ANNUAL REPORT 2017

CIMMYT
International Maize and Wheat Improvement Center
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.

In this issue, SDG icons attached to each story help signal how CIMMYT’s work ties to the SDGs.
On the offensive: Joining forces against fall armyworm in Africa
This devastating pest could lead to maize losses as high as $6.2 billion per year in Africa, with a need for $150 to $200 million annually to mitigate related damage.

Seeds of hope: Reducing malnutrition in Haiti
Jumpstarting the maize seed sector with 150 tons of improved seed.

Energizing Ethiopia’s wheat seed sector
Seed unions enlist farmer cooperatives to dramatically scale wheat seed production.

Zinc-enriched wheat fights malnutrition in Pakistan
Biofortification research and breeding result in Zincol, a wheat variety with 20 percent more zinc than conventional varieties.
Message from the Chair of the Board of Trustees

Supporting the Center’s quality research and staff for impact

In 2017, CIMMYT maintained and strengthened its integrated application of excellent science for impact, carried out through multiple partnerships with a strong emphasis on capacity building, to fulfill its mission.

Underpinning those efforts, the Center's new resource mobilization strategy seeks to nurture relationships with traditional donors as well as to develop exciting alternative funding pathways, and is closely linked with Center project management.

This year, CIMMYT played a pivotal role in facing major new threats such as wheat blast in Asia and fall armyworm in Africa.

With an emphasis on crops for future climates, through cross-institutional projects the Center is strategically testing and promoting maize and wheat agri-food systems that address changing climates in Africa and South Asia.

CIMMYT also afforded me a fantastic look at the field-level application of sustainable intensification practices and technologies through a visit with farmers and partners in Celaya, Mexico, a breadbasket region beset by natural resource challenges.

As part of addressing the 2015 United Nations Sustainable Development Goals (SDGs), CIMMYT is working to facilitate linkages within CGIAR and among public and private partners worldwide.

As always, the Board is impressed with the quality of CIMMYT science, staff, and impacts, and thanks the Center’s steadfast funders for their support, as well as welcoming new contributors.

We look forward to helping the Center build partnerships, further its institutional capacity, and strengthen resource-mobilization intelligence systems, as it executes its strategy.

Nicole L. Birrell
Chair, Board of Trustees

Message from the Director General

CIMMYT science and partnerships: Changing lives for the better

In 2017, CIMMYT and partners were at the center of global responses to several grave challenges to maize and wheat agriculture. In South Asia, we supported the fast-track release by Bangladesh of a new variety that resists wheat blast, a deadly and mysterious disease that appeared for the first time in the region in 2016. In Africa, our staff coordinated with global, regional, and national partners on an integrated strategy to control fall armyworm, a pest from the Americas that since 2016 has devastated over 1.5 million hectares of Africa’s maize. In the Americas, CIMMYT provided Haiti with 150 tons of improved maize seed to assist farmers and replenish emergency reserves as part of the nation’s recovery from the impact of earthquakes, droughts, and hurricanes.

Successful resource mobilization this year included exciting new directions and partnerships, such as the agreement with Henan Agricultural University in China, to open a joint maize and wheat research center, or the launch with Nestlé in Mexico of a responsible sourcing collaboration in which thousands of Mexican farmers will use sustainable practices to produce more than some 400,000 tons of maize and wheat.

In support of the dynamic new CGIAR research portfolio for 2017-22, CIMMYT is providing leadership and guidance and will oversee the new Excellence in Breeding Platform.

I offer sincere thanks to funders and other partners and stakeholders for your unwavering support of CIMMYT’s mission, especially in today’s uncertain and challenging circumstances. We are proud to work with you as a significant force for good.

Martin Kropff
Director General
CIMMYT released 71 new maize and 49 wheat varieties stacked with crucial traits including drought and heat tolerance to help farmers adapt to climate change. Some varieties offer enhanced levels of micronutrients, such as zinc and iron, through biofortification to fight hidden hunger.

Healthy crops

CIMMYT researchers authored 306 publications promoting agriculture science for development.

Publications

CIMMYT researchers work with farmers to tailor sustainable intensification practices, such as conservation agriculture, that boost food production while limiting environmental impact.

Farming innovations

Over 18 million farmers are benefiting through improved maize and wheat system farming practices.

Improved livelihoods

CIMMYT annually distributes more than 1,500 maize and wheat shipments. These shipments contain more than 500,000 individual seed packets sent to as many as 100 countries.

Maize and wheat seeds for the world

Almost 1,500 people working together in over 50 countries to provide maize and wheat science for improved livelihoods.

Hunger fighters

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Sharing knowledge

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Maize and wheat seeds for the world
New maize varieties and intensive efforts to tackle a deadly pest in Africa

MAIZE partners around the world released 79 new maize varieties in 2017, including 44 in sub-Saharan Africa, 26 in Latin America, and 9 in South Asia. In addition to high and stable yield potential, these varieties include traits such as tolerance to heat and drought, as well as resistance to devastating maize diseases, such as maize lethal necrosis (MLN), maize streak virus, tar spot complex, and the parasitic weed known as striga. Twenty-one of the varieties are biofortified through breeding for enhanced grain nutrients to combat malnutrition.

To stop the fall armyworm (FAW), a devastating pest from the Americas that continues its march across sub-Saharan Africa, MAIZE has worked closely with international and national partners, organizing stakeholder consultations and training events and producing a comprehensive technical guide on the integrated management of FAW. The MAIZE team has developed MLN-resistant maize hybrids that are now available in eastern Africa. The release of second-generation tropicalized haploid inducers and the use of doubled haploid lines in breeding programs have great potential to reduce breeding times and costs.

Wheat seed offers farmers resilience and nutrition

Applying advanced science, field research, and innovation in extension, WHEAT partners worked to raise the productivity and affordable availability of wheat for 2.5 billion resource-poor consumers in 89 countries. In 2017, national partners in 16 countries released 65 wheat varieties, derived all or in part from the research of CIMMYT or its principal WHEAT partner, the International Center for Agricultural Research in the Dry Areas (ICARDA).

In response to Ethiopia’s worst drought in 50 years and a critical shortage of maize and wheat seed, Ethiopian organizations, seed producers, and CIMMYT partnered to deliver to farmers over 3,400 tons of high-quality seed that was sown on more than 100,800 hectares, reaching 271,000 rural households and benefiting 1.6 million people.

Evidence-based approaches for gender in agricultural research

MAIZE and WHEAT have contributed to and drawn lessons from GENNOVATE, a CIMMYT-led study involving more than 7,500 rural men and women in 26 countries, as well as 11 CRPs and nearly a dozen crops and other agricultural outputs. In 2017, the initiative delivered reports on study outcomes to CIMMYT research engagements

CIMMYT is a leading implementation partner in the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), as well as participating in the CGIAR Research Program on Policies, Institutions and Markets, the Big Data for Agriculture Platform, and the CGIAR Genebanks Platform.
Seeds of Discovery, a platform for utilizing maize and wheat genetic resources, launched an online product catalogue describing freely available germplasm, software, services, publications, and self-learning modules on accessing and using maize and wheat genetic diversity. They also released four short videos describing this unique initiative. Learn more: seedsofdiscovery.org.

Funded by SAGARPA, BBSRC, MAIZE, WHEAT

In an article in Science, CIMMYT scientists and diverse agricultural research organizations and companies proposed the creation of an integrated, global network to improve the yield and climate resilience of key staple food crops. Modeled on the International Wheat Improvement Network created in 1968, which has provided returns on investment as high as 100 to 1, the global crop network would harmonize data sharing across crops and regions and speed up technology adoption.

Funded by BMGF, USAID

A study in Zimbabwe found that households that grew drought-tolerant (DT) maize were able to harvest over 600 kilograms more maize per hectare. This translates into $240 per hectare extra income, equivalent to 9 months’ worth of additional food security at no additional cost. DT maize offers an invaluable safety net for the 30 percent of adopting households in areas surveyed, which include many smallholder farmers with limited off-farm incomes or market access.

Over the years, generous funding for this work was provided by BMGF, DFID, GIZ, HGBP, IFAD, MAIZE, SIDA, SDC, UNDP and USAID

Funded by SAGARPA, BBSRC, MAIZE, WHEAT

The Chinese State Council presented CIMMYT with the prestigious International Science and Technology Cooperation Award for joint breeding research, which resulted in the development of high-yielding, disease-resistant wheat varieties with improved grain quality. CIMMYT’s breeding contributions are present in more than 26 percent of all major wheat varieties released in China this century.

Funded by ACIAR, BMGF, CGIAR, ICAR, USAID, CCAFS, WHEAT

In an unprecedented study of the maize genome, CIMMYT, advanced research institutions and national system researchers used novel and powerful approaches to analyze landrace diversity and identify more than 1,000 genes that influence the maize life cycle and adaptation to different environments. The resulting blueprint will help breeders better identify genetic variation of value from landraces and deploy this in the development of improved, climate-resilient maize varieties.

Funded by SAGARPA

To reduce air pollution around New Delhi, federal and state governments in India are pushing for sustainable alternatives to rice paddy residue burning, a widespread practice farmers use to clear their fields before sowing wheat. CIMMYT is working with partners to promote locally-manufactured farm implements that sow wheat seed directly into unplowed land, with residues of harvested rice paddies on the soil surface. This eliminates the need for burning crop residues and tilling the soil, and can reduce greenhouse gas emissions by 500 kilograms per hectare and increase farmer income by $150 per hectare.

Funded by ACIAR, BMGF, CGIAR, ICAR, USAID, CCAFS, WHEAT

CIMMYT’s new MLN Information Portal provides researchers with up-to-date information and surveillance tools to help curb the spread of maize lethal necrosis (MLN), a deadly disease that has ravaged maize in eastern Africa. Quickly diagnosing and monitoring MLN at the local, national, and regional levels is crucial to safeguard food security and livelihoods. For more information, visit www.mln.cimmyt.org.

Funded by USAID, BMGF, MAIZE

Highlights from around the world

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The fall armyworm could cause maize yield losses projected at $2.5 to $6.2 billion a year. Experts estimate that Africa will need an investment of at least $150 to $200 million annually for research and pest management to mitigate related damage.
The voracious fall armyworm (Spodoptera frugiperda) has marched across Africa in the last two years, causing millions of dollars in damage to maize and other crops and threatening the food security and livelihoods of smallholders and their families in nearly 40 African countries.

A highly aggressive and invasive insect pest, fall armyworm has ravaged crops in the Americas for decades and is now a major threat throughout Africa. The pest prefers maize, and smallholder farmers’ incomes in Africa are yet unknown, but targets to alleviate poverty and hunger detailed in the U.N. Sustainable Development Goals (SDGs) may be difficult to achieve without coordinated IPM efforts.

Beyond the economic damage to crops, indiscriminate and unguided application of highly toxic pesticides could harm the health of women and children on farms and damage the safety and sustainability of the region’s ecology and environment. At a conference in April on fall armyworm in Africa organized jointly by CIMMYT, the Alliance for a Green Revolution in Africa (AGRA), Centre for Agriculture and Biosciences International (CABI), the Brazilian Agricultural Research Corporation (Embrapa), Food and Agriculture Organization of the United Nations (FAO), the Kenya Agriculture and Livestock Research Organization (KALRO), the International Institute of Tropical Agriculture (IITA), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Centre for Insect Physiology and Ecology (ICIPE), the United States Department of Agriculture (USDA), and the U.S. Agency for International Development (USAID). Partners

Global partners on FAW management efforts include Alliance for a Green Revolution in Africa (AGRA), Centre for Agriculture and Biosciences International (CABI), the Brazilian Agricultural Research Corporation (Embrapa), Food and Agriculture Organization of the United Nations (FAO), the Kenya Agriculture and Livestock Research Organization (KALRO), the International Institute of Tropical Agriculture (IITA), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Centre for Insect Physiology and Ecology (ICIPE), the United States Department of Agriculture (USDA), and the U.S. Agency for International Development (USAID).

Integrated management of fall armyworm


USAID and CIMMYT held three regional training and awareness-raising workshops in Harare during 2017-18.

A study tour by an African delegation to Brazil is planned for March 2018 to understand how experts in that country have managed the pest for decades.

CIMMYT scientists are seeking sources of resistance to fall armyworm in maize seed collections, to test them and – through conventional breeding – incorporate the resistance into improved varieties. Initial experiments have uncovered promising breeding materials.

Costly implications

Fall armyworm could cause maize yield losses in Africa worth as much as $6.2 billion a year, according to the Centre for Agriculture and Biosciences International (CABI). Control measures may cost as much as $200 million annually, including developing and deploying integrated pest management (IPM) technologies and practices.

The full impact of the pest on seed security, food security, and smallholder farmers’ incomes in Africa is yet unknown, but targets to alleviate poverty and hunger detailed in the U.N. Sustainable Development Goals (SDGs) may be difficult to achieve without coordinated IPM efforts.

Beyond the economic damage to crops, indiscriminate and unguided application of highly toxic pesticides could harm the health of women and children on farms and damage the safety and sustainability of the region’s ecology and environment. At a conference in April on fall armyworm in Africa organized jointly by CIMMYT, the Alliance for a Green Revolution in Africa (AGRA), and the Food and Agriculture Organization of the United Nations (FAO) in Nairobi, experts raised concerns about the possible spread of fall armyworm into Asia and Europe.

A highly aggressive and invasive insect pest, fall armyworm has ravaged crops in the Americas for decades and is now a major threat throughout Africa.

Better varieties, systems, and incomes for African farmers

Eight years of work by the Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) project has facilitated the release of 40 improved maize and 64 legume varieties to smallholder farmers in Ethiopia, Kenya, Malawi, Mozambique, Tanzania and spill-over countries (Botswana, Rwanda, and Uganda).
seeds of hope: reducing malnutrition in Haiti
I n 2017, CIMMYT sent 150 tons of new and improved maize seed to Haiti to jumpstart the development of the country’s maize seed sector, improve local food security, and decrease malnutrition. This was the largest seed shipment to any country in CIMMYT’s history.

The lack of a strong seed system is one of the main factors that holds back farm productivity. Haiti has the lowest maize yields in Latin America and the Caribbean, and around half of the population is undernourished. A crippling earthquake in 2010, a longstanding drought, and Hurricane Matthew in 2016 have exacerbated the nation’s difficulties, affecting 2 million people.

In addition to the new seed shipment, Haitian farmers and community leaders are receiving training to help their country develop a thriving maize seed sector. Recent Haitian alumni of CIMMYT trainings have now become trainers and are passing along their new knowledge.

“It is a great satisfaction for me to participate in this training, as I learned how to better produce maize for seeds and I will get better crops when I apply the information from this training,” said Josette Léveillé, a farmer participating in the trainings.

The seed from CIMMYT comes from a maize variety developed specifically for Haiti in the 1990s using conventional breeding methods. Named “Hugo” in honor of the late CIMMYT maize breeder Hugo Córdova, the variety is well adapted to the country’s conditions and is a quality protein maize, meaning that it contains enhanced levels of lysine and tryptophan, which can decrease malnutrition and stunting among children who consume it.

The product of decades of maize research in Haiti and Latin America, Hugo quickly became a favorite among farmers. However, due to the country’s lack of a certified seed production process, yields began to decline over time and protein quality decreased.

“Farmers often sell their entire crop at harvest, leaving nothing for the next season, forcing them to plant simple maize grain that they buy from local markets rather than certified seed, which drastically reduces yield,” said Alberto Chassaigne, a maize seed system specialist at CIMMYT.

For the Haiti shipment, CIMMYT and partners developed Hugo Plus, a renewed version of Hugo that can produce up to seven tons of maize per hectare under good management, a full ton greater than the old Hugo variety.

Of the 2017 Hugo Plus shipment, 20 tons were sold to farmers at affordable prices in agricultural input boutiques established by Feed the Future (FTF) and partners, who have since been selling their harvest as seed to neighbors. The remaining 130 tons were used by CIMMYT and FTF to establish a strategic seed reserve in Haiti, offering an immediate source of seed in the event of a natural disaster.

This reserve, along with CIMMYT’s training of Haitian farmers on the importance of using seed rather than grain and how to produce seed, helps ensure that Hugo Plus and other improved varieties will continue to perform well, maintain quality, and increase food security. In the future, the project hopes to help consolidate the country’s emerging maize seed industry, with support from the newly trained seed producers and processors to ensure that the renewed Hugo remains high quality and that the strategic maize seed reserve is periodically rotated and refreshed.

More about Haiti

Haiti has been hit by 5 hurricanes in the past 10 years, and suffered a magnitude 7.0 earthquake in 2010 that impacted much of the country.

Natural disasters

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In the early 17th Century, the French established a presence on Hispaniola (present day Haiti and Dominican Republic) in the Caribbean Sea. In 1697, Spain ceded to France the western third of the island, which later became Haiti.

Hugo Córdova (1942-2009)

Using resilient, high-yielding hybrids, Dr. Hugo Córdova ensured that advanced technologies reached farmers’ hands throughout Central America and the rest of the developing world, generating improved seeds on at least 4 million hectares.

Josette Léveillé, a farmer participating in the trainings

“A roadside market in Petit-Goâve, Haiti, is a gathering place for local residents.”

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Funders

This work is supported by the Feed the Future program of the U.S. Agency for International Development (USAID).
A sunny November day brings hundreds of seed producers to Doyogena, a scenic highland village in Ethiopia’s Southern Nations, Nationalities, and Peoples’ Region (SNNP). The visitors form a bustling line to collect more than $90 each, on average, in profits from representatives of the Zereta Kembata Seed Multiplication and Marketing Union.

“The union collects certified seed of wheat varieties grown by more than 1,100 farmers, several hundred of whom are women, belonging to 8 farmer cooperatives,” said Yosef Balewold, the general manager of Zereta Kembata.

Pitted against a yearly onslaught of fast-evolving fungal diseases that can infect as much as $200 million worth of the crop they are growing, over 75,000 small-scale wheat farmers in Ethiopia’s 4 major wheat-growing regions gained access by late 2017 to a vital asset: over 400 tons of new, disease resistant wheat seed, much of it produced by other farmers.

Marketed in tandem with science-based recommendations for growing wheat, Ethiopia’s annual seed supply has steadily increased since 2014 through the Wheat Seed Scaling Initiative, led by CIMMYT.

“We’re energizing and diversifying Ethiopia’s wheat seed sector, partly by involving and benefitting both formal and farmer seed producers, including women and men,” said Bekele Abeyo, a CIMMYT scientist who leads the project.
Owing to the rapid rise of new and deadly strains of stem and yellow rust, farmers must swiftly begin to sow a range of varieties bearing new resistant genes, but limited access to the seed has been a bottleneck, according to Abeyo.

In addition to assisting government-managed seed enterprises and 4 private seed producers, CIMMYT supports 10 farmer cooperative unions that purchase, pack, and sell the seed grown by numerous primary cooperatives, as well as 12 farmer seed producer associations, including 4 women's groups, who profit from growing and selling quality seed of the new varieties.

**Women seize chance to advance**

The Tembo Awtena Women’s Seed Producers Association in Angacha District, SNNP, began producing wheat seed for sale in 2015, with support from the Wheat Seed Scaling Initiative.

“Women seized the opportunity to change their lives,” said Tembo Awtena member Huma Adane. “We used to make very little money from growing crops, but we earn more by growing quality seed.”

In 2016, with support from CIMMYT, we sold more than $7,400 worth of seed,” said Amarech Desta, Tembo Awtena chairwoman, adding that news of the association’s success had attracted 30 additional women farmers in 2017, bringing the total membership to 133.

Desalech Ashamo, an association member who is a single head of a household, received nearly $300 for the seed she grew in 2017 and used the earnings to paint her house. “A big advantage is that all our seed is sold in one lot, rather than piecemeal, so we receive a lump sum that can be used for a significant household project.”

Tembo Awtena members are especially pleased at being one of the three women’s seed production groups in the Oromia and SNNP regions to receive seed threshers through the Initiative. Association members had been threshing the wheat seed manually, a long and laborious process, according to Desta. “With the new machine, we will be able thresh in one hour what would take us three days by hand,” she said.

**Partners**

The success of the Wheat Seed Scaling Initiative depends on the commitment and contributions of diverse national and global partners, including key partner Ethiopian Institute of Agricultural Research. The work is funded by the U.S. Agency for International Development (USAID). Other important partners include state and district level officials in the Amhara, Oromia, SNNP, and Tigray regions. Most of the varieties come from breeding lines from CIMMYT and the International Center for Agricultural Research in the Dry Areas (ICARDA); a number of varieties were developed through the Delivering Genetic Gain in Wheat project, led by Cornell University and funded by the Bill & Melinda Gates Foundation and the UK’s Department for International Development (DFID).
A s part of work to foster competitive maize seed markets and offer farmers quality seed at affordable prices, CIMMYT is helping more than 100 small and medium-scale seed companies in Africa and Latin America to assess potential markets and to seize new opportunities.

“Just as carmakers retool assembly lines and marketing to roll out a new model, maize seed companies must revamp operations for new varieties,” said Kate Fehlenberg, manager of the CIMMYT-led Drought Tolerant Maize for Africa Seed Scaling (DTMASS) project. “It takes at least 3-5 years before the new product hits the market, so seed producers want assurance of demand before replacing older varieties or targeting new markets.”

CIMMYT supports public-private partnerships

- The Center’s maize and socioeconomics programs are applying geographic information systems technology to help identify and assess potential markets, allowing companies to home in on suitable improved varieties, forecast the volume of seed demand, and plan and resource marketing campaigns.
- Data on hybrids and their parent lines from CIMMYT breeding programs allow companies to estimate production costs and expected performance – crucial for decisions to invest in new varieties.
- Annual training events organized by CIMMYT for country partners cover hybrid seed production and offer tools to identify and analyze market opportunities.
- With international and local organizations, CIMMYT helps to scale out best agronomic practices and improved seed in farming communities, leveraging local distribution networks and offering technical expertise.
- The Center is partnering with digital service providers in target communities to make seed available to farmers and suppliers and to measure demand and adoption.

As a result, seed companies can invest in new high-yielding, resilient maize varieties in a much more secure environment, retire obsolete products, and boost smallholder farmers’ food security while improving their profits.
New maize and wheat sustainable sourcing partnerships in Mexico

In 2017, CIMMYT partnered with several world class agriculture and food processing companies to implement responsible local sourcing projects in Mexico. More than 3,300 local farmers growing maize and wheat on more than 35,000 hectares in 5 states of Mexico will benefit from these initiatives. Together, these farmers will supply 400,000 tons of grain to participating companies in the next 3-5 years.

Responsible local sourcing is a farmer capacity-building and market integration strategy that develops sustainable farming systems and promotes closer and more equitable business interactions between farmers, food processing companies and consumers. The effort will produce more nutritious food by shaping flexible and balanced grain supply chains that apply high quality standards to meet consumer expectations and demand. This will benefit local maize and wheat farmers who adopt sustainable intensification practices and improve natural resource management, through increased yields and incomes.

CIMMYT and partners have developed and released 49 maize hybrids since 2011: 16 yellow hybrids and 33 white hybrids.

More than 5,935 technicians trained in specialized topics.

Maize participant farmers harvest twice the average yield of their regions.

2,099 training events/field days

1468 demonstration modules

9,053 extension areas

33,348 farmers attended training events or field days

3,000 farmers involved in local sourcing projects

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*MasAgro is a CIMMYT-led bilateral project between CIMMYT and Mexico’s Department of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) that promotes agricultural development at different levels of Mexico’s maize and wheat value chains.
Appropriate mechanization can support the sustainable intensification of agri-food systems, helping to improve resource (soil, labor, water) use and providing social benefits like increased income, employment, food security, and less drudgery.

CIMMYT and partners design and test machinery and implements, train and support local manufacturers, work with extension agents and farmers in machinery use, and promote financial and rental services and farmer cooperatives. In Mexico, this has included the creation of machinery points: central locations from which farmers and entrepreneurs can borrow implements in return for providing mechanization services to other farmers. The aims of CIMMYT support include increasing the performance and efficiency of farm activities, creating jobs and entrepreneurial opportunities to make rural livelihoods more sustainable, fostering agriculture-led industrialization and markets for rural economic growth, and improving the quality of primary and processed goods.

Here CIMMYT researchers reflect on the opportunities associated with the adoption of agricultural mechanization in Africa, Asia, and Latin America.
Mechanization around the world

**AFRICA**

**Frédéric Baudron**
Cropping systems agronomist, sustainable intensification program, CIMMYT-Zimbabwe

CIMMYT efforts to promote mechanization have created rural job opportunities in eastern and southern Africa, where many struggle with high unemployment and poverty. Dozens of providers, both individuals and groups, have offered mechanization services such as tillage or shelling maize on contract in Ethiopia, Kenya, Tanzania, and Zimbabwe. In Tanzania, the average income from contract mechanization was $6,100 in 2017. One service provider in Mbeya district was $5,000. Evidence is accumulating regarding the benefits that agricultural mechanization for hire is having on rural livelihoods in all four countries.

**Timothy Krupnik**
Cropping systems agronomist, CSISA, CIMMYT-Bangladesh

Our work differs from farm mechanization research in developed countries, in that it focuses on offering solutions to the production problems of smaller-scale farmers with low investment capacities, who tend to grow crops on fragmented plots of land and face critical production risks. CIMMYT is increasingly a one-stop-shop for expertise in smallholder-appropriate farm mechanization. The machinery options we work with in South Asia respond to increasingly severe rural labor bottlenecks that prevent smallholders from intensifying their cropping systems. In addition to being agronomically beneficial, the machines we focus on are designed to be affordable and ergonomic and can be scaled-out to farmers through commercial and rural service pathways. Many of these machines also reduce fuel use and allow farmers to conserve agricultural resources like soil, thereby mitigating greenhouse gas emissions.

**Scott Justice**
Rural mechanization specialist, CIMMYT-Nepal

Bangladesh, Sri Lanka and increasingly Nepal provide good illustrations of how small, fragmented, and even mountain farms can be mechanized and achieve productivity gains, if policies support fair access to scale-appropriate agricultural machinery services. Besides increased productivity, mechanization is often accompanied by increased cropping intensity. While drudgery reduction always seems to come last in the literature on the benefits of agri-mechanization, it is an equally important outcome, particularly to reduce outmigration in Nepal.

We are beginning to see instances of younger and educated members of households who are less inclined to migrate for work, while conversely mechanization is allowing greater time for off-farm income generation.

**Asia**

**Carolina Camacho**
Post-doctoral fellow - social science, socioeconomics program, CIMMYT-Mexico

In the state of Chiapas in southern Mexico, a region where smallholders predominate, mechanization has played a key role in the development of a group of crop and livestock producers. With support and training from CIMMYT, they have organized more productively and now offer custom services using machinery, purchasing and marketing harvests, and providing technical advice. CIMMYT’s efforts have complemented local initiatives to develop farmer organizations and provide access to affordable financing, helping to give farmers a stronger voice in regional affairs and creating a cascade of innovation.

**Latin America**

**Jelle Van Loon**
Mechanization specialist, Latin America, sustainable intensification program, CIMMYT-Mexico

The diverse landscape of farmer conditions in Latin America demands a broad strategy and an integrated approach to facilitate improved farming practices. Besides research and development on functional machinery innovations, we conduct user-specific trainings and foster direct access to appropriate tools.

Through MasAgro, a long-term sustainable intensification project involving CIMMYT and Mexico’s agricultural secretariat, SAGARPA, we have advised and trained 17 metal workshops as providers of innovative, tailor-made farm equipment, and implements from 12 machinery hire points have serviced some 2,000 hectares of farmland in a single cropping season. We have also led the design or re-engineering of 40 prototypes to increase the return investments to make precision agriculture technology a more viable option for smallholder farmers.
Years of biofortification research and breeding have resulted in Zincol, a wheat variety with 20 percent more zinc than conventional varieties.
Years of biofortification research and breeding have resulted in Zincol, a high-yielding, zinc-enhanced variety that was released in 2016 and is gaining popularity in Pakistan. Consuming just three chapattis – an unleavened flatbread common in South Asia – made with flour from Zincol can provide up to 40 percent of a child’s daily zinc requirement and 20 percent of an adult’s.

In 2017, farmers from 22 seed producer associations in Pakistan planted large portions of their wheat fields with Zincol. Established to grow quality seed of new wheat varieties, these associations received assistance from the country’s National Rural Support Program, a key partner in the Pakistan Agricultural Innovation Program, led by CIMMYT.

“Over the 2016 and 2017 cropping seasons, 400 tons of seed of Zincol have been shared with farmers, seed companies and promotional partners,” said Imtiaz Muhammad, CIMMYT country representative in Pakistan and a wheat improvement specialist.

An additional 15 tons of Zincol was shared free of charge for testing with 600 farm families in Sukkar District, Sindh Province, through an initiative of World Vision-Canada and HarvestPlus, a CGIAR research program dedicated to the study and delivery of biofortified foods.

**Zinc links to health**

In Pakistan, 39 percent of children and 48 percent of pregnant women suffer from zinc deficiency, according to a 2011 National Nutrition Survey. These deficiencies lead to child stunting rates of over 40 percent and high infant mortality.

Zinc is essential for immune and nervous system development, making it especially vital for combatting malnutrition during pregnancy and in young children, according to the World Health Organization. South Asia has one of the highest rates of zinc-deficiency, resulting in a host of harmful effects.

“Zincol also carries the genetic background of NARC 2011, a popular, high-yielding Pakistan wheat variety that resists wheat stem rust, a deadly disease that threatens wheat worldwide,” added Velu Govindan, a CIMMYT wheat breeder who specializes in biofortification and helped develop Zincol.

Zincol took nearly a decade to reach farmers after the initial breeding cross in 2007, several years faster than is the norm in Pakistan. Today enough Zincol seed has been distributed to cover over 20,000 hectares, and that could expand to more than half a million hectares by 2019.

**Funders**

U.S. Agency for International Development (USAID), HarvestPlus and World Vision-Canada.
## CIMMYT financial overview

### 2017 and 2016 financial statements

A summary of the combined statement of financial position and combined statement of activities and other comprehensive income for CIMMYT Int. and CIMMYT A.C., are set out in tables 1 and 2. Total revenues for 2017 amounted to US$133.8 million and US$134.4 million in 2016 (excluding financial income). The surplus for 2017 totalled US$15 million and the deficit for 2016 US$4.8 million (results included an increase in extraordinary institutional provisions). Total net assets increased by US$15 million in 2017 to US$74.0 million.

As of this year, CIMMYT presents its Financial Statements under International Financial Reporting Standards (IFRS) only. The note to the Financial Statements can be found here https://www.cimmyt.org/financials and these notes further explain the IFRS transition process at CIMMYT, including a comparative overview.

### Table 1. Combined statement of financial position

<table>
<thead>
<tr>
<th>Category</th>
<th>2017 (US$)</th>
<th>2016 (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASSETS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash and cash equivalents</td>
<td>99,223</td>
<td>90,950</td>
</tr>
<tr>
<td>Program-related prepaid expenses</td>
<td>1,735</td>
<td>4,858</td>
</tr>
<tr>
<td>Accounts payable, net</td>
<td>11,078</td>
<td>13,976</td>
</tr>
<tr>
<td>Inventory and supplies, net</td>
<td>1,158</td>
<td>1,255</td>
</tr>
<tr>
<td><strong>Total assets</strong></td>
<td>114,154</td>
<td>114,181</td>
</tr>
<tr>
<td><strong>LIABILITIES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-current assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property, equipment, and net properties</td>
<td>48,111</td>
<td>49,433</td>
</tr>
<tr>
<td>Deferred expenses</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td><strong>Total non-current assets</strong></td>
<td>48,448</td>
<td>49,470</td>
</tr>
<tr>
<td><strong>TOTAL ASSETS</strong></td>
<td>162,602</td>
<td>163,651</td>
</tr>
</tbody>
</table>

### Table 2. Combined statement of activities and other comprehensive income

For the years ended December 31, 2017 and 2016 (in thousands of U.S. dollars)

<table>
<thead>
<tr>
<th>Category</th>
<th>2017</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grants revenue</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows 1 and 2</td>
<td>25,037</td>
<td>29,043</td>
</tr>
<tr>
<td>Windows</td>
<td>25,123</td>
<td>26,790</td>
</tr>
<tr>
<td>Bilateral</td>
<td>53,365</td>
<td>43,256</td>
</tr>
<tr>
<td><strong>Total grant revenue</strong></td>
<td>133,540</td>
<td>134,053</td>
</tr>
<tr>
<td><strong>Operating expenses and losses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research expenses</td>
<td>83,679</td>
<td>78,599</td>
</tr>
<tr>
<td>CGIAR collaborative expenses</td>
<td>10,995</td>
<td>11,033</td>
</tr>
<tr>
<td>Non-CGIAR collaborative expenses</td>
<td>25,859</td>
<td>32,559</td>
</tr>
<tr>
<td>General and administrative expenses</td>
<td>11,063</td>
<td>10,999</td>
</tr>
<tr>
<td><strong>Other expenses and losses</strong></td>
<td>2,956</td>
<td>3,041</td>
</tr>
<tr>
<td><strong>Total expenses and losses</strong></td>
<td>112,223</td>
<td>138,792</td>
</tr>
<tr>
<td><strong>Operating surplus/(deficit)</strong></td>
<td>2,328</td>
<td>(4,855)</td>
</tr>
</tbody>
</table>

### BILATERAL

<table>
<thead>
<tr>
<th>Institution</th>
<th>2017</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Centre for International Agriculture Research (ACIAR)</td>
<td>213</td>
<td>182</td>
</tr>
<tr>
<td>Australian Centre for International Agriculture Research (ACIAR)</td>
<td>213</td>
<td>182</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>52,782</td>
<td>63,623</td>
</tr>
</tbody>
</table>

### Other comprehensive income

<table>
<thead>
<tr>
<th>Category</th>
<th>2017</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel costs</td>
<td>47,617</td>
<td>47,761</td>
</tr>
<tr>
<td>CGIAR Collaborator Expenses</td>
<td>10,980</td>
<td>11,033</td>
</tr>
<tr>
<td>Non-CGIAR Collaborator Expenses</td>
<td>25,859</td>
<td>32,559</td>
</tr>
<tr>
<td>Supplies and services</td>
<td>34,788</td>
<td>37,072</td>
</tr>
<tr>
<td>Depreciation/Amortization</td>
<td>6,674</td>
<td>5,716</td>
</tr>
<tr>
<td>Cost sharing percentage</td>
<td>999</td>
<td>360</td>
</tr>
<tr>
<td><strong>Total operating expenses</strong></td>
<td>131,223</td>
<td>138,792</td>
</tr>
</tbody>
</table>

### Table 3. Sources of grants revenue

For the years ended December 31, 2017 and 2016 (in thousands of U.S. dollars)

<table>
<thead>
<tr>
<th>Category</th>
<th>2017</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grants Restricted</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>76</td>
<td>12,404</td>
</tr>
<tr>
<td>CGIAR</td>
<td>30,110</td>
<td>36,060</td>
</tr>
<tr>
<td>Non-CGIAR</td>
<td>405</td>
<td>481</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>34,921</td>
<td>39,546</td>
</tr>
<tr>
<td><strong>Grants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CGIAR</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total grants</strong></td>
<td>133,540</td>
<td>134,053</td>
</tr>
</tbody>
</table>

### Total grants revenue for 2017 and 2016 overview

Total grant revenue for 2017 was US$133.5 million and US$134.4 million in 2016 (excluding financial income). The surplus for 2017 totalled US$15 million and the deficit for 2016 US$4.8 million (results included an increase in extraordinary institutional provisions).

Net assets were increased by US$15 million in 2017 to US$74.0 million.
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Acronyms

ACIAR Australian Centre for International Agricultural Research
AGRA Alliance for a Green Revolution in Africa
BBSSRC Biotechnological and Biological Sciences Research Council
BMGF Bill & Melinda Gates Foundation
CABI Centre for Agriculture and Biosciences International
CCAFS CGIAR Research Program on Climate Change, Agriculture and Food Security
CIFOR Center for International Forestry Research
CRP CGIAR Research Program
CSISA Cereal Systems Initiative for South Asia
DFID Department for International Development
dg Director General
dt Drought tolerant
DTMASS Drought Tolerant Maize for Africa Seed Scaling
EIB Excellence in Breeding
FAO Food and Agriculture Organization of the United Nations
FAW Fall armyworm
FTF Feed the Future
GIZ Deutsche Gesellschaft für Internationale Zusammenarbeit
HGBF Howard B. Buffett Foundation
ICAR Indian Council of Agricultural Research
ICARDA International Center for Agrarian Research in the Dry Areas
ICPE International Centre of Insect Physiology and Ecology
ICRISAT International Crops Research Institute for the Semi-Arid Tropics
IFAD International Fund for Agricultural Development
ITA International Institute of Tropical Agriculture
IPM Integrated Pest Management
KALRO Kenya Agricultural & Livestock Research Organization
MAIZE CGIAR Research Program on Maize
MasAgro Sustainable Modernization of Agriculture project
MDG Millennium Development Goal
MLN maize lethal necrosis
SAGARPA Mexico’s Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food
SDC Swiss Agency for Development and Cooperation
SDG Sustainable Development Goal
SIDA Swedish International Development Cooperation Agency
SIMLESA Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa
SNNP Southern Nations, Nationalities, and People’s Region
UN United Nations
UNDP United Nations Development Programme
USDID United States Agency for International Development
USDA United States Department of Agriculture
WHEAT CGIAR Research Program on Wheat

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