ANNUAL REPORT 2017

CGIAR

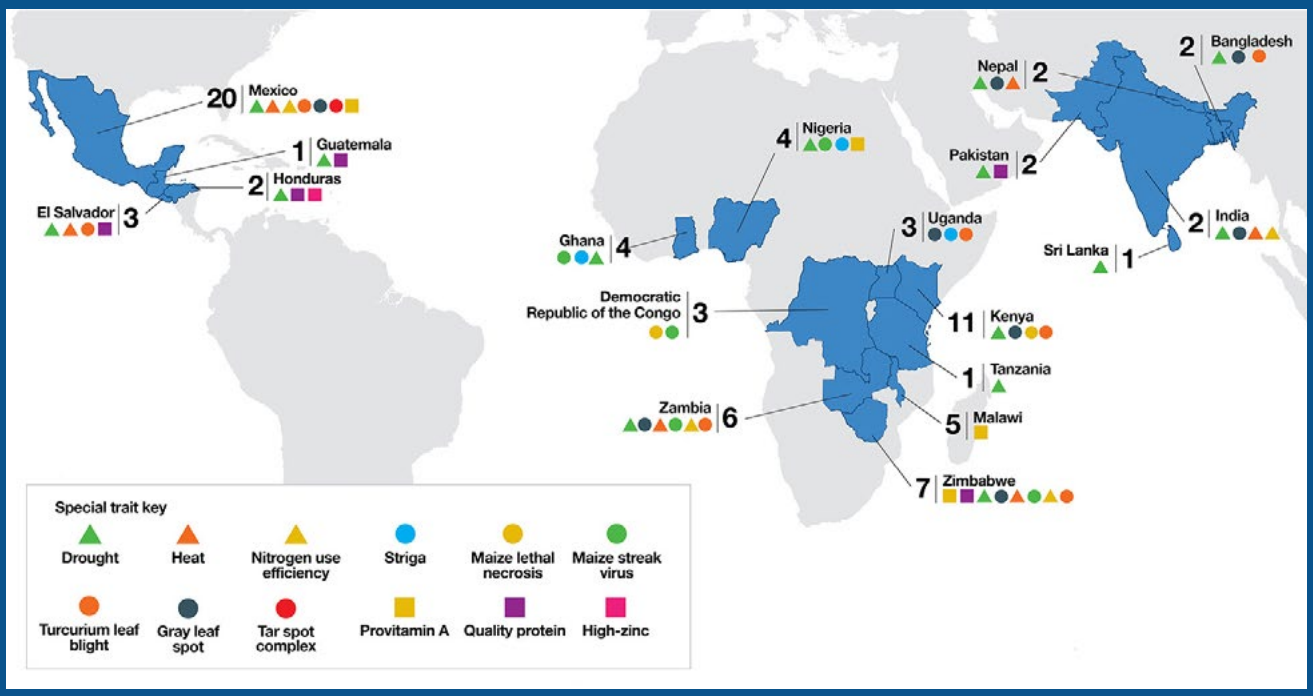
RESEARCH PROGRAM ON Maize

Message from the CRP MAIZE Director

In 2017, 79 improved maize varieties were released by MAIZE partners worldwide, including 26 in Latin America, 44 in Sub-Saharan Africa and 9 in Asia. These varieties are based on use of CGIAR lines from the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute of Tropical Agriculture (IITA). Some of the special traits stacked in these varieties include drought and heat tolerance, nitrogen use efficiency, enhanced protein quality, high kernel zinc and resistance to diseases of regional or global importance, such as maize lethal necrosis (MLN), tar spot complex (TSC), and resistance to the parasitic weed, Striga.

The fall armyworm (FAW), a devastating insect-pest from the Americas, continues its march across sub-Saharan Africa. MAIZE has been working closely with international, regional and national partners to produce a comprehensive technical guide on the integrated FAW management.

The MAIZE team is also working intensively to curb the spread and impact of maize lethal necrosis (MLN) in sub-Saharan Africa through the development and deployment of MLN-resistant maize hybrids, besides strengthening the capacities of national plant protection organizations across sub-Saharan Africa



Elite maize varieties released by MAIZE CRP partners in 2017, with depiction of key traits.

on MLN diagnostics and management. The rapid response to MLN and ongoing intensive efforts against FAW highlight MAIZE's expertise and partnerships to counter the present and future pest/disease challenges in the tropics.

The release of second-generation tropicalized haploid inducers (CIM2GTAILs) and the use of over 93,0000 doubled haploid (DH) lines in maize breeding programs in Latin America, Africa and South Asia have great potential to increase genetic gains for tropical breeding programs.

Sustainable intensification in maize based systems has yielded excellent results. MAIZE researchers found compelling research evidence on the multiple benefits of conservation agriculture and argued that it should be included as one of the major technology packages in Ethiopia's national agricultural extension system.

In "Gender and innovation processes in maize-based systems," a report from the GENNOVATE initiative to MAIZE, researchers found that improved maize seeds ranked as among the two most important agricultural innovations to have come into their communities for both women and men.

I wish to thank MAIZE partners, funders and stakeholders for their continued support and participation. Without the generous support of our funders, MAIZE could not tackle emerging challenges such as maize pests and diseases or climate variability. The CGIAR Research Program on Maize (MAIZE) receives W1&W2 support from the Governments of Australia, Belgium, Canada, China, France, India, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Sweden, Switzerland, UK, US and the World Bank.

We thank you for reading this Annual Report, and look forward to sharing our updates and achievements with you in the years to come.

B.M. Prasanna

Director of the CGIAR Agri-Food Systems Research Program on Maize

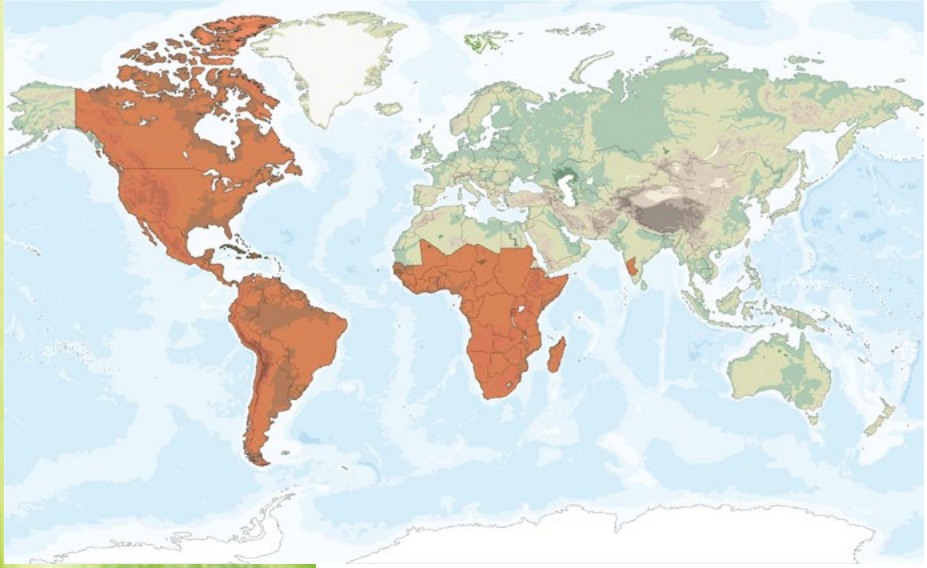
Contents

Fall armyworm: the battle continues

The fall armyworm (FAW), a devastating insect- pest from the Americas, continues its march across sub-Saharan Africa. Throughout 2017, MAIZE has worked closely with international, regional and national partners on a variety of fronts to tackle the challenge. As the FAW was reported on the Asian continent for the first time in August 2018 after its discovery in Karnataka, India, international cooperation and partnerships will prove crucial to manage the pest and protect vulnerable smallholder farmers.

A Stakeholders Consultation Meeting was held in Nairobi, in April 2017 on the strategy for effective management of FAW in Africa, attended by 160 experts from 29 countries. The meeting, co-organized by CIMMYT, the Alliance for a Green Revolution in Africa (AGRA) and the United Nations Food and Agriculture Organization (FAO), in partnership with the government of Kenya, developed a framework document on the strategy to fight the fall armyworm. In late 2017 MAIZE, in partnership with USAID and other collaborators, produced a comprehensive manual on fall armyworm pest management in Africa. It was released in January 2018. The manual, "Fall Armyworm in Africa: A Guide for Integrated Pest Management," provides tips on FAW identification as well as technologies and practices for effective and sustainable management.

Two Regional Training and Awareness Creation Workshops, involving nearly



Map of areas affected by fall armyworm as of August 2018. Photo: CIMMYT.

200 stakeholders, were organized by CIMMYT and USAID, in eastern Africa and southern Africa. MAIZE IITA researchers conducted surveys and collections of local strains of FAW. CIMMYT has initiated intensive screening of maize germplasm for native genetic resistance to FAW under artificial infestation in Kiboko, Kenya.

Without proper management, over the next one to two years (2018-19), FAW may cause up to six billion dollars' worth of damage across affected maize growing regions in sub-Saharan Africa (SSA). Though solutions for the short- and mid-term exist, strong multi-disciplinary and inter-institutional collaboration is required to develop and deploy integrated pest management (IPM) packages tailored to African agro-ecologies. For example, "breeding for fall armyworm resistant elite maize hybrids adapted to sub-Saharan Africa would require intensive germplasm screening and collaborative work with both the public and private sectors," said B.M. Prasanna, at an international stakeholders' meeting in Nairobi. Scientists estimate that Africa will need an investment of at least $150 to $200 million annually over at least the next five years to mitigate potential damage due to FAW, through the use of effective IPM-based options. Farmer awareness-raising and early detection are critical pieces in the solutions-mix. MAIZE and its partners are implementing regional train-the-trainer workshops, so that pest control and extension actors can effectively scout, determine the need for intervention, and appropriately apply specific practices to control the pest in maize and other crops.

Adult fall armyworm moths. Photo: G. Goergen, IITA.

Fall Armyworm attacking a maize cob. Photo: G. Goergen, IITA.

MLN gene editing and pre-breeding

MAIZE and partners have worked tirelessly to prevent the spread and mitigate the impact of maize lethal necrosis (MLN) disease since its discovery in Kenya in 2011. The disease, which causes premature plant death and unfilled, poorly formed maize cobs, can lead to up to 100 percent yield loss in farmers' fields. An MLN screening facility was established in 2013 in Naivasha, Kenya, followed by a quarantine facility in Zimbabwe in 2015. In the present, researchers continue to develop maize varieties with resistance to MLN using cutting-edge technologies and techniques to provide relief to farmers facing the disease.

Great strides were made in developing maize germplasm with resistance to maize lethal necrosis (MLN) disease in 2017, using both innovative technologies and novel maize genetic materials from around the world. MAIZE scientists have been working with Corteva Agriscience to identify one of the genes that confers strong

MLN symptoms on young maize shoots.

resistance against MLN. With fine-mapping, a strategy that combines laboratory molecular tools with field phenotyping, scientists have narrowed their search to fewer than eight genes (from a total of ~40,000 in the maize genome).

A promising candidate among these eight genes will be validated via gene editing directly in the MLN-susceptible parental lines to determine whether it confers resistance to MLN. Gene editing, compared to other breeding methods, will allow scientists to shave off one third of the time it would take to develop new MLN resistant lines; expediting development and release of improved varieties to farmers.

Pre-breeding research, based on new sources of resistant alleles from native maize varieties in the germplasm bank transferred to early-generation lines for breeding use, is also used in the fight against MLN. Utilizing a broader range of disease resistant alleles in breeding helps to create varieties with durable resistance (capable of maintaining resistance over time). In 2017, 255 advanced pre-breeding lines developed from MAIZE were planted at the MLN screening site in Naivasha, Kenya for in situ evaluation for the first time.

Optimizing sustainable intensification in Asia

Achievements of the CSISA initiative in 2017

Researchers and extension agents of the USAID supported Cereal Systems Initiative for South Asia (CSISA), a project aligned with the CGIAR Research Program on MAIZE (MAIZE), made significant progress in 2017. Initiatives aimed at improving agricultural production and standards of living for farmers in South Asia were developed and implemented. Central to CSISA's work on maize-based systems is the concept of sustainable intensification (SI), which aims to increase the productivity of existing farmland while minimizing negative impacts on the environment.

Farming practices that involve conversion of natural land to agriculture and inefficient use of resources and inputs such as fertilizers are not sustainable in the long-term. When considered alongside contemporary issues such as climate change, water scarcity, decreasing availability of arable land, and predicted population growth to over 9 billion people by 2050, it is clear an alternative approach is needed.

The situation is especially pronounced in South Asia, where a large and growing population, competition for crop land, escalating energy costs and intensifying groundwater scarcity in many areas means SI is at the forefront of agricultural research

for development. Of particular concern is the region's water resources — South Asia accounts for nearly a quarter of the world's food production but has access to less than 5 percent of its annual renewable water resources, with per capita water availability decreasing by nearly 70 percent since the 1960s.

Sustainable intensification of farming involves the adoption of better land management, efficient resource use and concepts of biodiversity conservation. Specific methods such as improvements to tillage and irrigation systems, efficient and informed use of fertilizer and other inputs, and effective mechanization to conserve energy and labor all contribute to increased productivity while conserving resources such as soil, water and biodiversity.

the implementation of SWI, with potential to generate revenue of over US$100 million annually to farmers.

The Government of Bangladesh has emphasized its support for sustainable intensification and actively promotes the adoption of surface water irrigation for cereal crop production.

"This research demonstrates the power of using advanced geospatial targeting and ex-ante analysis to help natural resources and development planners make better use of existing water resources in this unique region" says Krupnik.

Further work in Bangladesh included CSISA's efforts in an aligned scaling project on agricultural mechanization, which developed value chains to support the widespread scaling of equipment to increase efficient and effective resource use. The commercial supply of axial flow pumps, reapers, and seed fertilizer drills positively impacted 90,000 farmers.

Meanwhile, in India CSISA has tested methods to rapidly increase the number of machinery service providers in Odisha state. Women from tribal lands continued to make profits by growing improved maize seed using improved agronomic practices in fallow land during monsoon season despite challenging access to land and markets. This project will continue

"Sustainable intensification is built around the concept of increasing productivity while reducing negative environmental impacts and assuring equitable and inclusive development in agriculture,"

– Timothy J. Krupnik
CIMMYT Senior Scientist and Systems Agronomist, and Coordinator of CSISA efforts in Bangladesh

"SI also seeks to optimize the use of ecosystem services in production, while also positively contributing to the sustainable provision of ecosystem services so agriculture is of broad benefit to society."

Water management is at the heart of CSISA's work in southern Bangladesh allowing the sustainable intensification of poor quality agricultural land. An integrated study, by researchers from the International Maize and Wheat Improvement Center (CIMMYT) and MAIZE involving remotely sensed, geospatial and farmers' yield data found that the adoption of surface water irrigation (SWI) could benefit more than 100,000 hectares of fallow and rain fed cropland, substantially increasing maize productivity. The newly mapped rivers and canals can aid

into 2018, working with the women to improve their yields and income.

CSISA-Nepal improved input and output markets through the facilitation of partnerships and contracts between producers and exporters. More than 300 maize supply contracts were facilitated in two districts between feed mills and producer groups. Seed dealers, like NIMBUS, supplied more than 200 tons of hybrid maize seed through retailers' networks in order to supply inputs. Also in Nepal, partnerships were facilitated for market-based mechanization between 7 local agro-dealers and exporters from India and China. CSISA's involvement included providing introductions, facilitating tours to launch linkages, providing advice, and facilitating the mutual implementation of partnerships.

Improving farming methods is also a CSISA objective, and 2017 saw significant steps taken to enhance integrated weed management. Improved practices involving both herbicide and mechanical control methods were piloted, resulting in dramatically improved yields and profits. Grain yields increased by 30-35 percent, achieving a 10-fold increase in profits using trialed control methods. By avoiding the high labor costs of manual weed control it was possible to achieve this impressive gain: profits went from a near-loss baseline of US$ 38/ha to US$ 438/ha using mechanical weed control methods and US$ 582/ha using herbicide methods.

It is widely believed the agriculture industry can achieve sustainable intensification through innovations in science, capacity building and knowledge sharing through collaborative research programs, such as MAIZE and CSISA. Safeguarding the future of agriculture in South Asia will require a coordinated effort with a clear vision of both the challenges and the potential of proposed solutions. Adopting a sustainable approach will allow the region to produce more with less, using resource-efficient, sustainable solutions to conserve water, soil and biodiversity. This approach offers the potential of social, economic and environmental sustainability – components that are essential to ensure the future productivity of agricultural land for future generations.

To learn more about CSISA's work please see their recent newsletter here

To read an interview with Dr P.V. Vara Prasad, Director of the Feed the Future Sustainable Intensification Innovation Lab on the CSISA website please click here.

Doubled haploids for a faster breeding cycle

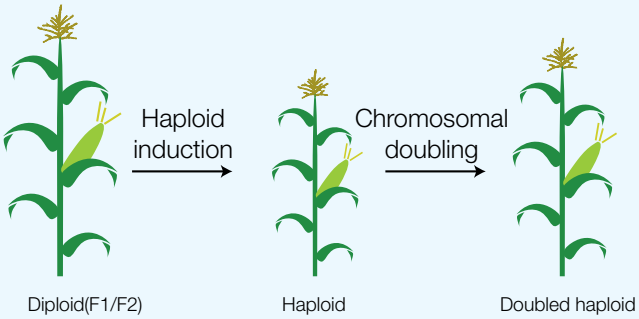
Doubled haploids and second generation tropicalized haploid inducers

The use of doubled haploid (DH) technology and release of second generation tropicalized haploid inducers by CIMMYT have allowed breeders to greatly reduce the time and cost associated with the development of improved maize lines. DH lines have reduced the time it takes to develop inbred lines from 3-4 years to just one year. Over 93,0000 DH lines were developed from 455 populations and delivered by CIMMYT in 2017 to maize breeding programs in Africa, Latin America and Asia.

The second generation tropicalized haploid inducers (CIM2GTAILs) released in 2017 have a haploid induction rate (HIR) that is over 40% higher than the first-generation tropical inducers released by CIMMYT in 2012. The CIM2GTAILS were developed by CIMMYT using marker assisted selection (MAS).

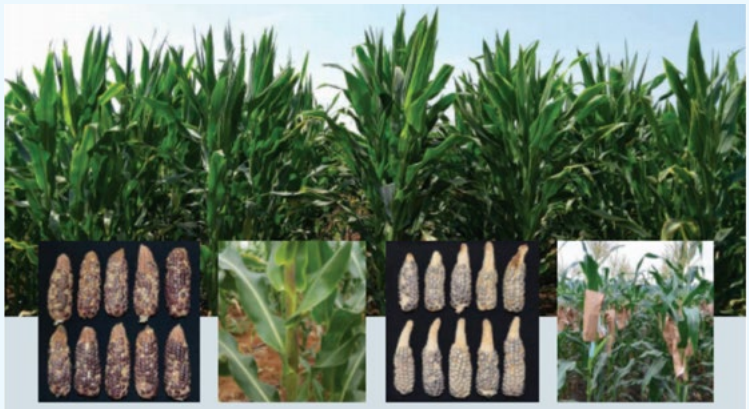
CIM2GTAILs are also superior in terms of agronomic performance. These improvements reduce DH development costs by at least 30%.

The second generation inducers are already used for large-scale haploid inductions in CIMMYT DH facilities. MAIZE received 20 requests for 2GTAILS from public and private sector partners in 2017. In addition, 29 researchers were trained in various technologies that can enhance genetic gains in maize breeding, including DH.



NOW AVAILABLE:

CIMMYT's superior second-generation tropically adapted haploid inducers



How do gender 'norms' affect innovation in maize-based systems?

Findings of the GENNOVATE report to MAIZE

A new report from GENNOVATE, a cross-CRP, global comparative research initiative, examines how local women's and men's expected roles and behaviors (norms) and social rules affect people's ability to access, adopt and benefit from innovations in maize-based farming. The report, "Gender and innovation processes in maize-based systems," was developed for MAIZE through a synthesis of individual interviews and discussion groups involving 1,600 women and men from 27 villages of Ethiopia, Malawi, Mexico, Nigeria, Nepal, Tanzania, and Zimbabwe.

The results show high variation. In some communities, there is evidence that gender norms and social rules are becoming less rigid, allowing both women and men to share empowerment in farming activities. Interestingly, such communities also perceive a higher rate of poverty reduction. Nonetheless, in some cases embedded social rules, such as hierarchies of wealth and authority which place better-off men at the top, still restrict the empowerment of women and those lower down on the ladder.

One of the most encouraging findings was that overall, both men and women ranked improved maize seed as among the two most important agricultural innovations (alongside conservation agriculture practices).

Participants cited increased crop yields and profits as tangible gains from improved maize seed, and women recognized it as of vital importance in maintaining household food security. The main constraints associated with improved maize seed were the financial cost and the inconsistent supply of quality seeds in their local markets. The latter is of particular concern to women, who often rely on seed bought from local markets for their crops rather than that obtained from private seed companies.

The study indicates that agricultural livelihoods are no longer the most viable option for many families in rural areas. Men are finding more lucrative opportunities in off-farm jobs and out-migration to urban centers. Therefore, farmland is increasingly left under the management and toil of women. Women also pursue the majority of agriculture-related informal trading and contribute a significant proportion of the labor in maize-based systems, as well as adopting the role of primary caregiver for the family.

Despite this, evidence suggests much of the agricultural decision-making and implementation of innovative farming practices remains with adult men. Reasons for this include traditional systems of patriarchal land ownership, lack of access to credit and cultural pressures which inhibit women's freedom of movement.

The GENNOVATE study included interviews with young people, casting light on their attitudes towards rural livelihoods, with the majority of young participants expressing strong aspirations for a non-farm livelihood and a limited sense of empowerment to engage with agricultural opportunities. Given these findings and recent trends of youth out-migration to urban centers, the prevailing view of policymakers—that the growing population of young people (particularly in Africa) can find ample employment in the agriculture sector—may be a challenge to realize.

The changing economic and social realities within which young people find themselves matter enormously, according to a recent study from researchers from CIMMYT and the Institute of Development Studies, and will influence their life choices. Researchers stress that adopting an undifferentiated view of young people as 'youth' and applying a single strategy with which to handle them, does not lead to effective management of rural youth issues. Youth research and initiatives must take explicit account of the highly diverse social, economic and gender backgrounds of young people and how these factors influence their ability to exploit employment and entrepreneurial opportunities. The study highlights the need for further research on youth-specific dimensions of rural economies as part of a dual approach, looking mainly at structural and policy changes that benefit rural livelihoods as a whole. Obtaining a more sensitive understanding of young people's patterns of engagement with agriculture can enhance the effectiveness of policies and initiatives to engage youth with agriculture.

The GENNOVATE report highlights several promising avenues for change. Central priorities are to foster policies that promote the fair and effective integration of women, the poor and young people into the agricultural framework and to improve the capacity of institutions and extension services to nurture women's, as well as men's, access to and use of agricultural technology.

The report also encourages a wider participatory environment, in which lessons are learnt from role model local women, men, and young people from diverse social backgrounds, who have successfully adopted innovations and progressive mind-sets in their farming practices. In the household, better cooperation is encouraged through a suite of household participatory tools, whereby men and women share decision-making and resource access within the household

Overall, the GENNOVATE report to MAIZE calls for a transition to a more inclusive and diverse agricultural framework, in which both women and men are actively engaged and valued. As report authors state, "The GENNOVATE study approach provides a means for large-scale research and intervention programs like the MAIZE CRP to better understand and contribute to social processes where both women and men effectively access and benefit from agricultural innovation."

Original citations:

Petesch, P., Badstue, L., Williams, G., Farnworth, C., & Umantseva, A. (2017). Gender and innovation processes in maize-based systems. GENNOVATE Report to the CGIAR Resewarch Program on Maize. GENNOVATE Research Paper. Mexico, D. F.: CIMMYT.

Ripoll, S., Andersson, J., Badstue, L., Büttner, M., Chamberlin, J., Erenstein, O., & Sumberg, J. (2017) Rural transformation, cereals and youth in Africa: What role for international agricultural research? Outlook on Agriculture. Vol 46, Issue 3, pp. 168-177.

Seeds of hope

Reducing malnutrition in Haiti

In 2017, the International Maize and Wheat Improvement Center (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.

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.

Hugo Córdova (1942-2009)

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.

Alberto Chassaigne (l) and Reginald Toussaint, USAID food security and agroforestry specialist (r), inspect seeds in storage.

In the future, the project hopes to help consolidate the country's emerging maize seed, 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.

Farmer Léveilllé Josette (l) during the training sessions.

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.

> "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. I will not keep this information to myself. I will meet with my organization and share the information with them."
>
> – Josette Léveillé
> A farmer participating in the trainings.

Funders:
This work is supported by the Feed the Future program of the U.S. Agency for International Development (USAID).

Sustainable Development Goals tied to work mentioned in this story. Of the 17 United Nations (UN) Sustainable Development 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.

Translating research into impact

Over its lifespan, the CGIAR Research Program on Maize (MAIZE), in collaboration with partner organizations, has produced a broad range of innovations, such as climate-resilient crops, sustainable land use practices, farm mechanization options and effective extension services, which have significant potential to improve livelihoods and foster more productive, sustainable maize farming. But ensuring research and its outcomes reach a meaningful number of farmers to have a widespread impact is challenging.

Flagship Project 1 (FP1) of the MAIZE Research Program: "Enhancing MAIZE research for development strategy for impact," seeks to ensure research is translated into impact. Its mandate is to prioritize, target, understand and enhance interventions in maize based agri-food systems for greatest impact using multidisciplinary collaborative research. Through monitoring and evaluation of the impacts of MAIZE work and the study of dynamics of gender and social inclusion, FP1 helps link MAIZE research to specific development needs, increasing its relevance and impact.

In 2017, MAIZE impact studies spanned broad but interconnected disciplines and topics, including such critical issues as climate-resilience, child nutrition, and poverty reduction across all MAIZE operational regions—Africa, Asia and Latin America.

MAIZE researchers recently revealed how using heat-tolerant maize varieties can minimize yield losses due to climate change in South Asia. Elevated year-round

temperatures and increased frequency and intensity of heat waves are among the many manifestations of climate change. The ensuing heat stress can devastate crop yields, presenting challenges to food production and security. Indeed, yield losses predicted in India from projected climate scenarios are expected to result in an annual deficit of up to US$20 billion.

Therefore, from both a food security and economic perspective, it is essential to know what impact climate-resilient maize varieties can have on yields in South Asia under projected future climate conditions. Researchers demonstrated that use of heat-tolerant maize varieties, such as those developed by MAIZE, can reduce yield loss in South Asia by up to 36% and 93% in 2030 and by 33% and 86% in 2050, under rainfed and irrigated conditions respectively. Such results highlight the importance of MAIZE work in developing and distributing climate-resilient maize, which has the potential to shield farmers from severe yield loss due to heat stress, helping them mitigate the impacts of climate change.

In one of the first empirical investigations of its kind, MAIZE researchers assessed how the adoption of improved maize varieties affects child nutrition in Ethiopia. Maize is the most important staple cereal crop in Sub-Saharan Africa, and better knowledge of the nutritional benefits of improved maize will provide vital information that can assist policy decisions aimed at reducing malnutrition.

The results from extensive household surveys found that the adoption of improved maize significantly benefits child nutrition in terms of height-for-age and weight-for-age measurements, with benefits most significant among children with poorest nutrition backgrounds. Researchers also found that households with female or less-educated leaders are less likely to use improved seed, highlighting potential constraints such as prohibitive financial cost, disruptions in local seed market supply, and difficulty travelling the long distance to seed dealers.

Not only does this study emphasize the importance of improved maize on child nutrition—especially those with poorer nutritional circumstances—it also underscores the importance of policies that enhance access to improved seed inputs and extension services for vulnerable and poorer households.

In Latin America, the western highlands of Guatemala are of particular significance in the history of maize farming—they comprise part of the area where maize was first domesticated. Today, maize is still central to farmers' livelihoods and food security, but life is hard, poverty affects over 50 percent of the

population while 48% suffer from chronic malnutrition. As a follow-up to the Buena Milpa project, MAIZE researchers investigated whether selling native maize at a higher premium to specialist, niche markets (an initiative that has had some success in neighboring Mexico) could boost poverty reduction in the region.

The study found that the majority of smallholder farmers in western Guatemala had extremely small landholdings where they only produced enough maize to feed their families for 6.9 months of the year, thereafter having to buy additional maize to eat. Given this reliance on subsistence and lack of surplus maize to sell at market, researchers suggest other types of poverty reducing interventions would be more appropriate. To this end, MAIZE is planning a series of workshops aimed at extension agent collaborators that will address social inclusion issues in this region of Guatemala.

New knowledge generated by MAIZE researchers in 2017 shows the valuable impact of MAIZE work in targeting critical challenges, including food insecurity, malnutrition, climate change and poverty reduction. Using its multidisciplinary, collaborative approach, MAIZE is committed to reaching as many farmers and consumers as possible to effect widespread change with the aim of improving livelihoods and supporting productive, sustainable maize farming.

Original citations:

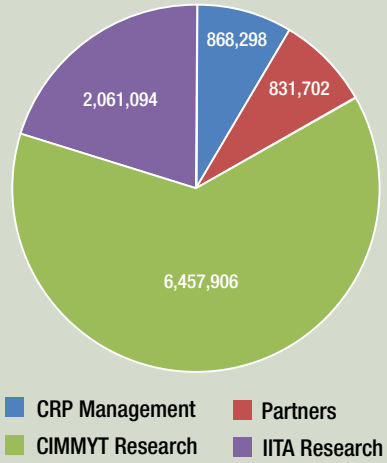
Tesfaye, K., Zaidi, P.H., Gbegbelegbe, S., Boeber, C., Rahut, D.B., Getaneh, F., Seetharam, K., Erenstein, O., Stirling, C. (2017) Climate change impacts and potential benefits of heat-tolerant maize in South Asia. Theoretical and Applied Climatology 130, 959–970.

Zeng, D., Alwang, J., Norton, G.W., Shiferaw, B., Jaleta, M., Yirga, C. (2017) Agricultural technology adoption and child nutrition enhancement: improved maize varieties in rural Ethiopia. Agricultural Economics 48, 573–586.

Hellin, J., Cox, R., López-Ridaura, S. (2017) Maize Diversity, Market Access, and Poverty Reduction in the Western Highlands of Guatemala. Mountain Research and Development 37, 188-197.

Financial Highlights

Total: U.S. $10,219,000



MAIZE greatly appreciates the contributions of all Window 1 and Window 2 funding partners for their support during Phase I through the CGIAR Fund. Without these donors MAIZE work in Phase I (2012-2016) and Phase II (2017-2022 ongoing) would not have been possible.

Visit the MAIZE website for more information

The CGIAR Research Program on MAIZE (MAIZE) is an international collaboration between more than 300 partners that seeks to mobilize global resources in maize research and development to achieve a greater strategic impact on maize-based farming systems in Africa, South Asia and Latin America.

Led by the International Maize and Wheat Improvement Center (CIMMYT), with the International Institute of Tropical Agriculture (IITA) as its main CGIAR partner, MAIZE focuses on increasing maize production for the 900 million poor consumers for whom maize is a staple food in Africa, South Asia and Latin America. MAIZE's overarching goal is to double maize productivity and increase incomes and livelihood opportunities from sustainable maize-based farming systems.

Writers/Editors: Jennifer Johnson and Carolyn Cowan

Contributors: Lone Badstue, Vijay Chaikam, Alberto Chassaigne, Kanwarpal Dhugga, Olaf Erenstein, Melaku Gedil, Bruno Gerard, Georg Goergen, Huntington Hobbs, Victor Kommerell, Tim Krupnik, Terry Molnar, Aaron Pillado, Kevin Pixley, B.M. Prasanna, Arturo Silva, L.M. Suresh, Ghislain Tepa-Yotto, Claudia Velasco.

Photos: CIMMYT, Alberto Chassaigne, M. DeFreese, G. Goergen, IITA, Peter Lowe, Ranak Martin, Joshua Masinde, Florence Sipalla.

Infographics and maps: Jennifer Johnson, Gerardo Mejia, Eliot Sanchez and Vijay Chaikam.

Layout and Design: Marcelo Ortiz Sánchez

Maize Management Committee

Marianne Bänziger
Lead Center Representative
Deputy Director General for Research and Partnership, CIMMYT

Olaf Erenstein
Socioeconomics Program Director, CIMMYT

Tahirou Abdoulaye
Senior Agricultural Economist
IITA

Kevin Pixley
Genetic Resources Program Director, CIMMYT

Melaku Gedil
Molecular Geneticist/Breeder
IITA

B.M. Prasanna
Director, MAIZE CRP and CIMMYT Global Maize Program

Abebe Menkir
Maize Breeder/Geneticist, IITA

Bruno Gérard
Sustainable Intensification Program Director, CIMMYT

Bernard Vanlauwe
Director R4D, Central Africa and Natural Resource Management, IITA

Victor Kommerell
Ex-officio
Program Manager, MAIZE

Claudia Velasco
Ex-officio
Program Administrator, MAIZE

Maize Independent Steering Committee (ISC)

Mike Robinson
Chair
Chief Science Advisor, Syngenta Foundation for Sustainable Agriculture

Felister W. Makini
Deputy Director General for Crops, KALRO

Ram Kaundinya
Management Consultant

Justin J. Rakotoarisaona
Secretary General of the African Seed Trade Association

Luis Flores Lui
Director General, Mexican Forestry, Agriculture and Livestock Research Institute (INIFAP)

Martin Kropff
Director General, CIMMYT

Nteranya Sanginga
Director General, IITA

B.M. Prasanna
Director, MAIZE CRP and CIMMYT Global Maize Program

Victor Kommerell
Ex-officio
Program Manager, MAIZE

Claudia Velasco
Ex-officio
Program Administrator, MAIZE

Correct citation: MAIZE. 2018. The CGIAR Research Program on Maize 2017 Annual Report. Mexico City: MAIZE.

RESEARCH PROGRAM ON Maize

The CGIAR Research Program on Maize (MAIZE)
Email: maizecrp@cgiar.org • Web: http://maize.org

International Maize and Wheat Improvement Center (CIMMYT)
Apdo. Postal 041 C.A.P. Plaza Galerías
Col. Verónica Anzures 11305
CDMX, Mexico
Tel: +52 (55) 5804 2004
Email: cimmyt@cgiar.org
www.cimmyt.org

International Institute of Tropical Agriculture (IITA)
IITA-Nigeria Ibadan,
PMB 5320, Ibadan
Oyo State, Nigeria
Tel: +234 2 7517472
Email: iita@cgiar.org
www.iita.org

Annual Report 2017. Mexico, CDMX: CIMMYT-IITA.