. Singh's key contributions to China agricultural development

over the past 30 years involve sharing improved germplasm, spreading knowledge about rust-disease resistance genetics and leading various trainings as part of an agreement between CIMMYT and the Chinese government. In addition to this national award, Singh has received three friendship awards from provinces in China.



Ravi Singh poses with his China Friendship Award.

CGIAR Research Programs on Maize and Wheat

The CGIAR Research Program on Maize (MAIZE) works to increase maize production for the 900 million poor consumers for whom the crop is a staple food in Africa, South Asia and Latin America. The CGIAR Research Program on Wheat (WHEAT) helps to raise the productivity, production and affordable availability of wheat for 1.2 billion resource poor consumers who depend on the crop as a staple food. The principal research partner for MAIZE is the International Institute of Tropical Agriculture (IITA) and for WHEAT the International Center for Agricultural Research in the Dry Areas (ICARDA). Both Programs work with research-for-development

networks comprising hundreds of public and private organizations worldwide, among them national programs, seed, machinery and irrigation companies, international centers, regional and local NGOs and farmers. In 2015, MAIZE and WHEAT significantly strengthened research and capacity in gender (see story on p. 39) and both received high marks from the CGIAR Independent Science and Partnership Council (ISPC) on their pre-proposals for a new phase of CGIAR Research Programs (CRPs), to be launched in 2017. This research is supported by CGIAR Fund Donors and other contributors listed on p.45.



MAIZE



MAIZE partners worldwide made tremendous progress. Sixty-four improved maize varieties, based on CIMMYT/IITA germplasm, were released through MAIZE partners in 2015, including 44 in sub-Saharan Africa, 13 in Latin America, and 7 in Asia. In addition to high and stable yield potential, some of the special traits stacked in these varieties include drought tolerance, heat tolerance, nitrogen use efficiency, enhanced protein quality, and resistance to diseases such as tar spot complex, Turcicum leaf blight, Gray Leaf Spot, and Maize Streak Virus (MSV), as well as tolerance to the parasitic weed *Striga*.

MAIZE researchers found breeder-ready markers for resistance to MSV. About 25,000 lines in the doubled haploid (DH) breeding pipeline were screened with markers for MSV resistance. National research

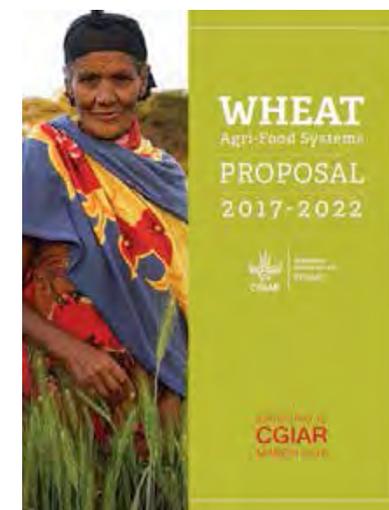
organizations and seed companies took advantage of the Maize Lethal Necrosis Screening Facility at the Kenya Agricultural and Livestock Research Organization (KALRO) Naivasha location to have 10,790 germplasm entries screened for the disease, identifying several disease-tolerant inbred lines and hybrids. MAIZE researchers rolled out an integrated control strategy that relies on Tar Spot Complex resistant improved varieties in Central America.

Over 7 million hectares were planted with improved MAIZE-derived technologies or management practices in 2015 as a result of CRP research, directly reaching more than 18 million smallholder farm families worldwide. In India and Nepal, Nutrient Expert®, developed through a MAIZE funded partnership between CIMMYT and the International



Plant Nutrition Institute (IPNI), has become widely recognized as a major climate-smart decision support system for raising yield while optimizing nutrient use.

WHEAT



A global study by WHEAT on the impacts of international collaboration in wheat breeding research during 1994-2014 found that CGIAR-derived varieties – nearly all traceable to CIMMYT and ICARDA breeding programs – covered more than 100 million hectares in 2014. The value of the added grain produced ranged from \$2.2 billion to \$3.1 billion each year. In Ethiopia, a region where wheat faces deadly droughts and rapidly-evolving pathogens, concerted action and high-yielding, disease resistant varieties from WHEAT partners, along with supportive government policies and better cropping practices, have helped

wheat production to more than double in a decade, rising from 1.6 million tons in 2003-04 to around 3.9 million tons during 2013-15. A study by the Center for Chinese Agricultural Policy showed that 350 Chinese researchers had taken part in CIMMYT wheat training programs since 1970, of which 15 percent were female during 1980-90, rising to 35 percent female during 2000-12. In 2015, 73 CGIAR-derived wheat varieties were released in 20 major wheat-producing nations by WHEAT partners. In the beginning of 2015, a revised governance structure was put in place, making Hans-Joachim Braun WHEAT CRP Director.



Farmers Maliamu Joni and Ruth Andrea harvest drought tolerant maize on their farm in Idakumbi village, Mbeya, Tanzania.

Maize Seed: Origin of agricultural development and food systems

Farmers' ready access to affordable, improved maize seed underpins increased productivity for maize food and feed worldwide. In regions like sub-Saharan Africa and Mexico, maize, the predominant food staple, is grown solely on rainfall by smallholder farmers, making access to affordable, drought tolerant seed all the more critical to food security.

Building on decades of partnerships with seed producers and successful research to create drought tolerant maize, CIMMYT is fostering more effective maize seed production and, increasingly, delivery systems in these regions, working to make resilient, high-yielding maize the preferred choice for seed companies and farmers. This means new maize varieties that not only yield well but also make good business sense.

Sub-Saharan Africa: drought tolerant maize is driving seed demand

Both the main food staple and income generator in sub-Saharan Africa, occupying more than half the cereal production area in more than half the region's countries, maize is grown mainly on small farms by millions of families far from markets, with few financial resources and a high aversion to risk.

Since the mid-1990s CIMMYT, with IITA and national partners in sub-Saharan Africa, has led the development and release of more than 200 drought tolerant varieties already benefiting over 5 million households on more than 2.5 million hectares annually.



Maize seeds are bagged at a local seed company in Latin America.

With half of Africa's maize area routinely affected by drought, the challenge to reach more farmers is huge.

"We're focusing on incentives across the maize value chain – market potential for producers, business opportunities for seed distributors, yield potential for farmers – coupled with a new emphasis on the informal sector, where so much seed and seed information comes from," said Kate Fehlenberg, manager of the CIMMYT-led Drought Tolerant Maize for Africa Seed Scaling (DTMASS) project. "We're doing this with targeted and tailored business information for each type of partner and bringing in new and more private sector experts in seed market analysis, communications and media, to make sure progress will continue."

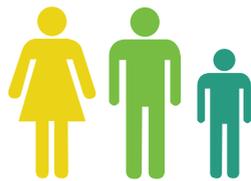
Mexico: Rocking the cradle of maize

Home of the farmers who over several millennia domesticated maize from a wild grass, Mexico's maize lands are dominated by age-old, low-input, low-yield maize cropping systems where farmers use saved seed of local or heirloom varieties.

Fewer than half of Mexico's maize farmers have access to improved seed. Through a major, joint initiative known as the Sustainable Modernization of Traditional Agriculture (MasAgro) project, CIMMYT and seed companies are targeting areas where maize agriculture is or can be more profitable, and particularly where hybrid maize may be of interest, according to Arturo Silva Hinojosa,

Goal by 2019:
68,000
 TONS OF CERTIFIED SEED

 benefitting more than
30 MILLION
 PEOPLE
 IN SUB-SAHARAN
AFRICA



» "We're focusing on incentives across the maize value chain - market potential for **producers, business opportunities for seed distributors, yield potential for farmers...**"

– Kate Fehlenberg
 Manager, CIMMYT-led DTMASS project

**CIMMYT
 + IITA**
 + partners
 DEVELOPED/RELEASED
200 DROUGHT
 TOLERANT
 VARIETIES
 on **2,500,000**
 hectares



leader of the CIMMYT-led International Maize Improvement Consortium (IMIC), Latin America division, which is part of MasAgro. "MasAgro has involved 57 small and mid-sized Mexican seed companies," said Silva. "These partners were able to increase sales by an annual average of 10 percent over 2011-15, as a result of MasAgro's capacity-building and maize breeding efforts."

In 2015, 48 companies produced a combined output of 1.2 million 60-kilogram bags of hybrid maize. The companies offered 26 drought tolerant hybrids adapted to Mexico's main rain-fed maize production regions.

"The improved seed was sold under 100 commercial names in 19 states, 78 regions and 257 municipalities," Silva explained. "As one result, the market share of drought tolerant maize increased by 44 percent in Mexico in 2015."

The hybrids yield at least as much as the best commercial hybrids often marketed at a higher price, according to Silva. "More importantly, they are resilient to heat and drought, or resistant to pests and prevalent diseases, making them ideal for smallholder farmers and global food security."

The development and dissemination of drought tolerant maize in Africa is funded by the Bill & Melinda Gates Foundation (BMGF), the United States Agency for International Development (USAID), the Norway Development Fund (DF) and CGIAR Fund Donors listed on p. 45. Funding for the International Maize Improvement Consortium (IMIC) comes from the Mexican Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA).



Mohamoud Ahmed Mohamoud of IFFA Seeds Limited proudly showing off his drought tolerant seed on a demo plot in Tanzania.



Billions in benefits from CIMMYT Wheat Breeding

Launched in the 1950s by Norman Borlaug, a wheat scientist whose research and development contributions helped save hundreds of millions from starvation in the 1960s-70s, the international wheat improvement network coordinated by CIMMYT and the International Center for Agricultural Research in the Dry Areas (ICARDA), both members of CGIAR, has been the main source of improved traits for wheat breeding programs and farmers in developing countries and often high-income nations. This has raised wheat yields, grain quality, and disease resistance, among other traits.

But what is the precise economic value of this breeding pipeline, which in recent times leverages annual donor contributions of approximately \$30 million to test, select, and share wheat lines worldwide, as well as supporting seed production and distribution to farmers?

To find the answer, CIMMYT socioeconomists undertook a momentous study, gathering survey responses from breeding programs in 66 major wheat producing countries, analyzing the pedigrees of 4,604 wheat varieties released during 1994-2014, and pouring over countless published reports and on-line resources.

» **About 100 million wheat farmers in developing countries** grow varieties that have CIMMYT and ICARDA breeding lines in their pedigrees.

Widespread, popular, and productive

As documented in “Impacts of International Wheat Improvement Research 1994-2014,” varieties on nearly half the world’s wheat lands – as well as 70 to 80 percent of all wheat varieties released in South Asia, Central and West Asia, and North Africa – feature breeding contributions from CIMMYT or ICARDA.

“This means that about 50 million wheat farmers in developing countries are growing varieties that have our breeding lines in their pedigrees,” says Hans Braun, director of CIMMYT’s global wheat program and the CGIAR Research Program on Wheat. “Through this improved seed, farmers gain immediate, free access to higher yields, resilience under hot and dry conditions, and resistance to devastating crop diseases.”

The study found that farmers’ use of this improved seed brings benefits in added grain of between \$2.2 and \$3.1 billion each year.¹ This means

that every \$1 invested provides returns of from \$75 to \$100, helping to raise farmers’ incomes and to keep wheat affordable for low-income consumers.

Wheat: Critical food for humanity’s future

Global food systems are currently awash in grain, thanks in part to the success of organizations like CIMMYT and ICARDA, but recent studies foreshadow a future of rising demand and food price instability that could wreak havoc, particularly among poor consumers.

To ensure the affordable availability of wheat – a food staple that provides around 20 percent of protein and calories consumed worldwide – researchers need to expand field testing for disease resistance and heat and drought tolerance and to significantly raise wheat’s genetic yield potential, according to Braun.

“This is a critical juncture,” says Braun. “The unfolding scenario implies a yearly growth in wheat



Climate change is already affecting wheat productivity in major breadbaskets like South Asia: A study in *Nature Climate Change* shows that, for every 1 degree Celsius increase in night temperature, wheat production decreases by 6 percent.



CIMMYT AND ICARDA
wheat breeding research
BRINGS BENEFITS OF
\$2.2 - \$3.1
BILLION ANNUALLY



demand of 1.4 percent to 2030, at constant prices. But yield gains in wheat remain below 1 percent per year over the last decade, mainly because the easiest gains in wheat have already been achieved and more dramatic progress will require new approaches.”

The new study proves that international collaboration on wheat research continues to provide

impressive returns on investments, as occurred during the 1960s-70s, according to Olaf Erenstein, director of the CIMMYT socioeconomic program. “Consistent and secure funding is crucial to maintain the research and institutional capacities required to deliver such impact,” says Erenstein, “particularly given the mounting challenges facing wheat food security and farm livelihoods in developing countries.”

EVERY \$1 INVESTED in wheat research **RETURNS \$75-\$100** in benefits






To achieve impacts in wheat agri-food systems, CIMMYT and ICARDA depend on national partnerships in over 100 countries and support from CGIAR Fund Donors and other contributors listed on p. 45.

¹ The study calculated benefits from investments in CGIAR wheat breeding research, not in-kind or other contributions of national partners and advanced research institutes, which are crucial to the success of global wheat improvement.



A maize crop infected with the Maize Lethal Necrosis disease in Kenya.

Maize Lethal Necrosis in Africa: Consolidating Collective Action

Efforts to control the spread of Maize Lethal Necrosis, a devastating maize disease that appeared in eastern Africa in 2011, are pulling together national, regional and international partners to deploy resistant varieties, spread improved farming practices for disease control, and create a “community of practice” for disease diagnosis and management.

Maize is the leading cereal crop in Sub-Saharan Africa, feeding more than 300 million people. Since 2011 it has suffered its worst threat in decades, with the appearance in eastern Africa of Maize Lethal Necrosis, a complex disease that results from the combined infection of two deadly viruses. It can be spread by insect pests and occasionally through infected maize seed.

At risk are food security and livelihoods in Democratic Republic of Congo, Ethiopia, Kenya, Rwanda, Tanzania and Uganda, where the disease has already been sighted, and in other maize lands to which it may spread. True to its middle name, the disease can be lethal for the maize of

smallholder farmers, who may lose as much as 100 percent of their harvest.

“We’ve made progress in developing and releasing MLN-tolerant maize varieties, but we need to intensify inter-institutional disease surveillance across Sub-Saharan Africa and, above all, to ensure the disease does not spread,” said B.M. Prasanna, director of the CGIAR Research Program on Maize and CIMMYT’s global maize program (GMP), who is coordinating multi-disciplinary and multi-institutional control efforts.

“Our goal is to strengthen national plant protection systems to detect, monitor and contain the disease’s

spread, particularly through seed, while supporting seed company efforts to produce and market disease-free seed for farmers,” Prasanna explained.

Besides breeding for tolerance or resistance, partners are testing and promoting with farmers agronomic mitigation practices such as crop rotations – particularly using legumes – and sharing standard procedures for disease diagnostics and management among national and regional phytosanitary agencies.

At a conference organized by CIMMYT in Nairobi, Kenya, during May 2015, over 150 scientists, regulators, and policymakers from 9 African countries, along with

scientists from Mexico, Switzerland and the USA, discussed effective control measures and developed strategies and recommendations as the basis for a regional project.

In October 2015, the Maize Lethal Necrosis Diagnostics and Management Project was launched to step up surveillance and, for the first time ever, establish a phytosanitary community of practice involving national plant protection organizations, ministries

of agriculture, grain/seed trade associations, and the commercial seed sector. Funded by USAID, the project will harmonize diagnostic protocols and procedures for companies to produce and market disease-free seed.

A major facility was established jointly by CIMMYT and the Kenya Agriculture and Livestock Research Organization (KALRO) at Naivasha, Kenya, in 2013, to screen breeding lines and populations against Maize

MLN COULD AFFECT FOOD SECURITY for more than **300** MILLION PEOPLE



in Eastern Africa



An MLN-resistant hybrid with good ear formation (just before harvest) under severe disease pressure at the MLN Screening Facility at Naivasha, Kenya.

“Our goal is to strengthen national plant protection systems to...**contain the spread of MLN...**”

– B.M. Prasanna
director of CGIAR Research Program on Maize and CIMMYT's global maize program



These photos show how MLN can become progressively worse over a short time.

MLN is reported in several major maize-producing nations of Africa



with up to **100% GRAIN YIELD LOSS** depending on severity

Lethal Necrosis. To date, more than 60,000 CIMMYT entries have been tested there and the service is open to test germplasm from public and private breeding programs in Africa, including seed companies.

“So far, we’ve identified several promising, resistant hybrids,” said Prasanna. “Five first-generation, tolerant hybrid varieties derived from CIMMYT breeding stocks have

already been released in Kenya, Tanzania and Uganda. Private companies have begun to produce seed for markets, and as many as 15 additional disease-resistant hybrids are in national performance trials in eastern Africa.”

Finally, DNA markers are being used to introduce resistance into 35 widely-used but susceptible CIMMYT maize lines.

Key partners and donors to CIMMYT's efforts in controlling MLN include the CGIAR Research Program on Maize (MAIZE), the United States Agency for International Development (USAID), the Bill & Melinda Gates Foundation (BMGF), Syngenta Foundation for Sustainable Agriculture (SFSA), the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), the Alliance for a Green Revolution in Africa (AGRA), the Kenya Agriculture and Livestock Research Organization (KALRO), and the Rwanda Agriculture Board (RAB). CGIAR Fund Donors and other generous contributors to CIMMYT maize research are listed on p. 45.



Kamlesh Kumar Pandey, a farmer in Buxar, Bihar, India, uses zero-tillage to sow wheat on his land.

Climate-resilient wheat farming for food security in South Asia

The use of resource-conserving practices like zero-tillage can improve livelihoods through efficient and sustainable farming.

With an average of just over 2.1 tons per hectare, wheat yields in the eastern Indian state of Bihar are the lowest in the Indo-Gangetic Plains and the state imports more than 800,000 tons of wheat each year to feed its expanding population. But according to a study published in 2015 by the Cereal Systems Initiative for South Asia (CSISA), a practice known as zero-tillage – the direct sowing of seed into unplowed soil and the residues of previous crops – may be able to close the gap between wheat production and consumption.

“Enhancing the productivity of rice-wheat cropping in South Asia’s Indo-

Gangetic Plains is essential to ensure food security for the region, which is home to more than 20 percent of the world’s population,” said Andrew McDonald, CIMMYT principal scientist and South Asia team leader for sustainable intensification. The eastern Indo-Gangetic Plains are characterized by pervasive poverty and high population density.

The study stated that Bihari farmers who used zero-tillage produced 19 percent more wheat per hectare. Combined with the significant savings in fuel costs by not plowing, the total economic benefit for zero-tillage users amounted to 6 percent of their annual household income.



"The positive effect of zero-tillage appears to be greater in low-productivity areas such as Bihar than in high-output zones like, for instance, Punjab State," said CIMMYT senior agricultural economist Alwin Keil and first author of the study.

Most smallholders in eastern India cannot afford the specialized seeder needed for zero-tillage, according to Keil. Thus, widespread adoption of the practice depends on an expanded network of entrepreneurs who have the seeder and hire out their services to sow wheat.

"In Bihar and the neighboring state of Uttar Pradesh, the number of zero-tillage service providers went from only 17 in 2012 to more than 1,900 in 2015," he said.

The region's farmers must also contend with high temperatures

during wheat's grain-filling stage, which can reduce yields by more than 50 percent, McDonald explained. With zero-tillage, wheat farmers can plant earlier so their crop matures before the spring heat.

According to a study published by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the International Food Policy Research Institute (IFPRI), zero-tilled wheat also saves water by better capturing rainfall, reducing evaporation and lessening the need to irrigate before sowing.

"Large-scale adoption of zero tillage for wheat saves farmers money by reducing tractor and fuel costs, explained McDonald. "It also improves soil and water quality, suppresses weeds, and can put Bihar on track to self-sufficiency in wheat."

These results were achieved through working partnerships with the CGIAR's International Rice Research Institute (IRRI), International Food Policy Research Institute (IFPRI) and International Livestock Research Institute (ILRI); as well as national research and extension systems, the Indian Council of Agricultural Research (ICAR) of India's Department of Agricultural Research and Education; and private companies and farmers. CSISA is funded by key donors, the United States Agency for International Development (USAID) and the Bill & Melinda Gates Foundation (BMGF).



Women farmers examine stored wheat seeds in Bihar, India.



FARMERS
in Bihar harvest

19%
MORE
WHEAT



per hectare using
ZERO TILLAGE



Genetic bridges To The Future

As severe weather and evolving crop diseases threaten farmers' livelihoods and global food security, scientists are using novel DNA tools and informatics to unearth high-value traits from vast maize and wheat seed collections, for use in breeding climate-resilient varieties to feed the future.

Thousands of years ago, the domestication of maize and wheat from wild grasses sustained the rise of great civilizations. Migration, trade and conquest eventually spread those grains to every corner of the world. Some varieties became tolerant to dry conditions, others to heat, frost, local diseases, and long or short growing seasons, over centuries of selection and breeding by farmers.

Realizing that modern varieties would supplant these locally-adapted "landraces," breeders and other specialists began to gather and conserve them in organized, cataloged collections in refrigerated genebanks.

"The genetic variation stored in the CIMMYT genebank, comprising 150,000 wheat collections and

28,000 maize collections, is crucial to developing the stress resistant maize and wheat varieties of the future," says Kevin Pixley, Director of CIMMYT's Genetic Resources Program, "but plant breeders are often reluctant to use that diversity."

The reason, explains Pixley, is that the unique and valuable traits from landraces come with many genes for less desirable, wild characteristics, which have to be removed through repeated crosses and selection. This multiplies the time and cost of creating elite varieties.

"It's like extracting and purifying gold from deep mines, so engineers and artisans can craft it into specialized products for industrial or personal use," Pixley explains, adding that DNA markers and other advanced technologies are now bringing the

"gold" of seed collections within reach of crop breeders.

"To help breeders, CIMMYT is crossing landraces with elite varieties to develop 'bridging germplasm' halfway in performance between unimproved and elite lines, but with increased stress adaptation or quality traits from the landraces."

More than 5,000 maize landraces from the genebank have been evaluated using DNA markers for one or more high-value breeding traits, and 350 of these are being used to develop bridging germplasm with enhanced drought tolerance, improved nutritional and end-use quality, and resistance to devastating diseases such as Maize Lethal Necrosis or the tar spot complex.

"The tar spot complex-resistant bridging germplasm will become available to breeders in 2017, and bridging germplasm for other traits will follow," Pixley says.

In the case of wheat, CIMMYT and partners have screened over 100,000 genebank seed collections for samples that carry drought or heat tolerance and disease resistance. More than 1,000 are being used to develop bridging germplasm, according to Pixley: "Breeders in China, India, Iran, Kenya, Mexico, Pakistan, and the USA are already testing the selected collections and bridging germplasm for use in their programs."



The CIMMYT genebank in Mexico.

PARTNERS AND DONORS

This research is facilitated by the support of key donors such as:

Mexico's Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA); the CGIAR Research Programs on Maize (MAIZE), Wheat (WHEAT) and Genebanks; the United Kingdom's Biotechnology and Biological Sciences Research Council (BBSRC); the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and the Ministry of Foreign Affairs of Japan (MOFA).

Partners who have been key in this effort include

Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Mexico | Punjab Agricultural University, India | Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya (CSK HPKV), India | Indian Agricultural Research Institute (IARI) | National Institute of Abiotic Stress Management (NIASM), India | Nuclear Institute of Agriculture (NIA), Pakistan | Dryland Agriculture Research Institute (DARI), Iran | Kenya Agricultural and Livestock Research Organization (KALRO) | Wheat Research Institute, China | Cornell University | Washington State University | South Dakota State University | James Hutton Institute | DuPont-Pioneer, Mexico | Diversity Arrays Technology (DARt P/L), Australia | Diversity Seek Initiative (DivSeek) | Global Crop Diversity Trust, both a partner and a donor.



Examples of the wheat genetic diversity stored in the CIMMYT genebank.

THE POWER OF A SEED

CIMMYT's collection of genetic resources has been placing seed of robust, higher-yielding and more nutritious maize and wheat crops in farmers' fields for 50 years.

With more than 175,000 accessions of maize and wheat made available to researchers and national agriculture institutions around the globe, CIMMYT maintains the world's largest seed bank of these two crops.



MILLIONS OF IMPROVED MAIZE AND WHEAT SEEDS ARE SENT ANNUALLY FROM CIMMYT HUBS IN COLOMBIA, CHINA, ETHIOPIA, INDIA, KENYA, MEXICO, TURKEY AND ZIMBABWE



EACH SEED HAS THE GENETIC POTENTIAL TO HELP FARMERS COMBAT

- Climate CHANGE
- Greater HEAT STRESS
- More extreme WEATHER EVENTS
- MALNUTRITION and UNDERNUTRITION
- New DISEASES AND PESTS
- More frequent DROUGHTS

AMONG OTHER CHALLENGES

CIMMYT will continue to harness genetic resources to ensure maize and wheat farmers are able to survive and thrive globally.



A farmer in Pakistan applies fertilizer to a field of improved maize.

Affordable maize seed and varieties for Pakistan

Pakistan's expanding maize sector is receiving much-needed support through the introduction of new varieties that promise to boost production and enhance child nutrition, while strengthening the national seed industry.

Since the early 1990s, maize production in Pakistan has increased by almost 75 percent, thanks to the adoption of hybrids. But the seed powering this growth is largely imported at a cost of US \$50 million annually. As a result, hybrid maize seed is more expensive in Pakistan than anywhere else in South Asia.

The four-year Agricultural Innovation Program (AIP), which receives support from the United States Agency for International Development, is helping to bring more affordable options to market. Since the launch of the program in 2013, Pakistani researchers have

identified more than 80 CIMMYT hybrids and open-pollinated varieties that are well adapted to the country's diverse environments. Twenty one public- and private-sector seed companies are testing the new varieties and delivering them to smallholders across the country.

"Varieties that can withstand drought and other biotic and abiotic stresses are vital, particularly for small-scale farmers," says Nadeem Arjad, Chairman of the Pakistan Agricultural Research Council. These varieties are a valuable asset for a country where flooding and drought destroy millions of dollars' worth of crops each year.



Quality protein maize hybrids developed by CIMMYT in Colombia (shown here) were the first new hybrid products to reach farmers in Pakistan.

Biofortified maize can also help fight malnutrition in Pakistan, where over half the children under the age of five are affected by stunting. Quality protein maize (QPM) was the first new hybrid product to reach farmers in Pakistan, and demonstration seed was distributed to 300 farmers this year and additional seed should reach about 2,000 farmers in 2017. Developed by CIMMYT in Colombia and evaluated and selected in Pakistan by the National Agricultural Research Center, the QPM hybrids will combat malnutrition in children and provide feed grain for the poultry industry.

AbduRahman Beshir, CIMMYT's maize improvement and seed systems specialist, says that overwhelming interest and collaboration on the part of public and private maize stakeholders are helping to drive CIMMYT's maize varietal deployment. "Our future

efforts in quality seed production and enhanced product positioning will reinforce the encouraging gains of the Agricultural Innovation Program, whose aims include supporting a vibrant maize seed supply system in Pakistan," says Beshir. These new hybrids will give local seed companies more leverage to offer farmers various options of hybrid seed and open pollinated varieties at a lower cost.

A network of over 20 partners from national agricultural research centers, seed companies, universities and other maize industry representatives from across Pakistan will also continue to build Pakistan's hybrid maize industry after AIP concludes. "This is the first time in the history of Pakistan that these partners are working together on a shared platform to foster self-sufficiency in maize seed supplies, and it's only the beginning," says Beshir.

» Hybrid maize seed is more expensive in Pakistan than anywhere else in South Asia. **The AIP project is helping to bring more affordable options to market.**



A field worker pollinates CIMMYT maize parental lines.

The Agricultural Innovation Program's (AIP's) mission to sustainably increase agricultural productivity and incomes in Pakistan is supported by the United States Agency for International Development (USAID). Partners who have been key in this effort include the Pakistan Agricultural Research Council (PARC), the International Livestock Research Institute (ILRI), the University of California Davis, the World Vegetable Center (AVRDC) and the International Rice Research Institute (IRRI).



Group demonstrations sponsored by CIMMYT-led projects are often the most efficient way to transfer knowledge to area farmers.

Turnout for these special events is high and can often reach into the hundreds of attendees. Subjects range from mechanization and technology to new practices innovative yield-enhancing techniques.

Members of the CIMMYT-led AIP project demonstrate a multi-crop bed planter during a training on conservation agriculture in Islamabad.



Investments in resilience help farmers Recover From Disaster

An exceptionally strong El Niño event in 2015 provided another reminder of the need to invest in agriculture resilient to climate risks. The United Nations predicts that 60 million people in Africa will be left hungry by droughts before the end of 2016.

Ethiopia is experiencing its worst drought in 30 years, and some areas had already suffered poor rains in previous years. In early 2015, 2.9 million people in Ethiopia were in need of food aid. By October, following the onset of El Niño, that number had risen to 8.2 million.

In a country where agriculture comprises more than 40 percent of the economy, drought can have a long-term impact on food security. Farmers who lose their stores of seed will find it difficult to sow in time for the next harvest.

Building on CIMMYT's fruitful two-decade presence in Ethiopia, the United States Agency for International Development has provided the center with US \$3.97 million to procure seed of improved drought-tolerant maize and disease-resistant wheat for free distribution to over 225,000 farm households in 74 drought-affected districts.

This will benefit more than 1.3 million people, according to Bekele Abeyo, CIMMYT senior wheat breeder and pathologist for sub-Saharan Africa, who is coordinating the seed relief initiative.



"This project addresses the pressing need for seed before the spring rains, when many families sow, and will also promote awareness and use of the latest improved varieties and more productive farming practices," Abeyo says, referring to the wide-spread farmer training activities that are part of the effort.

The improved, drought-tolerant maize and disease-resistant wheat will be sourced largely from Ethiopian farmers and seed companies, drawing on CIMMYT's work with the Ethiopian Institute of Agricultural Research (EIAR) and other local organizations to strengthen maize and wheat

seed production and distribution systems. In addition, CIMMYT will oversee distribution of 180 tons of sorghum seed.

"As the current crisis outstrips Ethiopia's ability to cope on its own, USAID is committed to helping the country meet immediate needs as well as to protect hard-won development gains and speed recovery through efforts like this emergency seed support," said Beth Dunford, Assistant to the Administrator of USAID's Bureau for Food Security, and Deputy Coordinator for Development of Feed the Future.

EFFECTS OF RECORD DROUGHT + EL NIÑO: 10 MILLION Ethiopians REQUIRE



FOOD AID
in 2016



Nepalese farmer Jhalak Bhandari & his wife lost their home in Thalochar village, Sindhupalchok in the earthquake, but he continues planting the rice that the family depends on for survival.



Bringing badly needed tools to earthquake-stricken farmers in Nepal

Of the 8 million people affected by earthquakes in Nepal during 2015, smallholder farmers in the hill regions are thought to be the worst hit, losing infrastructure, seed stores and farm assets, according to Andrew McDonald, CIMMYT principal scientist and leader of the Cereal Systems Initiative for South Asia (CSISA).

"Even where seed is available, farmers' ability to plant and harvest crops has been severely diminished due to the loss of draft animals and to labor shortages," explains McDonald.

Trust in CIMMYT and its strong legacy in Nepal led to a US \$1 million grant for CSISA from USAID to provide relief and recovery support

to farmers, starting in August 2015. As part of the effort, more than 33,000 farming households will receive 50,000 grain storage bags, 30 plastic cocoons for community grain storage, 400 mini-tillers and other modern agriculture power tools, 800 sets of small agricultural hand tools, and 20,000 posters on better-bet agronomic practices for rice and maize. The project will also provide training on better-bet agronomy and mini-tiller operation to the mini-tiller recipients.

Management committees at the central, district, and local levels have been formed to identify earthquake-affected areas and ensure efficient and transparent distribution.

» "...farmers' ability to plant and harvest crops has been **severely diminished due to the loss of draft animals and to labor shortages.**"

Andrew McDonald
CIMMYT leader of the CSISA initiative

As in Ethiopia, the project will spread awareness of agricultural technologies – in this case, farm mechanization – especially through close collaboration with government agricultural agencies.

PARTNERS AND DONORS

CIMMYT's efforts to bring relief to disaster-hit farmers in Ethiopia and Nepal are made possible with funding from the United States Agency for International Development (USAID), drawing on long-term projects funded by the Bill & Melinda Gates Foundation (BMGF) and USAID.

Partners involved in the Ethiopia seed relief initiative include:

Amhara Seed Enterprise | The Agricultural Transformation Agency, Ethiopia | Regional Bureaus of Agriculture and Natural Resources | Ethiopian Seed Enterprise | Farmer cooperative unions | Federal and regional research institutes | Oromia Seed Enterprise | Private seed companies | Southern Seed Enterprise

The Nepal Earthquake Recovery Support Program is being implemented in close coordination with Nepal's Ministry of Agricultural Development, Department of Agriculture, Department of Livestock Services, Nepal Agricultural Research Council (NARC), District Disaster Relief Committee, District Agriculture Development offices and District Livestock Services offices, and agriculture and livestock service centers.



Farmers in Santa Ana, Oaxaca, Mexico.



Overcoming challenges in Gender Research

Fieldwork in a large-scale investigation into gender norms and agency in agricultural innovation has been completed in 26 countries in Africa, Asia and Latin America.

By applying the same qualitative research methodology in different farming communities around the world, a study known as GENNOVATE aims to draw broad lessons about how gender norms – social rules prescribing men’s and women’s daily behaviors – affect the uptake of agricultural innovations.

In total, an estimated 8,000 men and women from 135 rural communities provided testimony that will guide efforts to better integrate gender in

agricultural research and to design practical tools that can be used by researchers.

GENNOVATE is a project carried out in conjunction with 11 CGIAR Research Programs. CRP MAIZE covered 27 communities in 7 countries, while WHEAT covered 48 communities in 8 countries. Four of the village case studies were carried out jointly with IITA in Nigeria, and seven with ICARDA in Uzbekistan and Morocco.



Anuprita Shukla (far right) with the Bangladesh regional study team.

MAIZE and WHEAT aim to produce the first comprehensive reports by the end of 2016, but the study has already had an impact on gender research in agriculture. "In each country, one team was trained in gender and qualitative research techniques. That kind of capacity is rare and difficult to find," said CIMMYT strategic gender leader and GENNOVATE executive committee chair Lone Badstue.

Anuprita Shukla, an investigator from Glasgow Caledonian University (GCU), coordinated fieldwork for CIMMYT in Bangladesh, India, Nepal and Pakistan under GCU professor Tahseen Jafry, who led the South Asia component of the study. For Shukla and the field teams that were trained, the experience has been life changing.

"GENNOVATE is different from most research, because CIMMYT is

already rooted in local communities and possesses the structure for this empirical evidence to actually improve new technologies and create more innovation for local people," said Shukla.

GENNOVATE study cases were selected to learn about innovation processes in contexts that vary widely in economic and gender dynamics. In the case of India, for instance, study areas across five states were chosen based on the guidance of WHEAT scientists working locally; within each state, 12 villages were selected according to economic and social census data.

Field teams would remain within each village, or nearby, for seven days to complete the intensive fieldwork, sometimes traveling directly to the next community.

» "This research provides empirical evidence that **women do have a significant role in farming...**"

Anuprita Shukla, fieldwork coordinator for CIMMYT in Bangladesh, India, Nepal and Pakistan

GENNOVATE GENDER RESEARCH in Africa, Asia and Latin America:



"On day one you create a village profile to get a wider view of what is going on. Then we started focus group discussions that in theory last four hours, but five to six hours in practice! Each evening there is a reflective meeting, and then you have to finish and send off the transcriptions and translations," said Shukla.

Fieldwork always poses unexpected challenges, but perhaps nowhere more so than in Nepal following the 8.1 magnitude earthquake that occurred in April 2015. "One of our outreach workers lost everything in the earthquake. Their village was gone but they were so courageous, and still looked forward to doing the fieldwork," said Shukla.

With no office, the team had to rent a laptop to finish the fieldwork. They also had to stop during a 12-hour overnight drive between villages to rescue a bus that had fallen into a valley.

With analysis still pending, Shukla can already see that the researchers' efforts will lead to valuable learning; overturning, for example, the accepted wisdom that women are not involved in wheat farming in Asia. "The women we spoke to go to the fields and are involved in tasks like weeding or seed preservation. They have a key role which is not acknowledged. This research provides empirical evidence that women do have a significant role in farming here. Women surprised us in terms of entrepreneurship and the decision-making. It's a lesson to be learned about these restrictive contexts," she said.

More information: gender.cgiar.org/collaborative-research/gennovate/

Donor:
Bill & Melinda Gates Foundation (BMGF).



A focus group exercise includes middle class men in Bangladesh.

Remembering Paula Kantor

On May 13, 2015, Paula Kantor, a gender and development specialist, died tragically at the age of 46 in a terrorist attack on the hotel where she was staying in Kabul, Afghanistan.

Kantor joined CIMMYT in February 2015 to lead a project aimed at empowering and improving the livelihoods of women, men and youth in important wheat-growing areas of Afghanistan, Ethiopia and Pakistan.

"Paula had vast experience – she spent most of her working life in these contexts – in very patriarchal societies – and had a great love for the people living in these regions," said Lone Badstue, gender specialist at CIMMYT. "She also had a deep understanding of what she felt needed to change so that both men and women could have a better chance to influence their own lives and choose their own path."

A US citizen, Kantor earned a master's degree in Gender and Development from Britain's Institute of Development Studies

at the University of Sussex in 1990 and then a doctoral degree focused on international economic development and gender from the University of North Carolina at Chapel Hill in 2000.

Before joining CIMMYT, Kantor served as a senior gender specialist with the CGIAR's WorldFish organization. She also worked at the International Center for Research on Women (ICRW) in Washington, D.C., developing intervention research programs in gender and rural livelihoods, including a focus on gender and agricultural value chains.

Kantor was previously based in Kabul where she worked as director and manager of the gender and livelihoods research portfolios at the Afghanistan Research and Evaluation Unit (AREU), an independent research agency.

Although only a member of the CIMMYT team for a short time, Kantor's involvement in "GENNOVATE," a collaborative, comparative research initiative

by gender researchers from a series of international agricultural research centers, was critical.

GENNOVATE focuses on understanding gender norms and how they influence the ability of people to access, try out, adopt or adapt new agricultural technology. Kantor provided key analytical and theoretical guidance, inspiring the group to take action and ensure that GENNOVATE took hold.

"Paula was a pillar in our gender work and a dear friend to many of us," said Badstue.



CIMMYT staff in 2015



Staff from around the world pose for a photo during Science Week.

Headquartered in Mexico, CIMMYT has 1,280 staff members, 225 of whom are scientists and other internationally recruited experts. Of the latter, slightly more than half work outside of Mexico at offices in 14 major maize- and wheat-producing countries of the developing world, assisted by 416 support staff. The 739 CIMMYT staff members in Mexico are distributed among the Center's main office and 4 other principal research stations.



STAFF FROM 54 COUNTRIES

2015 Publications



One way that CIMMYT shares its knowledge with the world is through its vast library of publications. This enables spillover benefits and maximizes the return on research investments. In 2015, CIMMYT researchers published over 208

articles in academic journals, with an increasing focus on publishing open access articles. Of the 208 journal articles, 107 have been published as Open Access. CIMMYT also actively publishes reports, field guides and manuals for shared use.

 <http://www.cimmyt.org/arpublication2015>

CIMMYT financial overview

Top donors, 2015 (in thousands of U.S. Dollars)

Donor	2015	2014
United States Agency for International Development	35,470	
CGIAR	29,987	
Bill & Melinda Gates Foundation	20,946	
Secretaría de Agricultura, Ganadería, Desarrollo Rural y Pesca (Mexico)	19,518	
Australian Centre for International Agricultural Research	7,057	
HarvestPlus Challenge Program	3,547	
Cornell University	3,319	
African Agricultural Technology Foundation	2,436	
Department of Foreign Affairs, Trade and Development (Canada)	1,784	
Deutsche Gesellschaft für Internationale Zusammenarbeit	1,721	

Table 1. Combined Statement of Financial Position As of December 31, 2015 and 2014 (Thousands of U.S. Dollars)

ASSETS	2015	2014
Current assets		
Cash and cash equivalents	93,295	82,448
Cash set aside due to Generation Challenge Program	-	4,035
Cash set aside due to Integrated Breeding Platform	4,756	3,793
Accounts receivable:		
Donors	11,333	17,239
CGIAR	2,293	5,107
Other	2,763	2,276
Allowance for doubtful accounts receivable	(2,519)	(945)
Inventory and supplies, net	1,362	1,517
Total current assets	113,283	115,470
Non-current assets		
Property and equipment, net	22,753	22,356
Prepaid rent - ICRAF Nairobi	500	500
Total non-current assets	23,253	22,856
Total assets	136,536	138,326
LIABILITIES AND NET ASSETS		
Current liabilities		
Short-term employee benefits	1,018	695
Accounts payable:		
Advance grant payments donors	38,782	39,001
Advance grant payments CGIAR Centers	6,458	1,326
Generation Challenge Program	-	4,408
Integrated Breeding Platform	5,518	5,893
Other	7,278	11,686
Accruals	845	346
Total current liabilities	59,899	63,355
Non-current liabilities		
Employee termination benefits	11,312	12,586
Provisions	227	222
Total non-current liabilities	11,539	12,808
Total liabilities	71,438	76,163
Net assets		
Unrestricted:		
Designated	22,753	22,356
Undesignated	42,345	39,807
Total unrestricted net assets	65,098	62,163
Total liabilities and net assets	136,536	138,326

2015 and 2014 financial statements

A summary of the combined statements of financial position and combined statements of activities for CIMMYT, Int. and CIMMYT, A.C., are set out in tables 1 and 2. Total revenues for 2015 amounted to US \$135.8 million and \$150.2 million in 2014 (including financial incomes for each year). The surplus for 2015 totaled \$2.9 million and for 2014 \$3.8 million.

Total net assets increased by \$2.9 million in 2015, to \$65.1 million and by \$4.1 million in 2014, to \$62.2 million.

Table 2. Combined Statement of Activities As of December 31, 2015 and 2014 (Thousands of U.S. Dollars)

	2015	2014
Revenues and gains		
Grant revenue	135,115	148,919
Other revenue and gains	425	936
Total revenue and gains	135,540	149,855
Expenses and losses		
Research expenses	77,089	82,198
CGIAR collaboration expenses	12,978	16,103
Non-CGIAR collaboration expenses	31,024	39,058
General and administration expenses	11,053	7,851
Other expenses and losses	(30)	(2)
Total expenses and losses	132,114	145,208
Financial incomes	227	319
Financial expenses	718	1,134
Surplus	2,935	3,832
Expenses by function		
Personnel costs	48,759	45,928
CGIAR collaboration costs	12,978	11,618
Other collaboration costs	31,024	34,528
Supplies and services	30,233	34,912
Travel	5,013	6,410
Depreciation	4,255	29,163
Cost sharing percentage	(148)	116
Total operating expenses	132,114	162,675

2015 and 2014 revenue overview

Total grant revenue for 2015 was \$135.1 million and \$148.9 million in 2014 (Table 3). Other revenues, gains and financial incomes amounted to \$0.7 million in 2015 and \$1.3 million in 2014.

Table 3. Schedule of Grant Revenue For the years ending December 31, 2015 and 2014 (Thousands of U.S. Dollars)

Donors	2015	2014
Restricted		
African Agricultural Technology Foundation (AATF)	2,436	2,454
Agrovegetal, S.A.	-	11
ASARECA	36	1
Australia		
Australian Centre for International Agricultural Research (ACIAR)	7,057	6,871
Grains Research and Development Corporation	871	1,504
Bill & Melinda Gates Foundation (BMGF)	20,946	17,982
Canada		
Department of Foreign Affairs, Trade and Development	1,784	2,026
NRC Canada	62	49
FCDC, Canada/ACIDF	36	35
CGIAR		
Centro Internacional de Agricultura Tropical (CIAT)	-	12
International Center for Agricultural Research in the Dry Areas (ICARDA)	252	155
World Agroforestry Centre (ICRAF)	107	154
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)	117	195
International Livestock Research Institute (ILRI)	240	140
International Rice Research Institute (IRRI)	1,522	1,390
International Institute of Tropical Agriculture (IITA)	1,173	862
Center for International Forestry Research (CIFOR)	78	-
CGIAR Research Programs (CRPs)*		
CRP on Wheat (WHEAT)	11,989	18,852
CRP on Maize (MAIZE)	9,776	19,337
CRP on Climate Change, Agriculture and Food Security (CCAFS)	2,640	3,329
CRP for Genebanks	1,197	1,077
CRP on Policies, Institutions and Markets (PIM)	249	345
International Water Management Institute (IWMI)	23	147
CRP on Agriculture for Nutrition & Health (A4NH)	3,492	3,228
Challenge Programs		
Generation Challenge Program	-	78
HarvestPlus	55	289
China	172	40

*CGIAR Fund Donors

Window 1, MAIZE and WHEAT: Australia, Bill & Melinda Gates Foundation, Canada, Denmark, Finland, India, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, the USA, and the World Bank.

Window 2, MAIZE: Australia, China, Mexico, South Africa, Switzerland, the United Kingdom, and the USA.

Window 2, WHEAT: Australia, Canada, China, Portugal, Russia, Switzerland, the United Kingdom, and the USA.

For more information, see the CGIAR page on Fund Donors.

Donors (continued)	2015	2014
Restricted		
Centro Internacional de Agricultura Tropical (CIAT)		
CCAFS Regional Activities	149	-
European Commission	64	99
Federación Nacional de Cafeteros de Colombia (FEDERACAFE)		11
Food and Agriculture Organization (FAO)	144	21
Germany		
Deutsche Gesellschaft für Internationale Zusammenarbeit	1,721	1,163
University of Hohenheim	50	-
Global Crop Diversity Trust	476	466
IDE-UK	1	492
India	458	750
International Fund for Agricultural Development (IFAD)	223	591
Iran, Islamic Republic of	66	192
Japan		
Japan International Research Center for Agricultural Sciences	11	71
Ministry of Agriculture, Forestry and Fisheries	258	69
MOFA	-	192
Kazakhstan, Republic of	176	188
Korea, Republic of	224	250
Mexico		
Barcel	72	50
Instituto Carlos Slim de la Salud	-	999
Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP)	134	100
Gobierno de Guanajuato	1,193	1,077
Mexico (MasAgro)		
Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA)	18,325	20,007
OPEC Fund for International Development	20	(4)
Peru	1	123
Pioneer Hi-Bred International	-	17
Spain	221	-
Seed Companies	183	344
Switzerland	759	2,791
Syngenta Foundation for Sustainable Agriculture	1,063	1,899
Turkey, Republic of (MARA)	230	230
United States of America		
United States Agency for International Development (USAID)	35,470	31,704
United States Department of Agriculture (USDA)	1,270	1,070
Cornell University	3,319	3,004
University of Tennessee	-	43
Michigan State University	327	-
Montana State University	-	16
University of Twente	-	116
Vilmorin	-	205
Miscellaneous Research Grants	2,196	10
Total Grants - Donors Unrestricted and Restricted	135,115	148,919



Board of Trustees

(As of July 2015)

John Snape (United Kingdom)
Chair, Board of Trustees.
John Innes Foundation Emeritus Fellow, United Kingdom.

Enrique Martínez y Martínez (Mexico)
(ex officio member)
Secretary of Agriculture, Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), Mexico.

Martin Kropff (The Netherlands)
(ex officio member) Director General, CIMMYT.

Luis Fernando Flores Lui (Mexico)
(ex officio member) Vice-Chair, Board of Trustees.
Director General of Agricultural Research, National Institute of Forestry, Agricultural and Livestock Research (INIFAP), Mexico.

Nicole Birrell (Australia)
Director, SMS Management & Technology Ltd., Superpartners Pty Ltd. & Wheat Quality Australia Pty Ltd., Australia.

Cornelis F. Broekhuijse (The Netherlands)
Financial Management, USA.

Alfonso Cebreros Murillo (Mexico)
Director of Government Relations, Maseca Group, Mexico.

Feng Feng (China)
Director of the Chinese Bureau of International Cooperation (NSFC).

Neal Gutterson (USA)
Vice President of Agricultural Biotechnology, DuPont Pioneer, USA.

Rita Mumm (USA)
Associate Professor, Emerita, Quantitative Genetics and Plant Breeding, University of Illinois Urbana-Champaign, USA.

Bongiwe Njobe (South Africa)
Executive Director (founder and sole proprietor) of ZA NAC Consulting and Investments.

Raúl Obando Rodríguez (Mexico)
(ex officio member)
Coordinator for Research, Innovation and Partnerships, National Institute of Forestry, Agricultural and Livestock Research (INIFAP), Mexico.

Bob Semple (Ireland)
Director of Suas and Global Standards, Ireland.

(As of April 2016)

John Snape (United Kingdom)
Chair, Board of Trustees.
John Innes Foundation Emeritus Fellow, United Kingdom.

José Calzada Rovirosa (Mexico)
(ex officio member)
Secretary of Agriculture, Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), Mexico.

Martin Kropff (The Netherlands)
(ex officio member) Director General, CIMMYT.

Luis Fernando Flores Lui (Mexico)
(ex officio member) Vice-Chair, Board of Trustees.
Director General of Agricultural Research, National Institute of Forestry, Agricultural and Livestock Research (INIFAP), Mexico.

Nicole Birrell (Australia)
Director, SMS Management & Technology Ltd., Superpartners Pty Ltd. & Wheat Quality Australia Pty Ltd., Australia.

Alfonso Cebreros Murillo (Mexico)
Director of Government Relations, Maseca Group, Mexico.

Feng Feng (China)
Director of the Chinese Bureau of International Cooperation (NSFC).

Neal Gutterson (USA)
Vice President of Agricultural Biotechnology, DuPont Pioneer, USA.

Rita Mumm (USA)
Associate Professor, Emerita, Quantitative Genetics and Plant Breeding, University of Illinois Urbana-Champaign, USA.

Bongiwe Njobe (South Africa)
Executive Director (founder and sole proprietor) of ZA NAC Consulting and Investments.

Raúl Obando Rodríguez (Mexico)
(ex officio member)
Coordinator for Research, Innovation and Partnerships, National Institute of Forestry, Agricultural and Livestock Research (INIFAP), Mexico.

Bob Semple (Ireland)
Director of Suas and Global Standards, Ireland.

Management Committee

Martin J. Kropff, Director General (as of June 2015)

Thomas A. Lumpkin, Director General (until May 2015)

Marianne Bänziger, Deputy Director General for Research and Partnerships

Hans-Joachim Braun, Director, Global Wheat Program

Olaf Erenstein, Director, Socioeconomics Program

Bruno Gérard, Director, Sustainable Intensification Program

Kevin Pixley, Director, Genetic Resources Program

B.M. Prasanna, Director, Global Maize Program

Stephen Mugo, CIMMYT-Africa Regional Representative

Etienne Duveiller, CIMMYT-Asia Regional Representative (until April 2016)

Arun Joshi, CIMMYT-Asia Regional Representative (as of April 2016)

Andrés Álvarez Cordero, General Counsel

Denis Huneault, Director, Business Services (as of April 2016)

Giselle Liberto, Director, International Human Resources

Geneviève Renard, Head, Corporate Communications

Graham Sim, Director, International Finance

Thomas W. Short, Deputy Director General for Corporate Services (until April 2015)

Contact Information

Mexico: CIMMYT, Apdo. Postal 6-641, 06600 Mexico, D.F., Mexico • Tel: +52 (55) 5804-2004 • Fax: +52 (55) 5804-7558 • Main contact: Dr. Martin Kropff, Director General (cimmyt@cgiar.org)

Afghanistan: CIMMYT-Afghanistan, Karte-Parwan, West of Baharistan Park, Park Lane #3, House #157, P.O. Box 5291, Kabul, Afghanistan • Phone: +93 202204563 • Fax: +93 202211936 • Administrative Contact: Aminullah Sharifi (a.sharifi@cgiar.org) • Country Representative: Rajiv Sharma (rk.sharma@cgiar.org).

Bangladesh: CIMMYT Bangladesh, House #10/B, Road #53 Gulshan-2, Dhaka-1212, Bangladesh, P.O. Box 6057, Gulshan-1, Dhaka-1212 • Phone/Fax: +88 02 9896676, +88 02 9894278, Fax Ext. 115 • Administrative Contacts: Raihan Sadaat (r.sadaat@cgiar.org)/Dhon Raj Lama (d.lama@cgiar.org) • Country Representative: Thakur P. Tiwari (t.tiwari@cgiar.org).

China: CIMMYT c/o Chinese Academy of Agricultural Sciences, 12 Zhongguancun South Street, Beijing 100081, P.R. China • Phone: +86 10 8210 5691 • Fax: +86 10 8210 8547 • Administrative Contact: Xin Wang (xin.wang@cgiar.org) • Country Representative: Zhonghu He (zhhecaas@163.com).

Colombia: CIMMYT c/o CIAT, Km. 17 Recta Cali-Palmira, A.A. 6713 Palmira, Valle del Cauca, Colombia • Phone/Fax: +57 2 4450025, CIAT: +57 2 4450100, ext. 3025 • Administrative Contact: Janeth Bolaños (janeth.bolanos@cgiar.org) • Country Representative: Luis Narro (l.narro@cgiar.org).

Ethiopia: ILRI/CIMMYT, P.O. Box 5689, Addis Ababa, Ethiopia • Phone: +251-11 6462324/26/27/6172000 • Fax: +251 11-6676923/6172001 • Administrative Contact: Tadele Asfaw (t.asfaw@cgiar.org) • Country Representative: Bekele Abeyo (b.abeyo@cgiar.org).

India: CIMMYT India, G2, B Block, National Agricultural Science Centre Complex (NASC), Dev Prakash Shastri Marg, New Delhi 110012 • Phone: +91 (11) 25842940/65441940 • Fax: +91 (11) 25842938 • Administrative Contact: Meenakshi Chandiramani (m.chandiramani@cgiar.org) • Country Representative: Arun Joshi (a.k.joshi@cgiar.org).

Iran: CIMMYT-Iran, Seed and Plant Improvement Institute (SPII) Campus, Shahid Fahmideh Blvd., Karaj, Iran. Postal Code: 3135933151. Phone: +98-26-3271-6804 • Fax: +98-26-3271 6919 • Administrative Contact: Mozhdéh Farahmand (m.farahmandmafi@cgiar.org) • Country Representative: Mohammad Reza Jalal-Kamali (cimmyt-iran@cgiar.org).

Kazakhstan: CIMMYT, P.O. Box 9, Astana, 010000, Kazakhstan • Office location: CIMMYT, Office #207, House 10, B. Maylin Str., Astana 010000, Kazakhstan • Phone/Fax: +7 (7172) 343713 • Administrative Contact: Aigerim Abdugazganova (cimmyt-kazakhstan@cgiar.org) • Country Representative: Muratbek Karabayev (m.karabayev@cgiar.org).

Kenya: CIMMYT, ICRAF House, United Nations Avenue, Gigiri, P.O. Box 1041 Village Market-00621, Nairobi, Kenya • Phone: +254 (20) 722 4600 • Fax: +254 (20) 722 4601 • Administrative Contact: Mildred Khalumba (m.khalumba@cgiar.org) • Africa Regional Representative: Stephen Mugo (s.mugo@cgiar.org).

Nepal: CIMMYT International, South Asia Regional Office (SARO), Agric. Botany Division - 1st floor, NARC Research Station, Khumaltar, Lalitpur • Administrative Contact: Binaya Parajuli (b.parajuli@cgiar.org) • Country Representative: Andrew McDonald (a.mcdonald@cgiar.org).

Pakistan: CIMMYT Pakistan-CSI Complex NARC, Park Road Islamabad • Phone: +92 51 9255522-24 • Fax: +92 51 9255434 • Administrative Contact: Awaiz Yaqub (a.yaqub@cgiar.org) • Country Representative: Muhammad Imtiaz (m.imtiaz@cgiar.org).

Turkey: CIMMYT, P.K. 39 06511, Emek/Ankara • Office location: Sehit Cem Ersever Caddesi 9/11 Tarla Bitkileri Arastirma Enstitusu 06170, Yenimahalle, Ankara, Turkey • Phones: +90 (312) 344 8777/327, 1631/327, 1657 • Fax: +90 (312) 327 0798 • Administrative Contact: Bahar Erdemel (b.erdemel@cgiar.org) • Country Representative: Alexei Morgounov (a.morgounov@cgiar.org).

Zimbabwe: CIMMYT, P.O. Box MP163, 12.5 KM Peg, Mazowe Road, Mount Pleasant, Harare • Office Phones: +263,772 469 211/2 Administrative Contact: Tawanda Mushandu (t.mushandu@cgiar.org) Cell: +263 773 098 798 • Country Representative: Mulugetta Mekuria (m.mekuria@cgiar.org) Cell: +263 263 712 604 006.

Acronyms

AGRA	Alliance for a Green Revolution in Africa	IITA	International Institute of Tropical Agriculture
AIP	Agricultural Innovation Program	IMIC	International Maize Improvement Consortium
ARI(s)	Agricultural Research Institute	ISPC	International Science and Partnership Council
BBSRC	Biotechnology and Biological Sciences Research Council (United Kingdom)	IWC	International Wheat Conference
BGRI	Borlaug Global Rust Initiative	KALRO	Kenya Agriculture and Livestock Research Organization
BISA	Borlaug Institute for South Asia	MAIZE	CGIAR Research Program on Maize
BMGF	Bill & Melinda Gates Foundation	MasAgro	Modernización Sustentable de la Agricultura Tradicional (Sustainable Modernization of Traditional Agriculture)
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security	MLN	Maize Lethal Necrosis
CRP	CGIAR Research Program	NARS	National Agricultural Research Systems
CSISA	Cereal Systems Initiative in South Asia	NGO	Non-governmental Organization
DTMASS	Drought Tolerant Maize for Africa Seed Scaling Project	QPM	Quality protein maize
EIAR	Ethiopian Institute of Agricultural Research	SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Mexican Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food)
GCU	Glasgow Caledonian University	SIMLESA	Sustainable Intensification of Maize and Legume Systems for Food Security in Eastern and Southern Africa
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Development)	USAID	United States Agency for International Development
GMP	Global maize program	WHEAT	CGIAR Research Program on Wheat
GWP	Global wheat program		
ICAR	Indian Council of Agricultural Research		
ICARDA	International Center for Agricultural Research in the Dry Areas		

Credits

Editors-in-chief

Geneviève Renard, G. Michael Listman

Creative Director

Clyde R. Beaver III

Layout and Design

Bosen Zhou

Infographics

Gerardo Mejia

Production Liaison

Marcelo Ortiz-Sanchez

Writers/Editors

Ricardo Curiel, Anuradha Dhar, Jennifer Johnson, G. Michael Listman, Katie Lutz, Alma McNab, Julie Mollins, Matthew O'Leary, Geneviève Renard, Katelyn Roett, Nathan Russell, Miriam Shindler, Samuel Storr, Brenda Wawa

Contributors

Bekele Abeyo, Lone Badstue, Abdu Rahman Beshir, José Juan Caballero, Ernesto Coeto, K.C. Dilli, Olaf Erenstein, Kate Fehlenberg, Mina Lantican, Mauricio Malpica, Cynthia Mathys, Andrew McDonald, Kevin Pixley, Patti Petesch, B.M. Prasanna, Anuprita Shukla, Arturo Silva, George Williams

Photographers

Cover: Peter Lowe
Inside this issue: Abdurahman Beshir, Yoseph Beyenne, Alberto Chassaingne, Xochiquetzal Fonseca, Srikanth Kolari, Peter Kosina, Mike Listman, Peter Lowe, Thomas Lumpkin, Victor Manuel Pérez Campos, B.M. Prasanna, Vinaynath Reddy, M. Waheed, United States Agency for International Development-Pakistan, and CIMMYT archives

ISSN# 0188-9214

Correct citation: CIMMYT. 2016. Building resilience to risk. CIMMYT Annual Report 2015. CDMX, Mexico: CIMMYT.

AGROVOC Descriptors: Maize; Wheat; Plant breeding; Genetic resources; Innovation adoption; Plant biotechnology; Seed production; Food security; Sustainability; Research policies; Economic analysis; Cropping systems; Agricultural research; Organization of research; Developing countries. Additional Keywords: CIMMYT. AGRIS category codes: A50 Agricultural Research; A01 Agriculture – General Aspects. Dewey decimal classification: 630.

© International Maize and Wheat Improvement Center (CIMMYT), 2016. All rights reserved. The designations employed in the presentation of materials in this publication do not imply the expression of any opinion whatsoever on the part of CIMMYT or its contributory organizations concerning the legal status of any country, territory, city, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. CIMMYT encourages fair use of this material. Proper citation is requested.

In our next issue:



To the donors and partners who have made a half century of innovation possible, we thank you. Billions have benefited from your commitment, just as billions more lives will be changed as you help us solve today's most difficult issues in food and nutritional security.

Building resilience to risk

 [@CIMMYT](https://www.facebook.com/CIMMYT)

 [/cimmyt](https://www.tiktok.com/@cimmyt)

 [+CimmytOrg](https://plus.google.com/+CimmytOrg)

 [@cimmyt](https://www.instagram.com/cimmyt)

 [/cimmyt](https://www.linkedin.com/company/cimmyt)

 [@CIMMYT](https://twitter.com/CIMMYT)

 [/CIMMYTint](https://www.youtube.com/CIMMYTint)

www.cimmyt.org

