MAIZE Agri-Food System
CGIAR Research Program

Annual Report
2016

CGIAR | RESEARCH PROGRAM ON Maize

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List of acronyms

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
BMGF	Bill & Melinda Gates Foundation
CA	Conservation agriculture
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CFT	Confined field trial
CIMMYT	International Maize and Wheat Improvement Center
CRP	CGIAR Research Program
CSISA	Cereal Systems Initiative for South Asia
DT	Drought-tolerant
DTM	Drought-tolerant maize
DTMA	Drought Tolerant Maize for Africa
DTMASS	Drought Tolerant Maize for Africa Seed Scaling
FP	Flagship project
GL	CGIAR Research Program on Grain Legumes
ha	Hectare
HTMA	Heat Stress Tolerant Maize for Asia
IDO	Intermediate development outcome
IEA	Independent evaluation arrangement
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
IPM	Integrated pest management
IPNI	International Plant Nutrition Institute
ISMA	Integrated Striga Management in Africa
KIT	Royal Tropical Institute
L&F	CGIAR Research Program on Livestock and Fish
M	Million
MARLO	Managing agricultural research for learning and outcomes
MasAgro	Sustainable Modernization of Traditional Agriculture program
MCMV	Maize chlorotic mottle virus
MLN	Maize lethal necrosis
NARS	National Agricultural Research System
NASECO	Nalweyo Seed Company
NPPO	National Plant Protection Organization
NPT	National performance trial
NUE	Nitrogen use efficiency
PIM	CGIAR Research Program on Policies, Institutions, and Markets
POWB	Plan of work and budget
QPM	Quality protein maize
QTL	Quantitative trait loci
RTB	CGIAR Research Program on Roots, Tubers and Bananas
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
SAP	Sustainable agricultural practice
SDG	Sustainable development goal
SFSA	Syngenta Foundation for Sustainable Agriculture
SIMLESA	Sustainable Intensification of Maize and Legume Systems for Food Security in Eastern and Southern Africa
SLO	System-level outcome
SME	Small and medium enterprise
SRF	Strategy and results framework
SSA	Sub-Saharan Africa
ToC	Theory of change
TSC	Tar spot complex
UNDP	United Nations Development Program
USAID	United States Agency for International Development

WEMA	Water Efficient Maize for Africa
WLE	CGIAR Research Program on Water, Land and Ecosystems

Part I – Technical Report

A. Key messages

A.1 Synthesis of progress and challenges

During 2016, MAIZE made strong progress on both of its research strategies, stress resilient and nutritious maize, and sustainable intensification of maize-based systems. At least 5,556,493 hectares were under improved MAIZE-derived technologies or management practices as a result of CRP research; directly reaching 11,405,929 smallholder farmers. In total, 111 improved maize varieties, based on CIMMYT/IITA germplasm, were released through MAIZE partners in 2016 (Figure 1); these include: 76 in sub-Saharan Africa (24 in eastern Africa; 12 in southern Africa; 40 in West Africa); 27 in Latin America (19 in Mexico; 1 in Honduras; 2 Nicaragua; 2 Ecuador; 3 Bolivia); and 8 in Asia (4 in India; 2 in Nepal; 2 in Bangladesh). Besides high and stable yield potential, some of the special traits stacked in these varieties include drought tolerance, nitrogen use efficiency (NUE), tar spot complex (TSC) resistance, Quality Protein Maize (QPM), increased provitamin A content (through the CGIAR Research Program on Agriculture for Nutrition and Health - A4NH), ear rot or mycotoxin resistance, and *Turcicum* leaf blight resistance (Figure 1). To view an interactive version of this map, click here.

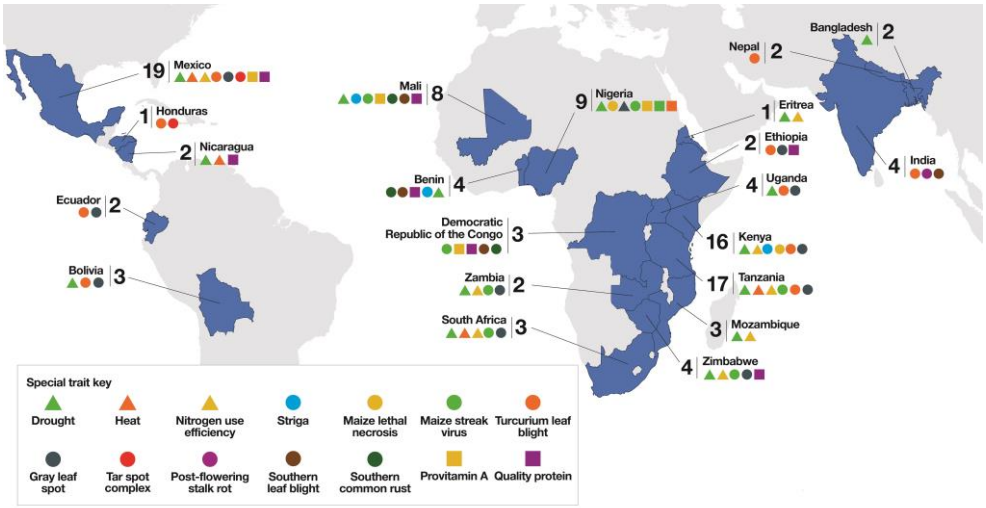


Figure 1: Improved maize varieties released by MAIZE partners in 2016, with depiction of some special traits. The map includes eight provitamin-A enriched varieties based on MAIZE germplasm that were released under A4NH CRP in Latin America and sub-Saharan Africa (1 in Mexico, 7 Mali,3 in DRC, and 1 in Nigeria) in 2016.

A.2 Synthesis of two most significant achievements

Drought- and heat-tolerant maize for Asia

In May 2016, India recorded its highest temperature ever when a town in the western state of Rajasthan reached 51 degrees Celsius. The searing heat across south Asia critically damaged crops and destabilized food security in the region. In continuous drought hit years of 2014 and 2015, 330 million people in India across 10 states were affected. MAIZE scientists have been hard at work to develop and deploy heat- and drought-tolerant maize varieties adapted to South Asia, especially for improving maize yields in the spring and monsoon seasons.

The Affordable, Accessible, Asian (AAA) Drought Tolerant Maize Project – a public-private partnership involving CIMMYT, Syngenta and national partners from Vietnam and Indonesia –identified three drought-tolerant (DT) elite maize hybrids for deployment in the west and central zones of India. This

region includes drought-prone and tribal areas, a high risk environment where smallholder farmers require improved maize seed at low-cost. The target area covers more than 1.5 million hectares in India, and translates to a seed market potential of about 34,000 metric tons; the improved DT maize hybrids offer the opportunity to address the needs of over two million households. The region's climate and other dynamics make seed marketing risky, unpredictable and unattractive, meaning that it is often overlooked by the multinational seed sector – exactly the kind of underserved area MAIZE seeks to target in partnership with small and medium enterprise (SME) seed company partners. The project plans to market a limited quantity of hybrid seed in 2017 followed by a full market launch in 2018.

Across south Asia, MAIZE scientists under the Heat Tolerant Maize for Asia (HTMA) project made great progress on variety development and deployment in 2016. The project licensed 20 new hybrids to public and private sector partners for deployment. Twelve new seed companies, including five each from Pakistan and Bangladesh and two from Nepal, signed research collaboration agreements and formally joined the HTMA project. In addition, a joint hybrid initiative by CIMMYT and DuPont Pioneer under HTMA helped in identifying promising single-cross hybrid combinations; two such combination hybrids were selected by DuPont-Pioneer for further large-scale testing.

Combining stress breeding and conservation agriculture to mitigate climate change

Climate change and land degradation affect countries across the world, reducing crop yields and destabilizing food security. Extreme weather events such as El Niño further exacerbate this problem. According to the U.S. Agency for International development (USAID), countries in sub-Saharan Africa (SSA) such as Malawi are particularly susceptible to these challenges due to high population growth, deforestation and soil degradation leading to food insecurity and hunger. MAIZE scientists are working to use climate-smart technologies such as conservation agriculture (CA) and DT maize varieties in conjunction to adapt to the negative effects of climate variability and change and to increase productivity and profitability for vulnerable smallholder farmers.

To respond to the increasing threats of climate variability and declining soil fertility, MAIZE tested improved DT maize varieties in combination with CA in seven districts of Malawi. These efforts were conducted in collaboration with lead center CIMMYT and partners including Malawi's Ministry of Agriculture extension services and Total LandCare, with support from USAID's Feed the Future program. The trials were set up in a "mother and baby" trial design including 60 long-term mother trials and 360 babies across a range of agro-ecologies, farm types and environments.

Despite a strong El Niño in 2016 that left more than half of Malawi's population in need of food relief, farmers experienced a great response from CA systems and DT maize varieties. The best DT variety (Peacock 10) planted under CA demonstrated 66 percent higher yields in comparison with the best non-DT commercial variety (DKC80-53) planted under conventional ridge tillage. This shows that a joint promotion of both of these climate-smart technologies, CA and DT maize varieties, can reap the benefit of both approaches as they are mutually re-enforcing. Farmers were able to harvest more maize in the 2016 cropping season while also spending 35-45 less labor days in the direct seeded CA systems as compared to preparing conventional ridging and using traditional weed control strategies. These multiple benefits preferentially benefit women and children who are usually tasked for this back breaking work.

MAIZE's work on GxExM (genotype by environment by management interaction) spans from southern Zimbabwe to southern and central Malawi and eastern Zambia to support farmers with options they need to adapt to climate change. A study by MAIZE scientists published in 2016 on the benefits of CA and DT maize in Mozambique found that direct-seeded manual CA treatments out yielded conventional tillage treatments in up to 89 percent of cases on maize, and that improved DT maize varieties out-yielded the traditional control variety by 26 to 46 percent (695–1422 kg ha^{-1}) on different

tillage treatments, across sites and seasons. Other winning technologies such as bio-fortified maize varieties and/or diversification of maize-based farming systems with grain legumes such as pigeon peas, groundnuts and cowpeas will support farmers to improve their diet and generate additional income. An increasing demand for such crops has started to change the landscape of rural farming areas in Malawi and Zambia in line with the advent of new grain market opportunities, for example in India. In the future, as farmers will have to produce more food on less land in an uncertain climate, sustainable cropping systems including CA must be examined as viable options to improve food and nutrition security and smallholder farmers' livelihoods.

A.3 Financial summary

MAIZE W1&W2 original budget for 2016 was USD$ 12.511 million (M)[1] including carry over from previous year, of which US$ 11.708 M was expended. The total budget for MAIZE was US$ 86.123 M. Total expenditures were US$ 74.859 M. MAIZE results were also scaled out through supplementary projects valued at US$ 2.063 M. MAIZE continued to implement the United Nations Development Program (UNDP) DAC marker in its financial analysis, which estimated a MAIZE gender budget of 30 percent (US$ 25.856 M). (See Annex 10).

[1] In 2016 MAIZE faced a dramatic W2 budget cut of 2.5 M

US$ millions	POWB approved budget (2016)	Actual expenditure (2016)
W1 & W2	12.51	11.708
W3	34.08	29.795
Bilateral	39.53	33.355
Total	86.123	74.859

B. Impact pathway and intermediate development outcomes (IDOs)

In preparation for Phase-II of the CGIAR Research Programs, MAIZE developed an impact pathway for the program and nested theories of change for its four Flagships (see Figure 4). These theories of change were created in line with the CGIAR's 2016-30 Strategy and Results Framework (SRF) and the United Nations' Sustainable Development Goals (SDGs) and demonstrate MAIZE's contribution. A participatory approach with scientists from both CIMMYT and IITA was used for their development.

MAIZE contributes to the three CGIAR System-Level Outcomes (SLOs) of (1) reduced poverty, (2) improved food and nutrition security for health, and (3) improved natural resource systems and ecosystem services. It also contributes to four CGIAR Intermediate Development Outcomes (IDOs) and eight associated sub-IDOs. Cross-cutting issues related to climate change, gender and youth, policies and institutions, and capacity development are equally important to the work of MAIZE and are included in the theories of change.

The completion rate on 2016 deliverables for projects under MAIZE ranges from 70 to 100 percent, with an overall output achievement above 90.2 percent, as documented in MAIZE reporting templates (for W1&2) and bilateral progress reporting (see Annex 1). A list of external reviews and adoption and impact studies are provided in Annex 4a and Annex 4b respectively. An overview of FP outputs delivering towards sub-IDOs and SLOs is provided at Annex 8. MAIZE's peer-reviewed articles in journals in 2016 are listed in Annex 9.

C. Progress along the impact pathway

C.1 Progress towards outputs

Counteracting MLN in sub-Saharan Africa

When maize lethal necrosis (MLN) first struck in Kenya in 2011, MAIZE and its partners immediately launched intensive efforts to identify and develop MLN-tolerant maize hybrids, while developing the capacity of partners to identify sources of MLN resistance (see 2016 coverage on this work from the BBC's Horizons program). MAIZE researchers and their partners have screened nearly 100,000 germplasm entries from all over the world. The first phase of these evaluations focused on existing released varieties and materials in the elite breeding pipelines, however, over 95 percent of these materials have proven susceptible to MLN. While the percentage of tolerant material discovered was low, since 2015 the MAIZE team has succeeded in releasing a number of MLN-tolerant maize hybrids in eastern Africa (see Section C.2, p.10). Due to the low percentage of materials with tolerance to MLN, there is a need to further expand the genetic sources of resistance to this virus complex. To this end, MAIZE scientists decided to focus their efforts on maize chlorotic mottle virus (MCMV), the virus that is the major factor in MLN disease and to which most of the material screened was susceptible. Starting in 2015, MAIZE scientists focused on evaluating landraces from areas of Latin America and the Caribbean that are known to have high incidences of MCMV and other viruses as well as high levels of maize genetic diversity. To date over 1,000 landrace accessions and populations have been evaluated and the 20 most promising landraces for MCMV tolerance have been crossed to high-performing CIMMYT elite lines and then selfed to create new advanced progenies for advanced evaluation.

In 2016, the first sets of lines were harvested and are currently being evaluated in the greenhouse for MCMV resistance. Over 900 F3 lines have been evaluated in the greenhouse for MCMV tolerance and these lines have additionally been genotyped in order to evaluate if the genetic source of any observed tolerance is from novel alleles or is from alleles that already exist in elite breeding materials. The F4 lines derived from the F3 lines with observed MCMV tolerance have been produced and are being sent to the MLN screening facility in Naivasha, Kenya for more in depth evaluation in 2017. Breeders hope to begin releasing semi-inbred lines with novel alleles for MCMV/MLN tolerance to the maize breeding community in late 2017 and in 2018.

Counteracting new maize pests in sub-Saharan Africa

Food security in sub-Saharan Africa is at risk because of two new maize insect-pests destroying crops and spreading rapidly in the region. The first is a new, highly destructive invasive pest *Spodoptera frugiperda* (fall armyworm), which has suddenly appeared in West, Central and southern Africa, causing panic among the farmers. It was first reported in Nigeria in January 2016 and had assumed epidemic proportions by the first quarter of 2017 in several southern African countries, including Mozambique, Namibia, South Africa, Zambia and Zimbabwe. To date, Zambia has confirmed reports that almost 90,000 hectares of maize have been

affected, Malawi reports some 17,000 hectares have been hit, Zimbabwe reports a potential 130,000 hectares affected, while in Namibia, approximately 50,000 hectares of maize and millet have been damaged, according to the FAO. MAIZE scientists are in intensive discussions with various research and development institutions worldwide, especially integrated pest management (IPM) experts, to identify the best possible short-, medium- and long-term solution to this major menace. Control of the fall armyworm requires a multi-pronged approach, following the principles of IPM, including chemical control, biological control, host-plant resistance, agronomic management at different scales (field, farm and landscape), and community-based and GIS-based tracking and early warning system. In early 2017, scientists will start undertaking experiments to screen elite maize germplasm to identify potential sources of even partial resistance to the insect pest. MAIZE agronomists will also be experimenting on suitable agronomic management practices to minimize the damage by the fall armyworm in maize-based cropping systems.

In West Africa, a recent survey (funded by the MAIZE W1&2) revealed that the spittlebug (*Poophilus costalis*) is the most prevalent and damaging species observed on maize across all agro-ecological zones in Togo and Ghana. Although maize farmers are aware of the damage by the spittlebug, most of them do not apply any control measures. Economic damage can be substantial (with up to 40 percent yield loss) already at densities of two insect adults per plant. Diverse host range ensures the survival of the spittlebug during the off-season, with preference for shady and moist environments. Some natural enemies were found to be associated with the pest, but their impact is presently still unknown. Eight isolates of the entomopathogenic fungus *Beauveria bassiana* – which can act as a parasite of the insect –showed promising results as biocontrol agent against the spittlebug. Studies to assess their endophytic competence in the maize plants – the degree to which these isolates increase the resistance of the maize plants to the spittlebug – are underway.

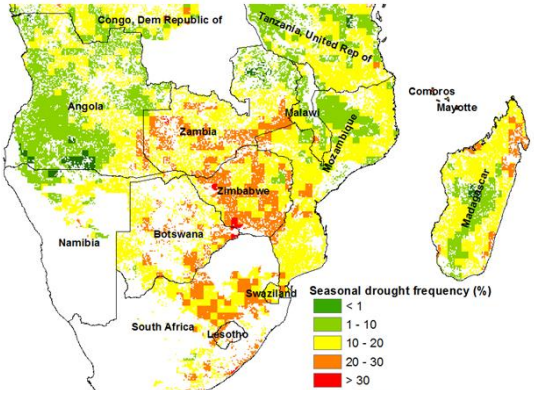


Figure 2: Seasonal drought frequency in Southern Africa

The next best thing to a crystal ball – GIS

As population growth, climate change impacts, and other challenges put increasing strain on the global food system, the development of advanced tools to guide decisions about food security at all levels is becoming ever more urgent. In collaboration with the International Food Policy Research Institute (IFPRI), University of Minnesota, Wageningen University, and others, MAIZE researchers are contributing importantly to this end through new approaches to foresight, ex-ante impact assessment, and targeting of improved agricultural technologies. In a particularly far-reaching example of this work, MAIZE researchers conducted and published a study that used big data analytics to refine geospatial targeting of drought-tolerant varieties in Malawi, Mozambique, Zambia and Zimbabwe. The analysis indicates that more than 2.5 million hectares of maize in these countries are exposed to drought with a frequency of 10-20 percent (i.e., once or twice per decade) or more. Spatial modeling further shows that DT maize varieties give a yield advantage of up to 40 percent over the commercial check varieties across drought-prone environments. There is thus huge potential for marketing the new DT maize varieties in these countries and also wide scope for using big data analytical tools to enhance the targeting and uptake of this and other climate-smart technologies.

C.2 Progress towards the achievement of outcomes

Ridding Africa´s maize value chain of a major health threat: Aflasafe to the rescue!

In 2016, 14 people in Tanzania died as a result of eating food contaminated with high levels of aflatoxins. Tanzanian maize samples were found to have extremely high levels of the toxin. In order to protect farmers and consumers in SSA from deadly aflatoxins in maize, CRP MAIZE developed both country- and region-specific Aflasafe biocontrol products: 1) Aflasafe TZ01 (Tanzania and surrounding regions); 2) Aflasafe TZ02 (Tanzania-specific); 3) Aflasafe MW02 (Malawi-specific); and 4) Aflasafe MWMZ01 (a regional product that can be used in both Malawi and Mozambique).

A soil nutrient tool that really does have all the answers – Nutrient Expert®

Developed by the International Plant Nutrition Institute (IPNI) in close collaboration with MAIZE, Nutrient Expert® has been made available on a wide variety of platforms, including versions for the web and mobile phones. In Nepal, Nutrient Expert® was estimated to have the potential to improve yields by about 3 t/ha over farmers' fertilization practices across different farm types, leading to an average additional income of US$ 688 over farmer fertilizer practice. Large-scale training for farm advisers in the use of Nutrient Expert® under a series of public and private sector agreements took place in 2016. One of these is focused on the Indian government´s Soil Health Card Program, aimed at disseminating more precise recommendations for soil nutrient management. Nutrient Expert® has also caught the attention of the private sector, including DuPont Pioneer and fertilizer company Mosaic, who see the tool as a way of better enabling farmers to benefit from their products.

***Striga* resistant maize adoption in Nigeria**

The parasitic weed *Striga* is a pervasive and recalcitrant problem of cereal-based systems in many parts of Africa. Developed by MAIZE, *Striga*-resistant maize varieties (SRMVs), such as SAMMAZ 11 or Across 97, SAMMAZ 15 and SAMMAZ 16, are easy for farmers to adopt and have already been released and widely disseminated in Nigeria. Adoption rate of these cultivars in the Federal Capital Territory area of Nigeria stands at about 41 percent. Adoption of SRMVs has led to both higher maize yields and increased household income of adopters by about US$ 110 per capita. Adoption also reduced the incidence of poverty among adopters by 9 percentage points (Hassan et al., 2016). There is also significant adoption of Integrated *Striga* Management (ISMA) practices in the northern part of Nigeria. The study by Hassan et al. (2016) highlighted the need for policies and programs aimed at enhancing adoption of SRMVs in Nigeria and beyond.

A deadly maize disease has met its match – MLN

MAIZE made exciting progress in the fight against the deadly maize lethal necrosis (MLN) disease in eastern Africa in 2016 on many fronts, from developing and deploying MLN tolerant varieties through to innovative technologies – such as standardized MLN survey and sampling protocols and digital surveillance tools - to information management – such as the launch of MLN information portal. Strategic capacity building took place via training of personnel from National Plant Protection Organizations (NPPOs) in eight countries in eastern and southern Africa in 2016 and an MLN Phytosanitary Community of Practice was establishment. Significant progress has also been made with regard to deployment of MLN-tolerant MAIZE hybrids in eastern Africa. In 2016, NASECO commercialized nearly 20 tons of certified seed of "Bazooka" in Uganda, and harvested around 300 tons of certified seed to be commercialized in 2017. In addition, the MAIZE team produced and distributed 100 kg of seed of MLN-tolerant pre-commercial hybrids to nine partners in East Africa for national performance trials (NPTs) and on-farm demonstrations. A strong pipeline of new MLN-tolerant/resistant MAIZE hybrids has been established, as shown by trials conducted in 2016 that compared 18 first-generation MLN-tolerant hybrids and 19 second-generation MLN-tolerant/resistant hybrids to the 9 most popular commercial hybrid checks in the region. Scientists found that the

commercial check hybrids were highly susceptible to MLN under artificial inoculation, giving a mean yield of 0.69 t/ha, while the mean grain yield of the first-generation and second-generation hybrids under MLN artificial inoculation were 3.41 and 4.49 t/ha, excellent news for farmers that have suffered crop losses from this disease.

African stem borer versus *Bt* maize

Nearly all of SSA is affected by *Busseola fusca* (Fuller), an indigenous stem borer that occurs at higher altitudes. Various control strategies have been tried, but all have limitations and none has provided a complete solution. The transgenic *Bt* maize provides a new management tool for small scale farmers and has the potential to increase yields where stem borers are a major constraint. *Bt* maize is capable of producing an insecticide – Bt protein – that can kill certain chewing insects. *Bt* maize has revolutionized stem borer control in several countries and also enabled growers to expand maize production into regions where high pest populations have made growing maize unprofitable. In 2016, MAIZE conducted confined field trials (CFT) with *Bt* maize in Kenya and Uganda and will conduct similar trials in Tanzania and Mozambique in 2017. In 2017, five seed companies – Capstone, Jermat, Monsanto, SeedCo and Klein Karoo will market TELA, developed and deployed through the WEMA project, to smallholders farmers in South Africa.

Value added makeover for traditional maize varieties

MAIZE is helping smallholders in remote mountainous areas of Mexico realize unique opportunities to derive greater economic benefits from their traditional landraces. While enhancing livelihoods in marginalized communities, this research is also giving farmers stronger incentives to conserve valuable genetic resources in their fields. MAIZE has made significant progress. A consensus has been reached on what constitutes "native landraces" and "native landrace-growing farmers". MAIZE facilitated the establishment of producer cooperatives; one such cooperative sent its first container of nearly 20 tons of a local landrace to a company in the USA, which sells to more than 60 high-end restaurants. An initiative is also underway to form a national non-profit group that unites Mexican landrace growers. Lastly, MAIZE researchers are working with farmers to multiply and deliver high-quality seed of rare color variants of maize landraces with strong market demand.

Delivering stress-tolerant maize for climate resilience

Climate change models paint an alarming picture of maize production in developing countries in SSA (see Fig.3). Beset by higher temperatures and more severe and frequent droughts, many countries will increasingly face food insecurity and declining rural livelihoods. Enhancing climate resilience of smallholder farming requires a mix of interventions, including new technologies as well as institutional innovations. Stress-tolerant maize varieties must form a central part of the mix, providing farmers with tangible insurance against crop losses. To this end, MAIZE works with over 200 small to medium enterprise (SME) seed companies and community-based seed producers across most maize producing countries in SSA.

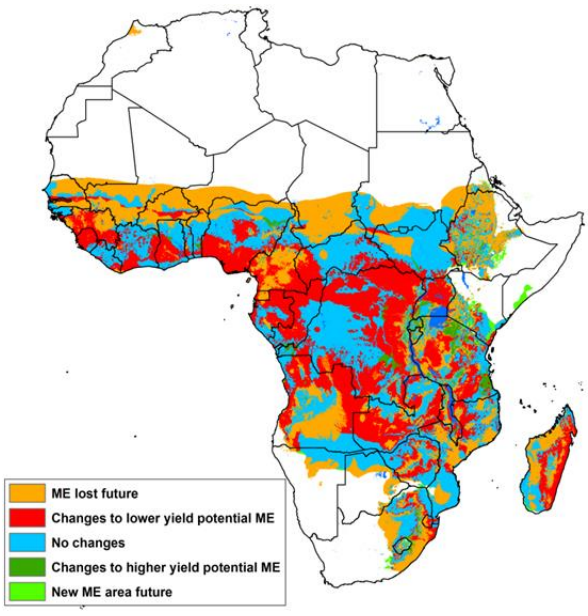


Figure 3: Projected changes in maize mega-environments in Africa.

In 2016, a total of 2,700,000 hectares were sown with high performing, yet stress resilient, maize

varieties in SSA, derived from MAIZE; reaching more than 6,705,000 farmers. In a study re-assessing impacts of Drought Tolerant Maize in Sub-Saharan Africa (2007-2016) across 13 target countries in sub-Saharan Africa, researchers found that DT maize varieties outperformed popular commercial maize varieties grown in SSA in terms of more stable yields, which, in turn, translated into more stable income. Benefits throughout the study period were estimated to be US$ 395 million for producers and consumers. The study found that, whilst adoption rates were high in some countries, e.g., 61 percent in Malawi, bottlenecks prevented large scale uptake in others, e.g., 9 percent in Zimbabwe. The study concluded that, to boost uptake of DT maize, seed companies and agro-dealers will need to redouble their efforts to expand seed supplies in local markets, with emphasis on selling seed in affordable 1 or 2 kilogram micro-packs. And, that, major promotional efforts are needed to raise awareness and understanding of the benefits of the new varieties, as the new varieties have great potential to reduce food insecurity and boost incomes at the household and national levels.

C.3 Impacts

MAIZE researchers published 19 impact assessment studies in 2016. Two ground breaking studies in Malawi and Zambia highlight win-win scenarios associated with the adoption of improved maize varieties and sustainable agricultural practices (SAPs). Thierfelder et al. (2016) examine the impact of Conservation agriculture (CA), a combination of SAPs, on maize yields and small farmer incomes over the period 2005 to 2014. The study determined that the adoption of CA out yielded conventional ridge tilled control plots in Mwansambo and Zidyana Districts between 22 and 31%, respectively, and increased income by 50 and 83%, respectively. This was in part due to the fact that crops were produced with 28 -39 less labor days ha^{-1} compared with the conventional practice. Successful extension of CA systems by Total Land Care (TLC), an NGO working in Malawi (and Zambia), using innovation systems approaches, has led to significant out-scaling of this technology to more than 30,000 farmers on more than 14,000 hectares in Malawi in the last decade and this is expected to increase. In the second study, which took place in Zambia, Manda et al. (2016) report that SAPs such as CA are essential in mitigating risks from climate change. For example, it was found that when practicing crop rotation and crop diversification (components of CA), farmers are sowing a diverse range of crops that can perform well under a range of environmental conditions and, due to different sowing dates and maturity periods of these crops, harvest produce at different times of year; reducing the risk of total crop loss if drought strikes. Indeed, the retention of crop residue, another SAP, was found to be a vital factor in "improving the soil and retaining moisture especially in drought prone areas". The results of the Zambia study clearly suggest that "farmers are adopting these SAPs to reduce the effects of droughts" (Manda et al., 2016). The study goes on to recommend the need for policy interventions that promote the combined adoption of improved maize varieties and SAPs, such as a maize–legume rotation and residue retention, which can boost yields and farm incomes especially among resource poor farmers who cannot afford inorganic fertilizers.

D. Gender research achievements

GENNOVATE

MAIZE is proud to report that all data collection for the cross-CRP GENNOVATE project is completed and that high level analysis and drafting of reports to CRPs should be completed by the end of March 2017. Indeed, the sheer amount of data generated through the project has necessitated development of a collaboration agreement and data sharing protocol to be used across all participating CRPs/Centers. This agreement is finalized and signed by all centers. GENNOVATE will develop a suite of case study synthesis reports in 2017, as well as two peer-reviewed articles on the design and methodological advances that have taken place due to this project.

One such GENNOVATE case study from the maize-based system of northern Nigeria (Saminika) provides evidence of reversed youth migration of young men. These young men had migrated to the semi urban cities and started petty trades and artisanship. A large number of these young men are returning to their communities and engaging in maize farming. Their decision to return to home was strongly influenced by: 1) increasing market demand for the new hybrid maize varieties; 2) functional innovation platforms facilitating intra-generational dialogue leading to relaxation of the traditional land ownership to allow young and unmarried men to access land, and; 3) state and local government investments to improve youth access to farm inputs and fertilizers, including improvement in financial institutions willing to grant agricultural loans to young men and women with limited collateral.

Gender mainstreaming and capacity development

Gender mainstreaming and capacity development gathered pace in 2016 with the completion of modules for the Gender Capacity Developing Program, as well as Gender Competency Framework and Learning Accountability System (with Cultural Practice). Selected modules of the Gender Capacity Developing Program were reviewed and tested in 2016 and will be fully rolled out in 2017 by KIT.

Gender achievements report 2012 – 2016

In 2016, CIMMYT published a report overviewing investments in gender during MAIZE Phase-I. The report determined that the focus on gender in MAIZE R4D had expanded significantly. Dedicated gender FTE staff expanded from zero in early 2012 to a global gender team of eight FTEs (currently four PhD- and four Master-level gender research staff positions, with further growth foreseen). IITA has 50 percent of a senior gender specialist and 100 percent of a gender post-doc aligned to MAIZE. The dedicated budget for gender increased significantly from virtually zero to an annual budget of over US$ 2,000,000, which includes two substantive gender projects, including leading GENNOVATE. Perhaps, more importantly, the MAIZE gender team now receives support from other CIMMYT and IITA social scientists (i.e. non-dedicated gender staff but with a gender interest and contribution).

Gender performance self-assessment as per **Annex 2** meets the requirements.

E. Partnership building achievements

Significant progress has been made towards integrated *Striga* management (see story on *Striga* in this report). Together with other *Striga* mitigation approaches, *Striga* tolerant germplasm plays a central role in integrated *Striga* management approaches. Indeed, for many extremely resource poor farmers, *Striga* tolerant/resistant maize seed remains the most economically feasible and practical means to combat *Striga*. Whilst IITA has already developed improved open-pollinated varieties (OPVs), inbred lines, and experimental hybrids with tolerance to *Striga hermonthica*, very little is known about the actual mechanisms of *Striga* resistance in maize. Using W1&2 funding, in 2016, MAIZE teamed up with Professor Julie Scholes and her team of *Striga* experts in the University of Sheffield, UK, in order to better understand the mechanisms of resistance to *Striga hermonthica* in maize. This collaboration aimed at characterizing and identifying the mechanisms of resistance and their genetic basis in *Striga* resistant maize inbred lines developed at IITA. It is hoped that identification of quantitative trait loci (QTLs) associated with *Striga* resistance will lead to the development of new MAIZE germplasm with increased *Striga* tolerance or even resistance, and ultimately benefit hundreds of thousands of resource-poor maize producers in SSA.

In 2016, using W1, 2 and 3 funding sources, MAIZE initiated collaborations with: 1) the Earth Institute, University of Columbia; 2) the International Institute for Applied Systems Analysis (IIASA), and; 3) Oak Ridge National Laboratory (ORNL) in order to develop a framework, metrics and indicators for measuring the contribution of MAIZE to sustainable development. 1) Couched within the Earth

Institute's contribution to the Sustainable Development Solutions Network (SDSN), professor Marc levy and colleagues are working with MAIZE to create a living manual on designing fit - for - purpose data systems to support SDG decision-making at the national level. The work is grounded in an approach that emphasizes the need to design data systems around priority decision making needs, to design data systems in a manner that is faithful to the linkages and interactions across multiple development processes, and to design data systems in a way that optimizes usable information by combining disparate measurement processes in a coordinated way. 2) The collaboration between MAIZE and IIASA aims to develop robust and cost effective sustainable intensification indicators and metrics at landscape level through matching monitoring and modelling technology to best characterize productivity, stability, resilience, systems' evolution and transition, and shock/impulse responses. 3) The collaboration with ORNL aims to develop and test a common framework for sustainability assessment of farming systems and landscapes that supports and adapts decision making for different stakeholders (i.e., farmers, farm advisors, policy makers, etc.) operating at different scales (i.e., field, farming system, regional-landscape, institutional-market). A common framework for integrated assessment will be developed with practical guidelines for the derivation of pertinent indicators at different scales and for different stakeholders as well as guidelines for the integration of indicators for the identification of trade-offs and synergies across scales.

In 2016, using W1&2 funding, MAIZE stepped up investments in scaling and agri-food system transformation work, especially with regard to identifying effective models/approaches for scaling and transformation. In December 2016, MAIZE was represented at a high level workshop on agri-food systems organized by CSIRO, SMB and ISPC. The purpose of the workshop was to tease out how pathways of action, research, and policy related to agri-food systems can better advance a transformation agenda. The workshop initiated critical dialogue between donors, IAR4D and private sector representatives as to how transformation of agri-food systems can be achieved. In February 2017, MAIZE and WHEAT CRPs welcomed onboard Lennart Woltering, a GIZ-CIM Scaling expert. Lennart will support scaling activities across MAIZE and WHEAT, and will help to link MAIZE and WHEAT research with German Development Corporation funded projects in the target countries.

MAIZE's principal concern is the funding uncertainty associated with W1&2 budget, which has led to at best postponement and at worst abandonment of some highly strategic investments.

MAIZE works closely with a number of CRPs. Some of the major strategic "give and take" with different CRPs are outlined in Annex 6.

Partner usage of MAIZE outputs is outlined in Sections C1 and C2.

F. Capacity building

In 2016, MAIZE co-funded an initiative called Learning Management System (LMS). It aims to maintain all MAIZE funded training concepts and training material centrally administrated. This platform serves to provide learning content and organize learning activities. The implementation of this platform comprised a fact finding study, finalized in November 2016, which gave the initial technical implementation requirements for the LMS process and will result in a series of administrative, technical, and strategic actions and establishment of a pilot LMS platform.

Besides the LMS initiative, MAIZE trained 46,490 people during 2016. Training was given to scientists, technicians and other participants through workshops, field days, specialized courses, seminars, and other events across 18 countries. MAIZE also continued investment in capacity development through support to 42 scholars of whom 21 were women across 14 countries into BSc, MSc and PhD programs under MAIZE staff (see Annex 12) currently co-supervision. See Annex 11 for further details.

MAZE has been performing different Cap Dev activities thought its bilateral projects in sub-Saharan Africa, Asia and Latin America. One very good example of this is the training activities undertaken through the DTMASS project in Africa. During 2016, DTMASS innovated beyond production technology and ramped up support to seed company partners with the goal to make drought-tolerant maize (DTM) a profitable (and hence, sustainable) long-term investment. The approach focuses on incentives for key stakeholders so as to make DTM an attractive choice for producers and retailers, ensuring access long after project support ends. During 2016, investments included: (1) market analysis and territory planning; (2) strengthening agri-dealer distribution networks; and (3) improving quality assurance of DTM seed. For (1), DTMASS deployed a commercial seed business expert to mentor the top seed company producers on various market analysis skills to effectively maximize their market share and profit potential in respective contexts. Distribution and marketing efforts (2) focused on Agro Dealers: identifying formal and informal retailers, training them on the benefits and handling of DT products (which was found to be lacking and hindering sales), and to network them to local DTM producers to maximize access to more locations (and farmers). This effort was complemented by reviving the Seed Road Maps developed earlier under the Drought Tolerant Maize for Africa (DTMA) project; Seed Road Maps are a production forecasting and resource planning tool that complements both territory planning and distribution networks. DTMASS also provided additional technical support to seed production partners in 2016 on DNA fingerprinting (for Quality Assessment and Quality Control), and phytosanitary procedures.

G. Risk management

In 2016, MAIZE regularly assessed and managed risks related to the delivery of results. However, three major risks identified in 2014 and 2015 remain unchanged: (1) W1&W2 budget insecurity and delayed transfer of W1&2 funds, which directly affects CRP research and development operations; (2) unfulfilled obligations by the partners for commissioned and competitive grants; (3) lack of a systematic and integrated approach for monitoring and evaluation at the output and outcome levels.

To mitigate risk (1), the MAIZE Management Committee continues to give high priority to multi-year investments of centers and partners, and is careful in issuing of new partner grants through the W1&2 budget. MAIZE continues to sign only one-year partner grant contracts, to manage partner expectations and to minimize any possible delays of payments to partners. For risk (2), MAIZE regularly monitors the fulfillment of obligations by partners and intervenes when necessary to ensure proper completion of grant requirements. As for risk (3), MAIZE is in the process of adopting the results-based management framework developed by CCAFS and used by all integrating CRPs and a number of agri-food system CRPs. The Managing Agricultural Research for Learning and Outcomes (MARLO) Platform will handle planning, monitoring, reporting and evaluation needs of MAIZE. Work is ongoing to ensure a smooth transition to the MARLO system, which should be completed by the end of 2017.

Developed by the MAIZE MEL expert, a list of newly identified risks associated with FP-level Theories of Change will be reviewed, revised, approved by the MAIZE Management Committee and the MAIZE risk register will be updated as appropriate.

H. Lessons learned

The information reported in Table 1 is obtained from detailed data presented in a variety of sources, including project technical reports and institutional databases. MAIZE is confident of the quality of the indicator information supplied. A review of the institutional lead center's process to collect the quantitative evidence and other types of performance or progress data across the MAIZE project portfolio was undertaken in 2015. This review allowed for more streamlined data collection and analysis activities. Further areas for improvement to the M&E process will be examined in 2017 to facilitate a more efficient data collection and reporting process.

The unclear definitions and measurement practices across the CRPs for the key performance indicators continues to be an issue, especially when reporting at the portfolio level. To ensure consistent and reliable reporting across CRPs, this issue will need to be addressed soon in Phase-II of the CRPs.

Continued advancements have been made in 2015 and 2016 for building a foundation to support effective monitoring at the project and program levels. MAIZE is developing a results-based management framework to support strategic planning, monitoring, reporting, evaluation and learning. This framework will go beyond the CRP's impact pathway and nested theories of change by including a monitoring, evaluation, reporting and learning plans. A proposed evaluation, reporting and learning plan has been included in the MAIZE proposal. The detailed monitoring plan for Phase-II is currently in development. It will include indicators to monitor outputs, outcomes and assumptions for each flagship project nested theory of change.

Both CIMMYT-led CRPs (MAIZE and WHEAT) continued the development of standardized processes and associated tools beyond project planning and design to include all phases in project management. These standard processes also include clear roles and responsibilities for each step and decision. The processes and tools are now officially available on the institution's internal website, and have already begun supporting improvements at the institutional level to the Results Management System to ensure effective project management.

Additional efforts are needed, however, to share monitoring best practices across the centers involved in MAIZE and with its partners. The newly established CGIAR Monitoring, Evaluation and Learning Community of Practice (MELCOP) met this year and began to work on issues related to measuring development impact at the CGIAR system level, as well as consistent templates and tools for Phase-II, including a template for the Plan of Work and Budget (POWB) and the Annual Report for Phase-II. The Community of Practice is also providing great opportunities to share best practices and learning amongst monitoring, evaluation and learning specialists.

Furthermore, MAIZE contributed to the CGIAR System Management Office-led Task Force on Indicators, which was tasked to identify a set of indicators for demonstrating the portfolio's progress against the System-level Outcomes. This contribution involved a review and analysis of the CRPs proposals and indicators from other organizations, development of generic impact pathways at the portfolio level, and identification of draft indicators for the System-level outcomes.

Annex 1: MAIZE indicator of progress in 2016

The "traffic light indicator" sums up the percentage achievement of projects under MAIZE, per Flagship Project (FP) in 2016, regardless of their funding (Windows 1 & 2 or bilateral funded). It monitors the progress per FP output, per FP and for the CRP as a whole.

Overall MAIZE performance was 90.2 on annual milestones/deliverables associated with FP outputs based on projects reported. Despite a number of minor delays, which are being tracked, no significant issues were reported.

2014 Activities progress by Flagship	**Windows 1 and 2 for programs**	**Competitive partner grants**	**Bilaterals and windows 3**	**Total weighed** (bilateral/Window 3: 82%; Windows 1 and 2 for programs 14%; Competitive grants 4%)
1-Sustainable intensification and income opportunities of maize-based cropping system	88	92	90	90
2-Novel tools, technologies and traits for improving genetic gains and breeding efficiency	94	95	93	94
3-Stress resilient and nutritious maize	90	100	92	94
4-Aligning with and strengthening maize seed systems for effective product delivery	86	70	91	83
5-Inclusive and profitable maize futures	85	90	95	90
Overall	**88.6**	**93.4**	**92.2**	**90.2**

The quantitative figures (% of achievement) are the result of a standardized qualitative assessment.

The % of achievement was estimated looking at the milestones/deliverables declared in the 2016 work plan and the related achievement assessed by the scientists (*and reviewed by the supervisor*) or by the projects (*in their reports submitted to the donors*). Each project has been weighted to insure that it could be associated to other projects with different number of milestones/deliverables/budget, after that we proceed with the aggregation of the results at CoA and FP level.

The comparison among bilateral, scientists funded using W1&2 and competitive grant, similarly has been done weighting the 3 categories. The weight was done based on the budget allocation: the bilateral projects are the biggest component of our budget, followed by W1&2 allocations to scientists and finally competitive grants (and not the base of investment effectiveness / value-for money/effectiveness).

*As of March 2017, the majority of Competitive and Commissioned Grants under FP4 were in No-Cost Extension. This is the principal factor responsible for the lower level of achievement.

Annex 2: Performance indicators for gender mainstreaming with targets defined

Performance indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
1. Gender inequality targets defined	Sex-disaggregated social data is being collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations and The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs)	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations and The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs) and CRP targets changes in levels of gender inequality to which the CRP is or plans to contribute, with related numbers of men and women beneficiaries in main target populations
2. Institutional architecture for integration of gender is in place	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy - CRP M&E system has protocol for tracking progress on integration of gender in research	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy - CRP M&E system has protocol for tracking progress on integration of gender in research and A CRP plan approved for capacity development in gender analysis	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy - CRP M&E system has protocol for tracking progress on integration of gender in research and A CRP plan approved for capacity development in gender analysis and The CRP uses feedback provided by its M&E system to improve its integration of gender into research

Annex 3: MAIZE ToC and Flagship projects and intermediate development outcomes

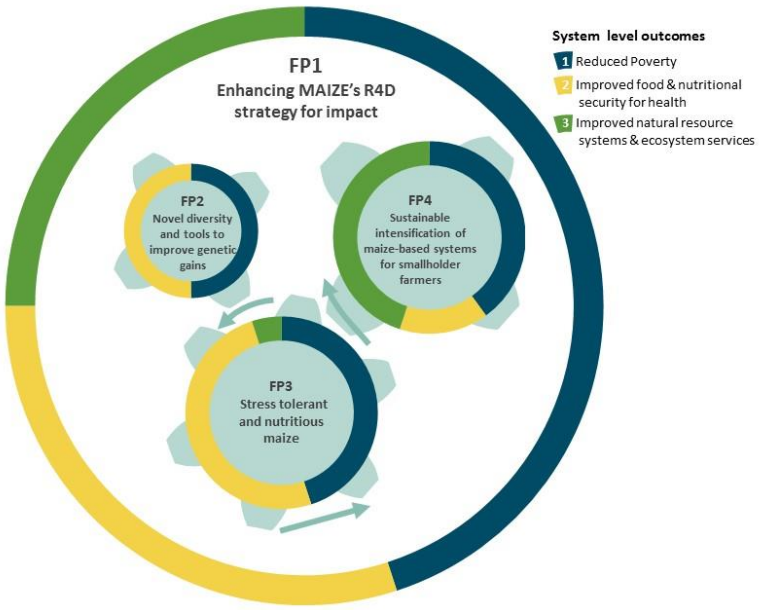


Figure 4: Phase-II MAIZE strategy by flagship projects.

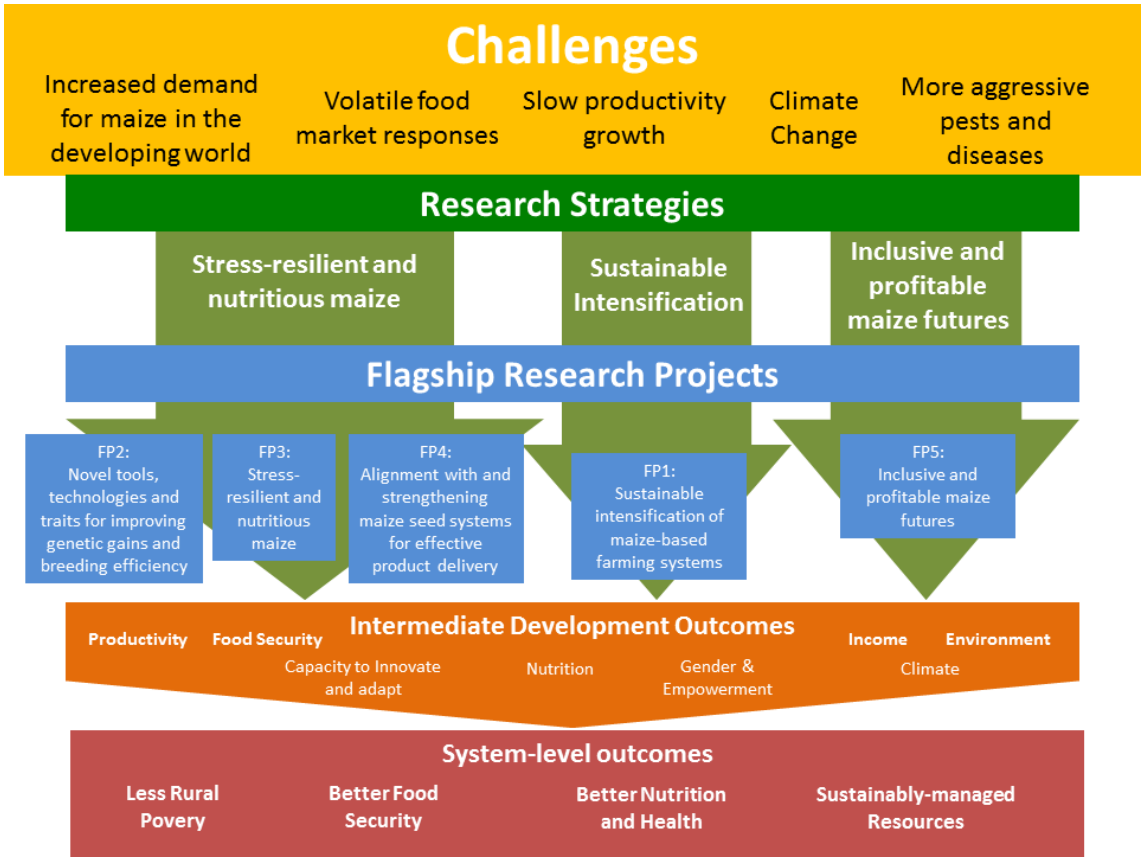


Figure 5: Phase-I MAIZE intermediate development outcomes.

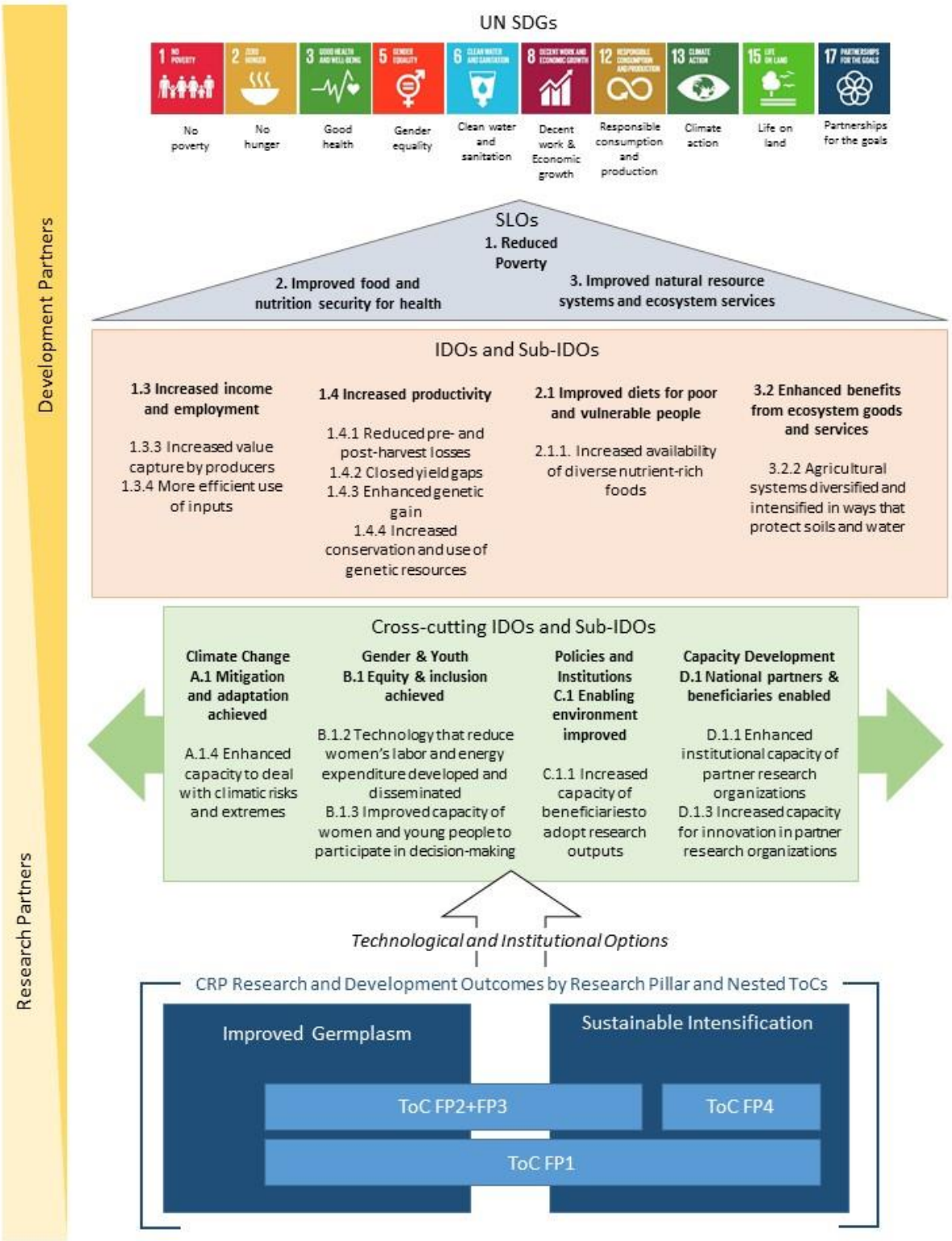


Figure 6: Phase-II MAIZE Theory of Change.

Annex 4a: Progress towards impact (external reviews)

2009	1. CGIAR social science stripe review (MAIZE SI1) 2. Hill maize research in Nepal (MAIZE SI4, bilateral) 3. CGIAR Harvest Plus review (MAIZE SI7) 4. Genotyping at CIMMYT (MAIZE SI9)
2010	1. Water efficient maize for Africa (MAIZE SI4, bilateral) 2. Conservation agriculture in southern Africa (MAIZE SI2, bilateral)
2011	1. Cereal systems initiative South Asia (MAIZE SI2 &SI3, bilateral) 2. New seed initiative for southern Africa (MAIZE SI4, bilateral) 3. Drought-tolerant maize for Africa (MAIZE SI4, bilateral) 4. MycoRed (MAIZE SI6, bilateral)
2012	1. CA and smallholder farmers in E&S Africa-Leveraging institutional innovations and policies (MAIZE SI1, bilateral) 2. NRM research in the CGIAR (MAIZE SI2, SI3) 3. Maize-rice systems in Bangladesh (MAIZE SI2, SI3 bilateral) 4. Enhancing total farm productivity in smallholder CA based systems in eastern Africa (MAIZE SI2, bilateral) 5. SIMLESA mid-term review (MAIZE SI2, bilateral) 6. Governance & Management of the cereal systems initiative South Asia (MAIZE SI2 &SI3, bilateral) 7. Mechanization in Bangladesh (MAIZE SI2, bilateral) 8. Alignment of MAIZE SI2 with CRP1.2 (internal between two CRPs involved) 9. Water efficient maize for Africa (MAIZE SI4, bilateral) 10. Review of the integrated breeding platform (MAIZE, SI9, bilateral)
2013	1. Gender audit of MAIZE (MAIZE) 2. Innovation system thinking for improved research impact (MAIZE SI2) 3. New seed initiative for southern Africa (MAIZE SI4, bilateral) 4. International maize improvement consortium (MAIZE SI5) 5. Transgenic strategy (MAIZE SI9) 6. Plant breeding support in the CGIAR (MAIZE SI4-9; BMGF) 7. Biotechnology research in the CGIAR (MAIZE SI4, SI8, SI9, ISPC)
2014	1. Review of capacity building & partnerships (MAIZE) 2. Global gender norms study (FP 5) 3. MLN studies (FP 3) 4. Three countries MAIZE adoption and impact studies (Nepal, Ethiopia and Malawi) (FP5)

	5. Trait preferences for heat-tolerant maize (FP5) 6. More than 20 value chain studies 7. More than 10 policy analysis
2015	1. CGIAR independent evaluation arrangement (MAIZE) 2. CGIAR internal audit unit (MAIZE) 3. Cereal systems initiative for South Asia (bilateral – FP1) 4. Water efficient maize for Africa (bilateral – FP3) 5. Harvest Plus (bilateral – FP5) 6. Improved maize for African soils (bilateral – FP3) 7. Farm power and conservation agriculture for sustainable intensification (bilateral – FP1) 8. Adoption pathways project (bilateral – FP5) 9. Sustainable intensification of maize-legume cropping systems for food security in eastern and southern Africa (SIMLESA; bilateral – FP1)
2016	1. Heat stress tolerant maize for South Asia (bilateral) 2. Nutritious maize for Ethiopia (bilateral) 3. IEA review – Partnerships 4. IEA Review – Gender 5. IEA review – Capacity Development

Annex 4b: Progress towards impact (adoption and impact assessments)

2010	A meta-analysis of community-based studies on quality protein maize (MAIZE SI7)
	Adoption and continued use of improved maize seeds: Case study of Central Ethiopia (MAIZE SI4, SI5)
	Determinants of agricultural technology adoption: The case of improved pigeon pea varieties in Tanzania (MAIZE SI2)
	How cost-effective is biofortification in combating micronutrient malnutrition? An ex ante assessment (MAIZE SI7)
	Potential for herbicide resistant maize seed for Striga control in Africa (MAIZE SI4)
	Quality protein maize: progress, impact, and prospects (MAIZE SI7)
	The effectiveness of quality protein maize in improving the nutritional status of young children in the Ethiopian highlands (MAIZE SI7)
	DTMA ex ante analysis - Potential impact of investments in drought tolerant maize in Africa (MAIZE SI4)
2011	Agricultural technology adoption, seed access constraints and commercialization in Ethiopia (MAIZE SI4, SI5)
	Agricultural technology, crop income, and poverty alleviation in Uganda (MAIZE SI1)
	Are soil conservation technologies "win-win?" A case study of Anjeni in the north-western Ethiopian highlands (MAIZE SI2)
	Assessing the influence of neighbourhood effects on the adoption of improved agricultural technologies in developing agriculture (MAIZE)
	Assessing the potential economic impact of Bacillus thuringiensis (Bt) maize in Kenya (MAIZE SI4)
	Determinants of improved maize seed and fertilizer adoption in Kenya (MAIZE SI2)
2012	Adoption and impact of DT maize in Zimbabwe (MAIZE SI4)
	Adoption of agricultural technologies in Kenya: How does gender matter (MAIZE)
	Adoption of bio-diversification, conservation tillage and modern seed: Welfare and environmental implications (MAIZE SI1)

	Adoption of interrelated sustainable agricultural practices in smallholder system: Evidence from rural Tanzania. Technological forecast and social change (MAIZE SI2)
	Adoption of multiple sustainable agricultural practices in rural Ethiopia (MAIZE SI2)
	Analysis of adoption and diffusion of improved maize varieties in Ethiopia (MAIZE SI4, SI5)
	Can metal silo technology offer solution to grain storage and food security problem in developing countries? An impact evaluation From Kenya (MAIZE SI6)
	Could farmer interest in a diversity of seed attributes explain adoption plateaus for modern maize varieties in Malawi? (MAIZE SI4)
	Estimating consumer willingness to pay for food quality with experimental auctions: the case of yellow versus fortified maize meal in Kenya (MAIZE SI7)
	Identifying recommendation domains for targeting dual-purpose maize-based interventions in crop-livestock systems in East Africa (MAIZE SI1)
	Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia (MAIZE SI1)
	Improved maize technologies and welfare outcomes in smallholder systems: Evidence from application of parametric and non-parametric approaches (MAIZE SI1)
	Maize impact in Zambia (MAIZE SI4, SI5)
	Poverty reduction effects of agricultural technology adoption: A micro-evidence from rural Tanzania MAIZE SI1)
	The choice of spatial and temporal cropping systems diversification in Malawi: impacts on crop income and agro-chemicals use (MAIZE SI2)
	Welfare effects of agricultural technology adoption: The case of improved groundnut varieties in rural Malawi (MAIZE SI2)
	Welfare impact of farm input subsidy and improved maize in Malawi (MAIZE SI1)
	Welfare impacts of maize-pigeon pea intensification in Tanzania (MAIZE SI2)

	What determines gender inequality in household food security in Kenya? Application of exogenous switching treatment regression (MAIZE SI1)
2013	What are the farm-level impacts of Malawi's farm input subsidy program? A critical review (MAIZE SI1)
	Food security as a gender issue: Why are female-headed households worse off compared to similar male-headed counterparts? (MAIZE SI1)
	Household, community, and policy determinants of food insecurity in rural Malawi (MAIZE SI1)
	Mapping the effect of market liberalisation policies on the maize seed systems in Kenya based on micro-evidence from 1992 to 2010 (MAIZE SI1)
	Maize stover use and sustainable crop production in mixed crop–livestock systems in Mexico (MAIZE SI2)
	Gender and innovation in agriculture: A case study of farmers' varietal preference of drought-tolerant maize in Southern Guinea Savannah region of Nigeria (MAIZE SI4)
	On-farm evaluation of maize varieties in the transitional and savannah zones of Ghana: Determinants of farmer preferences (MAIZE SI4)
	Potential impacts of increasing average yields and reducing maize yield variability in Africa (MAIZE SI4)
	Smallholder farmers' perceptions of drought risk and adoption of modern maize in Southern Malawi (MAIZE SI4)
	Economic analysis of modern maize varieties in Malawi (MAIZE SI4)
	Maize for food and feed in East Africa—The farmers' perspective (MAIZE SI7)
	Potential for dual-purpose maize varieties to meet changing maize demands: Overview (MAIZE SI7)
	Potential for dual-purpose maize varieties to meet changing maize demands: Synthesis (MAIZE SI7)
	Assessing the potential of dual-purpose maize in southern Africa: A multi-level approach (MAIZE SI7)

	Identifying recommendation domains for targeting dual-purpose maize-based interventions in crop-livestock systems in East Africa (MAIZE SI7)
	The role of farming experience on the adoption of agricultural technologies: evidence from smallholder farmers in Uganda
2014	From adoption claims to understanding farmers and contexts: A literature review of Conservation Agriculture (CA) adoption among smallholder farmers in southern Africa
	Determinants of smallholder farmers' hybrid maize adoption in the drought prone Central Rift Valley of Ethiopia
	Impact of improved maize adoption on welfare of farm households in Malawi: A panel data analysis
	Measuring the impacts of Malawi's farm input subsidy program
	Understanding the impact and adoption of conservation agriculture in Africa: A multi-scale analysis
	Consumer acceptance of quality protein maize (QPM) in East Africa
	Can agricultural input subsidies reduce the gender gap in modern maize adoption? Evidence from Malawi
	Improved maize varieties and household food security: Achieving impact in Tanzania
	Sustainable agricultural intensification in Ethiopia: Achieving maximum impact through adoption of suites of technologies
	Evaluating the impact of improved maize varieties on food security in Rural Tanzania: Evidence from a continuous treatment approach
	What determines gender inequality in household food security in Kenya? Application of exogenous switching treatment regression
	Economic, production and poverty impacts of investing in maize tolerant to drought in Africa
	The use of improved maize varieties in Tanzania
	Exploration of farmers' preferences and perceptions of maize varieties: implications on development and adoption of quality protein maize (QPM) varieties in Zimbabwe
	Adoption potential of Conservation Agriculture practices in sub-Saharan Africa: Results from five case studies

	Adoption and extent of conservation agriculture practices among smallholder farmers in Malawi
	Quantifying the impact of weather extremes on global food security: A spatial bio-economic approach
	Measuring the effectiveness of crop improvement research in sub-Saharan Africa from the perspective of varietal output, adoption, and change: 20 crops, 30 countries, and 1150 cultivars in farmers' fields
	Adoption and outcomes of hybrid maize in the marginal areas of India
2015	Analysis of adoption and impacts of improved maize varieties in eastern Zambia
	Determinants of child nutritional status in the eastern province of Zambia: the role of improved maize varieties
	Determinants of maize stover utilization as feed, fuel and soil amendment in mixed crop-livestock systems, Ethiopia
	Drought tolerant maize for farmer adaptation to drought in sub-Saharan Africa: Determinants of adoption in eastern and southern Africa
	Evaluation of artisan training in metal silo construction for grain storage in Africa: Impact on uptake, entrepreneurship and income
	Ex post impacts of improved maize varieties on poverty in rural Ethiopia
	Factors that transformed maize productivity in Ethiopia
	"Filling the maize basket" supports crop diversity and quality of household diet in Malawi
	Gendered food security in rural Malawi: why is women's food security status lower?
	The influence of gendered roles and responsibilities on the adoption of technologies that mitigate drought risk: The case of drought-tolerant maize seed in eastern Uganda
	Production risks and food security under alternative technology choices in Malawi: Application of a multinomial endogenous switching regression
	Social and income trade-offs of conservation agriculture practices on crop residue use in Mexico's central highlands

	Speed of adoption of improved maize varieties in Tanzania: An application of duration analysis
	Subsidies promote use of drought tolerant maize varieties despite variable yield performance under smallholder environments in Malawi
	Understanding the adoption of a portfolio of sustainable intensification practices in eastern and southern Africa
	Assessing the effectiveness of maize and wheat improvement from the perspectives of varietal output and adoption in East and southern Africa (book chapter in Walker & Alwang)
	Varietal adoption, outcomes and impact (book chapter in Walker & Alwang)
	Varietal generation and output (book chapter in Walker & Alwang)
	Maize technologies and rural poverty reduction in Ethiopia (book chapter in Walker & Alwang)
	Adoption and impacts of sustainable agricultural practices on maize yields and incomes: Evidence from rural Zambia
	Adoption of Striga (Striga hermonthica) management technologies in northern Nigeria
	Assessing the long-term welfare effects of the biological control of cereal stem borer pests in East and Southern Africa: Evidence from Kenya, Mozambique and Zambia
	Big constraints or small returns? Explaining non-adoption of hybrid maize in Tanzania
	Community-survey based assessment of the geographic distribution and impact of maize lethal necrosis (MLN) disease in Kenya
	Constraints in adopting improved technologies for maize cultivation: The case of Africa
	Determinants of child nutritional status in the eastern province of Zambia: The role of improved maize varieties
	Development of conservation agriculture (CA) systems In Malawi: Lessons learned from 2005 to 2014
	Effectiveness and economics of hermetic bags for maize storage: Results of a randomized controlled trial in Kenya

2016	Factors influencing farmers' adoption of energy-based water pumps and impacts on crop productivity and household income in Pakistan
	Future prospects for cereal and legume production
	Impact of irrigation water scarcity on rural household food security and income in Pakistan
	Maize yield effects of conservation agriculture based maize–legume cropping systems in contrasting agro-ecologies of Malawi and Mozambique
	Measuring rural consumers' willingness to pay for quality labels using experimental auctions: the case of aflatoxin-free maize in Kenya
	Resource saving and productivity enhancing impacts of crop management innovation packages in Ethiopia
	Targeting drought-tolerant maize varieties in Southern Africa: A geospatial crop modeling approach using big data
	The effect of major income sources on rural household food (in)security: Evidence from Swaziland and implications for policy
	The influence of gender and product design on farmers' preferences for weather-indexed crop insurance
	Understanding market participation choices and decisions of maize and cowpea farmers in northern Nigeria

Annex 5: Key performance indicators

MAIZE CRP										
#	CRPs concerned by this indicator	Indicators	Glossary & Comments	Deviation narrative (if actual is more than 10% away from target)	2012	2013	2014	2015	2016	
					Actual	Actual	Actual	Actual	Target	Total
KNOWLEDGE, TOOLS, DATA										
1	All	1. Number of flagship "products" produced by CRP	Glossary: These are frameworks and concepts. they should be likely to change the way stakeholders along the impact pathway allocate resources and/or implement activities. change the way these stakeholders think and act. For the CRP MAIZE, each Flagship Project is a flagship "product".	Following a standardization of CRP structures, the MAIZE strategy was reorganized around five Flagship Projects (FPs) in 2014, encompassing the nine Strategic Initiatives of the original MAIZE proposal	9	9	5	5	5	5
2	All	2. % of flagship products produced that have explicit target of women	Included in FPs: FP1 - Sustainable Intensification FP3 - Stress resilient and nutritious maze FP4 - Alignment with and strengthening maize seed systems for effective product	Following a standardization of CRP structures, the MAIZE strategy was reorganized around five Flagship Projects (FPs) in 2014, encompassing the nine Strategic Initiatives of the original MAIZE proposal	4	6	4	4	4	4

		farmers/NRM managers	delivery FP5 - Inclusive and profitable maize futures							
3	All	3. % of flagship products produced that have been assessed for likely gender-disaggregated impact	Included in FPs: FP1 - Sustainable Intensification FP3 - Stress resilient and nutritious maze FP4 - Alignment with and strengthening maize seed systems for effective product delivery FP5 - Inclusive and profitable maize futures	Following a standardization of CRP structures, the MAIZE strategy was reorganized around five Flagship Projects (FPs) in 2014, encompassing the nine Strategic Initiatives of the original MAIZE proposal		9 of which 2 more in-depth	4	4	4	4
4	All	4. Number of "tools" produced by CRP	Glossary: These are significant decision-support tools, guidelines, training manuals, software, and/or videos that are significant in that they should be likely to change the way stakeholders along the impact pathway allocate resources and/or implement activities		28 (16 co-developed with other CRPs)	27 (17 co-developed with other CRPs)	37	191	35	191
5	All	5. % of tools with explicit target of women farmers	Tools target men and women users equally			n/a				
6	All	6. % of tools assessed for likely gender-disaggregated impact	Tools target men and women users equally			55				

7	All	7. Number of open access databases maintained by CRP	Institutional Multimedia Publications Repository, Institutional Research Data and Software Repository, Germinate maize, Maize Doctor, Maize Atlas		1	12	5	5	5	5
8	All	8. Total number of users of these open access databases			592	3,370	185,331	71,857	100,000	121,882
9	All	9. Number of publications in ISI journals produced by CRP	From KPI database		84 (18 with other CRPs)	137	64	108	120	111
10	1,2,3, 4, 6	10. Number of strategic value chains analyzed by CRP				27	24	49	24	33
11	1,5,6,7	11. Number of targeted agro-ecosystems analysed/characterised by CRP								
12	1,5,6,7	12. Estimated population of above-								

		mentioned agro-ecosystems								
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS										
13	All	13. Number of trainees in short-term programs facilitated by CRP (male)	From CIMMYT Training database, plus Competitive Partner Grants and IITA Short-term = < 90 days		22,428 (15,144 with other CRPs)	36,588 (151 with other CRPs)	15,625	27,728	20,000	35,196
14	All	14. Number of trainees in short-term programs facilitated by CRP (female)	From CIMMYT Training database, plus Competitive Partner Grants and IITA Short-term = < 90 days		5,941 (73 with other CRPs) (IITA 15)	13,592 (73 with other CRPs)	9,204	11,401	6,000	11,059
15	All	15. Number of trainees in long-term programs facilitated by CRP (male)	From CIMMYT Training database, plus Competitive Partner Grants and IITA Long-term = > 90 days		37 (5 with other CRPs)	149 (7 with other CRPs)	181	60	60	74
16	All	16.Number of trainees in long-term programs facilitated by CRP (female)	From CIMMYT Training database, plus Competitive Partner Grants and IITA Long-term = >90 days		16 (1 shared other CRPs)	80 (4 with other CRPs)	86	38	30	57

17	1,5,6,7	17. Number of multi-stakeholder R4D innovation platforms established for the targeted agro-ecosystems by the CRPs	Latin America- 48, Asia-46, Sub-Saharan Africa- 72		75	87	132	168	80	166
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT										
18	All	18. Number of technologies /NRM practices under research in the CRP (Phase-I)			32,300	30,122	34,123	47,736	30,000	41,116
19	All	19. % of technologies under research that have an explicit target of women farmers								
20	All	20. % of technologies under research			55%					

		that have been assessed for likely gender-disaggregated impact									
21	1,5,6,7	21 Number of agro-ecosystems for which CRP has identified feasible approaches for improving ecosystem services and for establishing positive incentives for farmers to improve ecosystem functions as per CRP's recommends				5					
22	1,5,6,7	22. Number of people who will potentially benefit from plans, once finalized, for									

		the scaling up of strategies								
23	All, except 2	23. Number of technologies /NRM practices field tested (Phase-II)			1,180	1,554	2,063	2,855	1,200	4,095
24	1,5,6,7	24. Number of agro-ecosystems for which innovations (technologies, policies, practices, integrative approaches) and options for improvement at system level have been developed and are being field tested (Phase-II)			3	4				

25	1,5,6,7	25. % of above innovations/ approaches/ options targeted at decreasing inequality between men and women			3					
26	1,5,6,7	26. Number of published research outputs from CRP utilized in targeted agro-ecosystems			32					
27	All, except 2	27.Number of technologies /NRM practices released by public and private sector partners globally (Phase-III)			48	77	34	170	50	236
POLICIES IN VARIOUS STAGES OF DEVELOPMENT										

28	All	28. Numbers of Policies/ Regulations/ Administrative Procedures Analyzed (Stage 1)			3	1	12	10	8	18
29	All	29. Number of policies / regulations / administrative procedures drafted and presented for public/stakeholder consultation (Stage 2)			1	1	3	4	3	11
30	All	30. Number of policies / regulations / administrative procedures presented for legislation (Stage 3)	Underwent the third stage of the policy reform process (policies were presented for legislation/decree to improve the policy environment for smallholder-based agriculture.) Clearly identify in this cell the type of policy and the country/region concerned			0	0	6	5	1

31	All	31. Number of policies / regulations / administrative procedures prepared passed/approved (Stage 4)	Underwent the fourth stage of the policy reform process (official approval (legislation/decree) of new or revised policy / regulation / administrative procedure by relevant authority).			0	0	6	5	-
32	All	32. Number of policies / regulations / administrative procedures passed for which implementation has begun (Stage 5)	Completed the policy reform process (implementation of new or revised policy / regulation / administrative procedure by relevant authority) Clearly identify in this cell the type of policy and the country/region concerned			0	0	8	5	-
OUTCOMES ON THE GROUND										

33	All	33. Number of hectares under improved technologies or management practices as a result of CRP research	Given the lack of a comprehensive system that track global adoption, we synthesized available evidence based on key bilateral project progress reports and performance information collected in various institutional databases. The key geographic countries in which the adoption has been observed include: Ethiopia, Uganda, Kenya, Tanzania, Angola, Zambia, Malawi, Zimbabwe, Mozambique, Mexico, Nigeria, Benin, Ghana, Mali, India, Nepal, Bangladesh.		313,120	417,000	2,305,462	7,785,185	700,000	5,556,493
34	All	34. Number of farmers and others who have applied new technologies or management practices as a result of CRP research	Given the lack of a comprehensive system that track global adoption, we synthesized available evidence based on key bilateral project progress reports and performance information collected in various institutional databases. The key geographic countries in which the adoption has been observed include: Ethiopia, Uganda, Kenya, Tanzania, Angola, Zambia, Malawi, Zimbabwe, Mozambique, Mexico, Nigeria, Benin,		869,778	1,100,000	4,088,967	18,407,175	5,000,000	11,405,929

			Ghana, Mali, India, Nepal, Bangladesh.								

Annex 6: Interactions of MAIZE with other CRPs

	FPI	FP2, FP3 & FP4	FP5
Commodity CRPs	Give & Take: Innovations tested and integrated at common innovation platforms Give & Take: Systems analysis framework at various levels/scales refined	Give & Take: Collaboration on high-through genotyping platform (HTGP); Collaboration on decision support tools through the GOBII project Data and informatics tools (with WHEAT)	Give & Take: Innovations tested and integrated at common innovation platforms
Systems and NRM CRPs	Give: Precision agriculture and approaches to increase input use efficiency for better targeting Give & Take: development of sustainable intensification indicators and metrics at different geographical scales. Take: Systems approaches, technologies, methodologies; help ensure positive or neutral ecosystem impacts.	Give: System optimized germplasm Take: Learn about need for further adaptation	
Agriculture for Nutrition & Health	Give: Rural nutrition through a farming systems lens	Give: Provitamin A and kernel Zn-enriched improved maize germplasm in MAIZE genetic backgrounds Give & Take: Improved uptake of biofortified maize varieties by both public and private sector partners; Collaboration on biofortified maize seed scale-up and delivery in target countries in southern Africa	
CCAFS	Give: Technologies & information, long-term experiments; pilots at innovation platform sites. Give: Proof of concepts on climate smart technical innovations. Take: Models and tools	Give: Drought- and heat stress tolerant improved maize germplasm in South Asia and sub-Saharan Africa Take: Model impact on climate change	
Policies, Institutions and Markets	Give & Take: Overcoming value chain bottlenecks Give: Upscaling farm and landscape lessons learned to meso and meta levels.	Stewardship of genetic engineering research	Give: MAIZE specific data and learning Take: Foresight models, cross commodity value chain and seed sector policies

Annex 7: CRP financial reporting (LSeries)

Ref	Description	Comments
	Budget and financial reports	
L101	CRP cumulative financial summary	
L106	CRP annual funding summary	
L111	CRP annual financial summary	Total spending for the year by Center, including Gender expenditure
L121	CRP - Expenditure by natural classification report	Included mainly for reconciliation purposes and to eliminate double counting of CGIAR collaboration costs; note that it is the *net* amount (i.e. expenses excluding CGIAR collaboration costs) which should be used as the total for L111 and L131
L131	CRP - Flagship Projects report	Simplified - Source of funding no longer required; note that this report is still titled "Themes"; transition is underway and some CRPs are already recording costs by Flagship Project. If that is the case for your CRP, please change the title of the report.
L136	Gender expenditure by theme	
L141	CRP - Cluster of activities report	
	Analytical financial reports	
L211	CRP partnerships report	
Notes		
Most reports are for current year only. Exceptions are L101 which is multi-year (cumulative).		
All reports shown here are for individual CRP's. The Consortium Office will prepare consolidated CRP reports.		

Budget figures in all of the attached forms should be the annual confirmed budget (POWB) for the year.

W1/2 total will be as the financing plan notified by the Consortium Office, and W3/Bilateral the forecast prepared internally.

Actual events since the signing of the PIAs result in the budget per PIA no longer being a meaningful measure of performance.

For reporting purposes, please delete from L121 and L131 Centers not relevant to your CRP.

CRP No.3.2 - MAIZE	Cumulative financial summary
Period: 01/01/2016- 12/31/2016	

Amounts in USD (000's)

Report description: L101

Name of report: Cumulative financial summary

Frequency/Period: Annual

Deadline: Every April 15th

Summary report - by CG partners

	(a) Total POWB budget since inception					(b) Actual cumulative expenses					(c) Variance/Balance				
	Windows 1 & 2	**Window 3**	**Bilateral funding**	**Center funds**	**Total funding**	**Windows 1 & 2**	**Window 3**	**Bilateral funding**	**Center funds**	**Total funding**	**Windows 1 & 2**	**Window 3**	**Bilateral funding**	**Center funds**	**Total funding**
5. CIMMYT	62,412	95,113	170,003	-	327,528	61,609	88,054	153,462	-	303,125	803	7,059	16,541	-	24,403
11. IITA	9,250	10,480	43,069	-	62,806	9,250	10,115	42,090		61,455	-	372	979	-	1,351
Total for CRP	**71,662**	**105,600**	**213,072**	**-**	**390,334**	**70,859**	**89,169**	**195,551**	**-**	**364,580**	**803**	**7,431**	**17,520**	**-**	**25,754**
	18%	**27%**	**55%**	**0%**	**100%**	**19%**	**27%**	**54%**	**0%**	**100%**	**3%**	**29%**	**68%**	**0%**	**100%**

CRP No.3.2 - MAIZE

Period: 01/01/2016- 12/31/2016

Amounts in USD (000's)

Annual funding summary

Report Description L106

Name of Report: Annual funding summary

Frequency/Period: Annual

Deadline: Every April 15th

PART 1 - Annual FINANCE PLAN (Totals for Windows 1 and 2 combined)

Approved level for year - Initial approval (as per PIA)

Approved level for year - Final amount

PART 2 - Funding summary for year

		2016 Actual funding			
		Windows 1&2	Window 3	Bilateral Funding	Total Funding
	CIMMYT:				
1	USAID	-	14,970	627	15,597
2	BMGF	-	11,747	1,693	13,439
3	CGIAR Fund	10,213	-	-	10,213
4	SAGARPA	-	-	9,224	9,224
5	ACIAR	-	1,066	2,549	3,615

6	AATF	-	-	2,236	2,236
7	CIDA	-	-	1,109	1,109
8	IITA	-	-	1,004	1,004
9	GIZ	-	-	459	459
10	SFSA	-	-	401	401
11	U of Twente	-	-	349	349
12	Cornell	-	-	308	308
13	BBSRC	-	-	193	193
14	Harvard University	-	-	191	191
15	ICAR	-	191	-	191
16	USDA	-	-	176	176
17	FHMM	-	-	143	143
18	BISA	-	-	139	139
19	ICRISAT	-	-	108	108
20	ASARECA	-	-	94	94
21	ILRI	-	-	94	94
22	Purdue University	-	-	91	91
23	ICRAF	-	-	79	79
24	CAAS China	-	79	-	79
25	TDF	-	-	64	64
26	IPNI	-	-	62	62
27	FAO	-	-	57	57
28	FEDERCAFE	-	-	54	54
29	Others < US$?	-	10	336	345

IITA

1	CGIAR Fund (CIMMYT)	1,495	1,216	617	3,328
2	BMGF	-	-	14	14
3	AWF	-	-	46	46
4	MINADER	-	-	61	61
5	USAID	-	416	5	421
6	SYNGENTA	-	-	255	255
7	CORAF	-	-	169	169
9	FARA	-	-	3	3
10	ADA	-	102	-	102
11	AGRA	-	-	86	86
12	AFDB	-	-	10,032	10,032
13	IFAD	-	(1)	-	(1)
14	Netherlands	-	-	5	5
15	SWEDISH UNIV.OF AGRIC. SCIENCE	-	-	-	-
17	WACCI - GHANA	-	-	57	57
18	NIGERIA	-	-	42	42
20	USDA - ARS	-	-	73	73
22	NESTLE - SWITZERLAND	-	-	9	9
26	MOSANTO	-	-	46	46
27	L'Union Économique et Monétaire Ouest Africaine	-	-	(1)	(1)
28	Others < US$?	-	-	-	-
Total for CRP No. 3.2 - CRP on Maize		**11,708**	**29,795**	**33,356**	**74,859**

CRP No.3.2 - MAIZE
Period: 01/01/2016-12/31/2016

Annual financial summary by centers

Amounts in USD (000's)

Report description

L111

Name of report: Annual financial summary by centers & other participants

Frequency/Period: Annual

Deadline: Every April 15th

Summary report - by CG partners	(a) CRP 2016 POWB approved budget					(b) CRP 2016 expenditure					(c) Variance this year				
	Windows 1 & 2	Window 3	Bilateral funding	Center funds	Total funding	Windows 1 & 2	Window 3	Bilateral funding	Center funds	Total funding	Windows 1 & 2	Window 3	Bilateral funding	Center funds	Total funding
5. CIMMYT	11,016	32,531	28,071	-	71,618	10,213	28,062	21,837	-	60,112	803	4,469	6,234	-	11,506
11. IITA	1,495	1,549	11,461	-	14,505	1,495	1,733	11,519	-	14,747	-	(184)	(58)	-	(242)
Total for CRP	**12,511**	**34,080**	**39,532**	**-**	**86,123**	**11,708**	**29,795**	**33,355**	**-**	**74,859**	**803**	**4,285**	**6,176**	**-**	**11,265**
	15%	**40%**	**46%**	**0%**	**100%**	**16%**	**40%**	**45%**	**0%**	**100%**	**7%**	**38%**	**55%**	**0%**	**100%**

Annual financial summary by natural classification

CRP No. 3.2, MAIZE

Period: 01/01/2016- 12/31/2016

Amounts in USD 000's

Report description: L121

Name of report: Financial summary by natural classification lines

Frequency/Period: Annual

Deadline: Every April 15th

	POWB approved budget					Actual					Unspent/Variance				
Total CRP 3.2, CRP on Maize	**Windows 1 & 2**	**Window 3**	**Bilateral funding**	**Center funds**	**Total funding**	**Windows 1 & 2**	**Window 3**	**Bilateral funding**	**Center funds**	**Total funding**	**Windows 1 & 2**	**Window 3**	**Bilateral funding**	**Center funds**	**Total funding**
Personnel	4,349	8,396	11,323	-	24,068	4,349	6,992	9,530	-	20,871	(0)	1,404	1,793	-	3,197
Collaborators costs - CGIAR Centers	303	2,505	5,781	-	8,589	303	2,704	5,734	-	8,741	-	(199)	47	-	(152)
Collaborator costs – Partners	1,674	6,648	7,789	-	16,111	1,674	7,185	5,018	-	13,877	-	(537)	2,772	-	2,234
Supplies and services	3,841	10,140	10,195	-	24,176	3,037	8,143	9,294	-	20,475	803	1,997	901	-	3,701
Operational travel	427	1,062	1,243	-	2,732	427	1,114	1,224	-	2,765	(0)	(52)	19	-	(33)
Depreciation	585	1,659	515	-	2,759	585	712	510	-	1,807	(0)	947	5	-	952
Sub-total of direct costs	**11,178**	**30,411**	**36,847**	**-**	**78,436**	**10,375**	**26,851**	**31,310**	**-**	**68,536**	**803**	**3,560**	**5,537**	**-**	**9,900**
Indirect costs	1,333	3,669	2,685	-	7,687	1,333	2,944	2,046	-	6,323	(0)	725	639	-	1,365
Total - All costs	**12,511**	**34,080**	**39,532**	**-**	**86,123**	**11,708**	**29,795**	**33,355**	**-**	**74,858**	**803**	**4,285**	**6,176**	**-**	**11,265**
LESS Coll costs CGIAR Centers	(303)	**(2,505)**	**(5,781)**	**-**	**(8,589)**	(303)	**(2,704)**	**(5,734)**	**-**	**(8,741)**	**-**	**199**	**47**	**-**	**152**
Total net costs	12,208	31,575	33,751	-	77,534	11,405	27,091	27,621	-	66,117	803	4,484	6,130	-	11,417

Amounts for each participating center below

CIMMYT	POWB approved budget				Actual				Unspent/Variance			
Personnel	3,595	8,049	9,123	20,767	3,595	6,603	7,319	17,517	(0)	1,446	1,804	3,250
Collaborators costs - CGIAR Centers	303	2,505	183	2,991	303	2,704	108	3,115	-	(199)	75	(124)
Collaborator costs - Partners	1,654	6,436	6,778	14,867	1,654	6,947	4,001	12,602	-	(511)	2,777	2,265
Supplies and services	3,371	9,489	8,335	21,196	2,567	7,416	7,425	17,408	803	2,074	911	3,788
Operational travel	374	953	646	1,973	374	993	624	1,990	(0)	(39)	22	(17)
Depreciation	559	1,641	464	2,665	559	693	459	1,710	0	948	6	954
Sub-total of direct costs	**9,855**	**29,073**	**25,529**	**64,457**	**9,052**	**25,354**	**19,935**	**54,341**	**803**	**3,718**	**5,594**	**10,116**
Indirect costs	1,161	3,458	2,542	7,161	1,161	2,708	1,902	5,770	(0)	751	640	1,391
Total - All costs	**11,016**	**32,531**	**28,071**	**71,618**	**10,213**	**28,062**	**21,837**	**60,112**	**803**	**4,469**	**6,234**	**11,506**
LESS coll costs CGIAR Centers	(303)	**(2,505)**	**(183)**	**(2,991)**	**(303)**	**(2,704)**	**(108)**	**(3,115)**	**-**	**199**	**(75)**	**124**
Total net costs	**10,713**	**30,026**	**27,888**	**68,628**	**9,910**	**25,358**	**21,729**	**56,997**	**803**	**4,668**	**6,159**	**11,631**

IITA	POWB approved budget				Actual				Unspent/Variance			
Personnel	754	348	2,200	3,302	754	389	2,211	3,355	-	(42)	(11)	(53)
Collaborators costs - CGIAR Centers	-	-	5,598	5,598	-	-	5,626	5,626	-	-	(28)	(28)
Collaborator costs - Partners	20	213	1,012	1,244	20	238	1,017	1,275	-	(26)	(5)	(31)
Supplies and services	470	651	1,860	2,980	470	728	1,869	3,067	-	(77)	(9)	(87)
Operational travel	53	109	597	759	53	122	600	775	-	(12)	(3)	(15)
Depreciation	26	18	51	95	26	20	51	97	-	(2)	(0)	(2)
Sub-total of direct costs	**1,323**	**1,338**	**11,318**	**13,979**	**1,323**	**1,497**	**11,375**	**14,194**	**-**	**(159)**	**(57)**	**(216)**
Indirect costs	172	211	143	526	172	236	144	552	-	(25)	(1)	(26)
Total - All costs	**1,495**	**1,549**	**11,461**	**14,505**	**1,495**	**1,733**	**11,519**	**14,747**	**-**	**(184)**	**(58)**	**(241)**
LESS coll costs CGIAR Centers	-	-	**(5,598)**	**(5,598)**	-	-	**(5,626)**	**(5,626)**	-	-	**28**	**28**
Total net costs	**1,495**	**1,549**	**5,863**	**8,907**	**1,495**	**1,733**	**5,892**	**9,120**	**-**	**(184)**	**(29)**	**(213)**

Annual financial summary by flagship project

CRP No. 3.2, MAIZE
Period: 01/01/2016-12/31/2016
Amounts in USD 000's

Report description	L131
Name of report:	Financial summary by flagship project
Frequency/Period:	Annual
Deadline:	Every April 15th

	POWB approved	Current year actual expenditures	Unspent budget
Summary report - by flagship project			
Flagship 1 - Sustainable intensification of maize-based cropping systems.	25,729	21,735	3,994
Flagship 2 - Novel tools, technologies and traits for improving genetic gains and breeding efficiency.	9,948	9,201	747
Flagship 3 - Stress resilient and nutritious maize.	22,320	19,610	2,709
Flagship 4 - Aligning with and strengthening maize seed systems for effective product delivery.	17,652	15,304	2,348
Flagship 5 - Inclusive and profitable maize futures.	9,332	7,865	1,467
CRP management/coordination	1,144	1,144	(0)
Total - All costs	**86,123**	**74,858**	**11,265**

CIMMYT			
Flagship 1 - Sustainable intensification of maize-based cropping systems.	20,796	16,665	4,130
Flagship 2 - Novel tools, technologies and traits for improving genetic gains and breeding efficiency.	9,174	8,424	750
Flagship 3 - Stress resilient and nutritious maize.	20,323	17,645	2,677
Flagship 4 - Aligning with and strengthening maize seed systems for effective product delivery.	14,132	11,690	2,442
Flagship 5 - Inclusive and profitable maize futures.	6,173	4,666	1,507
CRP management/coordination	1,022	1,022	(0)
Total - All costs	71,618	60,112	11,506

IITA			
Flagship 1 - Sustainable intensification of maize-based cropping systems.	4,933	5,070	(137)
Flagship 2 - Novel tools, technologies and traits for improving genetic gains and breeding efficiency.	774	777	(3)
Flagship 3 - Stress resilient and nutritious maize.	1,997	1,965	32
Flagship 4 - Aligning with and strengthening maize seed systems for effective product delivery.	3,520	3,614	(94)
Flagship 5 - Inclusive and profitable maize futures.	3,159	3,199	(40)
CRP management/coordination	122	122	-
Total - All costs	14,505	14,747	(242)

CRP No. 3.2, MAIZE
Period: 01/01/2016- 12/31/2016
Amounts in USD 000's

Annual financial summary of gender by flagship project

Report description: L136

Name of report:	Financial summary of gender expenditure by flagship project
Frequency/Period:	Annual
Deadline:	Every April 15th

	POWB approved	Current year actual expenditures	Unspent budget
Summary gender report - by flagship project			
Flagship 1 - Sustainable intensification of maize-based cropping systems.	8,086	7,454	632
Flagship 2 - Novel tools, technologies and traits for improving genetic gains and breeding efficiency.	1,450	1,421	29
Flagship 3 - Stress resilient and nutritious maize.	4,537	4,085	451
Flagship 4 - Aligning with and strengthening maize seed systems for effective product delivery.	6,657	6,209	448
Flagship 5 - Inclusive and profitable maize futures.	5,025	4,634	391
CRP management/coordination	102	102	0
Total - All costs	**25,856**	**23,905**	**1,951**

CIMMYT			
Flagship 1 - Sustainable intensification of maize-based cropping systems.	3,153	2,385	768
Flagship 2 - Novel tools, technologies and traits for improving genetic gains and breeding efficiency.	676	644	32
Flagship 3 - Stress resilient and nutritious maize.	2,540	2,120	419
Flagship 4 - Aligning with and strengthening maize seed systems for effective product delivery.	3,137	2,595	542
Flagship 5 - Inclusive and profitable maize futures.	1,866	1,435	431
CRP management/coordination	102	102	0
Total - All costs	11,473	9,281	2,192

IITA			
Flagship 1 - Sustainable intensification of maize-based cropping systems.	4,933	5,069	(136)
Flagship 2 - Novel tools, technologies and traits for improving genetic gains and breeding efficiency.	774	777	(3)
Flagship 3 - Stress resilient and nutritious maize.	1,997	1,965	32
Flagship 4 - Aligning with and strengthening maize seed systems for effective product delivery.	3,520	3,614	(94)
Flagship 5 - Inclusive and profitable maize futures.	3,159	3,199	(40)
CRP management/coordination	-	-	-
Total - All costs	14,383	14,624	(241)

CRP No. 3.2, MAIZE
Period: 01/01/2016- 12/31/2016
Amounts in USD 000's

CRP Partnership report

Report description **L211**

Name of report: CRP partnerships report
Frequency/Period: Annual
Deadline: Every April 15th

Total CRP 3.2, CRP on Maize					**Actual expenses - This year**				
Item	**Institute acronym**	**Institute name**	**Country**		**Windows 1 & 2**	**Window 3**	**Bilateral**	**Center funds**	**TOTAL**
CIMMYT									
1	AATF	The African Agricultural Technology Foundation	Africa		-	70	-	-	**70**
2	AGRA	The Alliance for a Green Revolution in Africa	Africa		-	64	-	-	**64**
3	ARIH	Agricultural Research Institute Hombolo	Tanzania		-	-	55	-	**55**
4	CIAT	Centro Internacional de Agricultura Tropical	Colombia		-	77	101	-	**178**
5	CIRAD	Centro de Cooperación Internacional en Investigación Agronómica para el Desarrollo	France		60	-	-	-	**60**
6	CPM Agree	Seed production project in Malawi	Africa		-	66	-	-	**66**
7	CSIS	Center for Strategic and International Studies	USA		-	70	-	-	**70**

8	CSU	Charles Sturt University	Australia		157	-	-	-	**157**
9	CU	Columbia University	USA		-	75	-	-	**75**
10	Diversity Arrays	Diversity Arrays Technology PTY LTD.	Australia		50	-	152	-	**202**
11	DTMASS	Drought Tolerant Maize for Africa Seed Scaling	Africa		-	1,084	-	-	**1,084**
12	EIAR	Ethiopian Institute of Agricultural Research	Ethiopia		-	168	247	-	**415**
13	FARM RADIO	Farm Radio International	Canada		-	-	104	-	**104**
14	FUNDIT	Fundación para la Innovación Tecnológica Agropecuaria y Forestal	Guatemala		-	901	-	-	**901**
15	ICAR	Indian Council of Agricultural Research	India		-	185	-	-	**185**
16	ICRAF	World Agroforestry Center / ICRAF	Kenya		-	-	100	-	**100**
17	IDE	International Development Enterprises	Bangladesh		-	228	-	-	**228**
18	IDEI	International Development Enterprises	India		-	54	-	-	**54**
19	IFPRI	International Food Policy Research Institute	USA		-	133	-	-	**133**
20	IIASA	The International Institute for Applied Systems Analysis	Australia		68	-	-	-	**68**

21	IITA	International Institute of Tropical Agriculture	Nigeria		223	2,030	-	-	**2,254**
22	ILRI	International Livestock Research Institute	Kenya		80	-	-	-	**80**
23	INIFAP	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias	Mexico		-	-	272	-	**272**
24	IRRI	The International Rice Research Institute	Philippines		-	446	-	-	**446**
25	IWMBD	Institute of Water Modelling	Bangladesh		-	-	55	-	**55**
26	KENDAT	Kenya Network for Dissemination of Agricultural Technologies	Kenya		-	92	-	-	**92**
27	Kenya Seed	Kenya Seed Company Ltd	Kenya		-	88	-	-	**88**
28	KIT	Royal Tropical Institute	Netherlands		180	-	-	-	**180**
29	KLEIN	Klein Karoo Seed Zambia Ltd	Africa		-	56	-	-	**56**
30	NARO	National Agricultural Research Organization	Uganda		-	132	-	-	**132**
31	NASECO	NASECO	Uganda		-	54	-	-	**54**
32	ORNL	Oak Ridge National Laboratory (ORNL)	USA		68	-	-	-	**68**
33	PATTI	Patti Petesch	USA		60	-	-	-	**60**
34	PIONEER HI-BRED	Pioneer Hi-Bred International, Inc.	USA		-	793	582	-	**1,375**

35	PURDUE	Purdue University	USA		-	258	-	-	**258**
36	Regents umn	Regents of the University of Minnesota	USA		-	198	-	-	**198**
37	SARI	SARI External	Mexico		-	67	-	-	**67**
38	SDC	Society Development Committee	Bangladesh		-	115	-	-	**115**
39	SHZRDI	Southern Highlands Research zone	Tanzania		-	53	-	-	**53**
40	TLZ	Total Landcare Zambia	Africa		-	52	-	-	**52**
41	UACH	Universidad Autónoma de Chapingo	Mexico		-	-	83	-	**83**
42	UBarcelona	University the Barcelona	Spain		113	-	-	-	**113**
43	UH	Universität Hohenheim	Germany		-	60	-	-	**60**
44	UQ	The University of Queensland	Australia		-	-	555	-	**555**
45	UR	University of Reading	England		-	120	-	-	**120**
46	US	University of Sheffield	England		100	-	-	-	**100**
47	USDA ARS	Agricultural Research Service	USA		-	105	-	-	**105**
48	WRC	Wheat Research Centre	Bangladesh		-	52	-	-	**52**
49	WUR	Wageningen University and Research Centre	Netherlands		657	75	-	-	**732**
50	Other < 50k	Others	Others		141	1,577	1,497	-	**3,215**
	IITA:								
1	PREMIER SEED	PREMIER SEED	Nigeria		-	10	-	-	**10**

2	UNILORIN	UNILORIN	Nigeria		-	14	32	-	**46**
3	AFRICARICE	AFRICARICE	Côte d'Ivoire		-	-	2,586	-	**2,586**
4	IITA	IITA	DRC-KINS		-	-	2	-	**2**
5	IITA	IITA	Nigeria		-	-	576	-	**576**
6	IITA	IITA	Ghana		-	-	36	-	**36**
7	Bayero University	Bayero University	Nigeria		-	-	18	-	**18**
8	University Of Ghana	University Of Ghana	Ghana		-	-	17	-	**17**
9	ICARDA	ICARDA	Tunisia		-	-	3,040	-	**3,040**
10	KADP	Kaduna State Agricultural Development Project	Nigeria		-	-	9	-	**9**
11	INERA	INERA	Congo		-	-	21	-	**21**
12	INRAB	INRAB	Benin Republic		-	45	-	-	**45**
13	SARI	SARI	Ghana		-	23	7	-	**30**
14	NAERLS	NAERLS	Nigeria		-	10	18	-	**28**
15	KTARDA	Kastina state Agricultural and Rural Authority	Nigeria		-	-	7	-	**7**
16	IER	IER	Mali		-	47	85	-	**132**
17	CRI	CRI	Ghana		-	27	-	-	**27**
18	IAR	IAR	Nigeria		-	44	19	-	**63**
19	KU LEUVEN	Katholieke Universiteit, Leuven	Belgium		-	-	98	-	**98**

20	IRAD	IRAD	Cameroon		10	-	15	-	**25**
21	BAKER TILLY	BAKER TILLY	Nigeria		-	-	4	-	**4**
22	ARS	United States Department of Agriculture	USA		-	-	1	-	**1**
23	M & B SEEDS & AGRIC.	M & B SEEDS & AGRIC.	Ghana		-	5	-	-	**5**
24	Oyo State Agricultural Dev	Oyo State Agricultural Dev	Nigeria		-	-	13	-	**13**
25	Universite De Parakou	Universite De Parakou	Benin Republic		-	3	-	-	**3**
26	Malkerns Research Station (MRS)	Malkerns Research Station (MRS)	Swaziland		10	-	-	-	**10**
27	AVRDC	The World Vegetable Center	Taiwan		-	-	3	-	**3**
28	MASLASHA	Zamfara State Agricultural Development (ZADP)	Nigeria		-	10	11	-	**21**
29	NADP	Nasarawa State Agricultural Development Project (NADP)	Nigeria		-	-	19	-	**19**
30	KWARA STATE AGRICULTUR DEV	KWARA STATE AGRICULTUR DEV	Kwara State Agricultural Dev NIGERIA		-	-	6	-	**6**
									-
Total for CRP 3.2, CRP on Maize					**1,977**	**9,889**	**10,752**	**-**	**22,618**

5. CIMMYT					Actual expenses - This year				
Item	Institute acronym	Institute name	Country		Windows 1 & 2	Window 3	Bilateral	Center funds	TOTAL
1	AATF	The African Agricultural Technology Foundation	Africa			70			**70**
2	AGRA	The Alliance for a Green Revolution in Africa	Africa			64			**64**
3	ARIH	Agricultural Research Institute Hombolo	Tanzania				55		**55**
4	CIAT	Centro Internacional De Agricultura Tropical	Colombia			77	101		**178**
5	CIRAD	Centro de Cooperación Internacional en Investigación Agronómica para el Desarrollo	France		60				**60**
6	CPM Agree	Seed production project in Malawi	Africa			66			**66**
7	CSIS	Center for Strategic and International Studies	USA			70			**70**
8	CSISA	Cereal Systems Initiative for South Asia	Bangladesh			55			**55**
9	CSU	Charles Sturt University	Australia		157				**157**
10	CU	Columbia University	USA			75			**75**

11	Diversity Arrays	Diversity Arrays Technology PTY LTD.	Australia		50		152		**202**
12	DTMASS	Drought Tolerant Maize for Africa Seed Scaling	Africa			1,084			**1,084**
13	EIAR	Ethiopian Institute of Agricultural Research	Ethiopia			168	247		**415**
14	FARM RADIO	Farm Radio International	Canada				104		**104**
15	FUNDIT	Fundación para la Innovación Tecnológica Agropecuaria y Forestal	Guatemala			901			**901**
16	ICAR	Indian Council of Agricultural Research	India			185			**185**
17	ICRAF	World Agroforestry Center	Kenya				100		**100**
18	IDE	International Development Enterprises	Bangladesh			228			**228**
19	IDEI	International Development Enterprises	India			54			**54**
20	IFPRI	INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE	USA			133			**133**
21	IIASA	The International Institute for Applied Systems Analysis	Australia		68				**68**
22	IITA	International Institute of Tropical Agriculture	Nigeria		223	2,030			**2,254**
23	ILRI	International Livestock Research Institute	Kenya		80				**80**

24	INIFAP	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias	Mexico				272		**272**
25	IRRI	The International Rice Research Institute	Philippines			446			**446**
26	IWMBD	Institute of Water Modelling	Bangladesh				55		**55**
27	KENDAT	Kenya Network for Dissemination of Agricultural Technologies	Kenya			92			**92**
28	Kenya Seed	Kenya Seed Company Ltd.	Kenya			88			**88**
29	KIT	Royal Tropical Institute	Netherlands		180				**180**
30	KLEIN	Klein Karoo Seed Zambia Ltd.	Africa			56			**56**
31	NARO	National Agricultural Research Organization	Uganda			132			**132**
32	NASECO	NASECO	Uganda			54			**54**
33	ORNL	Oak Ridge National Laboratory (ORNL)	USA		68				**68**
34	PATTI	Patti Petesch	USA		60				**60**
35	PIONEER HI-BRED	Pioneer Hi-Bred International, Inc.	USA			793	582		**1,375**
36	PURDUE	Purdue University	USA			258			**258**
37	Regentsumn	Regents of the University of Minnesota	USA			198			**198**
38	SARI	SARI External	Mexico			67			**67**

39	SDC	Society Development Committee	Bangladesh			115			**115**
40	SHZRDI	Southern Highlands Research zone	Tanzania			53			**53**
41	SIMLESA	Sustainable Intensification of Maize and Legume Systems for Food Security in Eastern and Southern Africa	Africa				306		**306**
42	TLZ	Total Landcare Zambia	Zambia			52			**52**
43	UACH	Universidad Autónoma de Chapingo	Mexico				83		**83**
44	Ubarcelona	University the Barcelona	Spain		113				**113**
45	UH	Universität Hohenheim	Germany			60			**60**
46	UQ	The University of Queensland	Australia				555		**555**
47	UR	University of Reading	England			120			**120**
48	US	University of Sheffield	England		100				**100**
49	USDA ARS	Agricultural Research Service	USA			105			**105**
50	WRC	Wheat Research Centre	Bangladesh			52			**52**
51	WUR	Wageningen University and Research Centre	Netherlands		657	75			**732**
52	Other < 50k	Others	Others		141	1,577	1,497		**3,215**
Total for CRP					**1,957**	**9,651**	**4,109**	**-**	**15,717**

11. IITA					**Actual expenses - This year**				
Item	**Institute acronym**	**Institute name**	**Country**		**Windows 1 & 2**	**Window 3**	**Bilateral**	**Center funds**	**TOTAL**
1	PREMIER SEED	PREMIER SEED	Nigeria			10		-	**10**

2	UNILORIN	UNILORIN	Nigeria			14	32	-	**46**
3	AFRICARICE	AFRICARICE	Côte d'Ivoire				2,586	-	**2,586**
4	IITA	IITA	DRC-KINS				2	-	**2**
5	IITA	IITA	Nigeria				576	-	**576**
6	IITA	IITA	Ghana				36		**36**
7	BAYERO UNIVERSITY	BAYERO UNIVERSITY	Nigeria				18	-	**18**
8	UNIVERSITY OF GHANA	UNIVERSITY OF GHANA	Ghana				17	-	**17**
9	ICARDA	ICARDA	Tunisia				3,040	-	**3,040**
10	KADP	Kaduna State Agricultural Development Project	Nigeria				9	-	**9**
11	INERA	INERA	Congo				21	-	**21**
12	INRAB	INRAB	Benin Republic			45		-	**45**
13	SARI	SARI	Ghana			23	7	-	**30**
14	NAERLS	NAERLS	Nigeria			10	18	-	**28**
15	KTARDA	Kastina State Agricultural and Rural Authority	Nigeria				7	-	**7**
16	IER	IER	Mali			47	85	-	**132**
17	CRI	CRI	Ghana			27		-	**27**
18	IAR	IAR	Nigeria			44	19	-	**63**
19	KU LEUVEN	Katholieke Universiteit, Leuven	Belgium				98		**98**
20	IRAD	IRAD	Cameroon		10		15	-	**25**
21	BAKER TILLY	BAKER TILLY	Nigeria				4	-	**4**

22	ARS	United States Department of Agriculture	USA				1	-	**1**
23	M & B SEEDS & AGRIC.	M & B SEEDS & AGRIC.	Ghana			5		-	**5**
24	Oyo State Agricultural Dev	Oyo State Agricultural Dev	Nigeria				13	-	**13**
25	UNIVERSITE DE PARAKOU	UNIVERSITE DE PARAKOU	Benin Republic			3		-	**3**
26	Malkerns Research Station (MRS)	Malkerns Research Station (MRS)	Swaziland		10			-	**10**
27	AVRDC	The World Vegetable Center	Taiwan				3		**3**
28	MASLASHA	Zamfara State Agricultural Development (ZADP)	Nigeria			10	11		**21**
29	NADP	Nasarawa State Agricultural Development Project (NADP)	Nigeria				19		**19**
30	Kwara State Agricultural Dev	Kwara State Agricultural Dev	Nigeria				6	-	**6**
Total for CRP					**20**	**238**	**6,643**	**-**	**6,901**

Annex 8: Contribution of MAIZE to Sub-IDOs, IDOs and SLOs of the new CGIAR 2016-2030 Strategy and Results Framework

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
Reduced poverty	**Increased resilience of the poor to climate change and other shocks**	Increased household capacity to cope with shocks						
		Reduced production risk						
	Enhanced smallholder market access	Improved access to financial and other services						
		Reduced market barriers						
	Increased incomes and employment	**Diversified enterprise opportunities**						
		Increased livelihood opportunities						
		Increased value capture by producers						
		More efficient use of inputs						

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
Reduced poverty & improved food and nutrition security for health	**Increased productivity**	**Reduced pre- and post-harvest losses, including those caused by climate change**						
		Closed yield gaps through improved agronomic and animal husbandry practices						
		Enhanced genetic gain						
		Increased conservation and use of genetic resource						
		Increased access to productive assets, including natural resources						
Improved food and nutrition security for health	**Improved diets for poor and vulnerable people**	**Increased availability of diverse nutrient-rich foods**						
		Increased access to diverse nutrient-rich foods						

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
		Optimized consumption of diverse nutrient-rich foods						
	Improved food safety	Reduced biological and chemical hazards in the food system						
		Appropriate regulatory environment for food safety						
	Improved human and animal health through better agricultural practices	Improved water quality						
		Reduced livestock and fish disease risks associated with intensification and climate change						
		Increased safe use of inputs						
Improved natural resource	Natural capital enhanced and protected,	Land, water and forest degradation (including deforestation) minimized and reversed						

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
systems and ecosystems services	especially from climate change	Enhanced conservation of habitats and resources						
		Increased genetic diversity of agricultural and associated landscapes						
	Enhanced benefits from ecosystem goods and services	More productive and equitable management of natural resources						
		Agricultural systems diversified and intensified in ways that protect soils and water						
		Enrichment of plant and animal biodiversity for multiple goods and services						
		Increased resilience of agro-ecosystems and communities,						

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
	More sustainably managed agro-ecosystems	**especially those including smallholders**						
		Enhanced adaptive capacity to climate risks						
		Reduced net greenhouse gas emissions from agriculture, forests and other forms of land use						
Climate change	Mitigation and adaption achieved	Reduced net greenhouse gas emissions from agriculture, forests and other forms of land use						
		Increased above- and below-ground biomass for carbon sequestration						
		Improved forecasting of impacts of climate change and targeted technology development						

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
		Enhanced capacity to deal with climatic risks and extremes						
		Enabled environment for climate resilience						
Gender and youth	**Equity and inclusion achieved**	**Gender-equitable control of productive assets and resources**						
		Technologies that reduce women's labor and energy expenditure developed and disseminated						
		Improved capacity of women and young people to participate in decision-making						
Policies and institutions		**Increased capacity of beneficiaries to adopt research outputs**						

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
	Enabling environment improved	**Increased capacity of partner organizations, as evidenced by rates of investment in agricultural research**						
		Conducive agricultural policy environment						
		Conducive environment for managing shocks and vulnerability, as evidenced in rapid resource mechanisms						
Capacity development	**National partners and beneficiaries enabled**	**Enhanced institutional capacity of partner research organizations**						
		Enhanced individual capacity in partner research organizations through training and exchange						
		Increased capacity for innovation in partner research organizations						

System-level outcomes (SLOs) / Cross-cutting issues	Intermediate development outcomes (IDOs)	Sub-IDOs	Novel diversity and tools	Breeding	Seed systems	Sustainable intensification	Adding value (new FP under Phase-II)	Enhanced impacts
		Increased capacity for innovation in partner development organizations and in poor and vulnerable communities						

Annex 9: List of MAIZE publications in peer-reviewed journals

List of Publications	Impact Factor
Abera, W., Hussein, S., Derera, J., Laing, M.D., Regasa, M.W. (2016). Heterosis and combining ability of elite maize inbred lines under northern corn leaf blight disease prone environments of the mid-altitude tropics. Euphytica, 208: 391-400.	1.618
Adamtey, N., Musyoka, M. W., Zundel, C., Cobo, J. G., Karanja, E., Fiaboe, K. K., Muriuki, A., Mucheru-Muna, M., Vanlauwe, B., Berset, E., Messmer, M. M., Gattinger, A., Bhullar, G., Cadisch, G., Fliessbach, A., Mader, P., Niggli, U., Foster, D. (2016). Productivity, profitability and partial nutrient balance in maize-based conventional and organic farming systems in Kenya. Agriculture, Ecosystems and Environment, 235: 61-67.	3.564
Adetonah, S., Coulibaly, O., Satoguina, H., Sangare, A., Dossavi-yovo, N. H. (2016). Gender analysis in grain maize value chain in northern and central Benin. International Journal of Research in Social Sciences, 6(7): 51-64.	-
Akinola, A., Abdoulaye, T., Valbuena, D., Erenstein, O., Haileslasie, A., Germaine, I., Shehu, M., Ayedun, B. (2016). Determinants of crop residue use along an intensification gradient in West Africa's savannah zones. Tropicultura, 34: 396-410.	-
Akter, S., Khanam, F., Rossi, F.J., Krupnik, T.J. (2016). The influence of gender and product design on farmers' preferences for weather-indexed crop insurance. Global Environmental Change, 38: 217-229.	5.679
Alamu, E. O., Maziya-Dixon, B., Olaofe, O., Menkir, A. (2016). Evaluation of harvesting time and husk effects on retention of nutritional properties of boiled fresh orange maize hybrids. Ciencia e Tecnica Vitivinicola, 31 (6): 114-143.	0.14
Alamu, E. O., Maziya-Dixon, B., Popoola, I., Gondwe, T., Chikoye, D. (2016). Nutritional evaluation and consumer preference of legume fortified maize-meal porridge. Journal of Food and Nutrition Research, 4(10): 664-670.	-
Ali, A., Dil Bahadur Rahut, Behera, B. (2016). Factors influencing farmers' adoption of energy-based water pumps and impacts on crop productivity and household income in Pakistan. Renewable and Sustainable Energy Reviews, 54: 48-57.	6.798
Ali, A., Rahut, D.B., Imtiaz, M. (2016). Acceptability of GM foods among Pakistani consumers. GM Crops & Food, 7: 117-124.	1.55
Annor, B., Badu-Apraku, B. (2016). Gene action controlling grain yield and other agronomic traits of extra-early quality protein maize under stress and non-stress conditions. Euphytica, 212(2): 213-228.	1.618
Asiimwe, A., Tabu, I. M., Lemaga, B., Tumwegamire, S. (2016). Effect of maize intercrop plant densities on yield and B-carotene contents of orange-fleshed sweet potatoes. African Crop Science Journal, 24 (1): 75-87.	-
Awoyale, W., Maziya-Dixon, B., Alamu, E. O., Menkir, A. (2016). Effect of packaging materials and storage conditions on the degradation of xanthophylls in yellow-maize Ogi powder. Journal of Food and Nutrition Research, 4(8): 522-527.	-

Badu-Apraku, B., Fakorede, M., Gedil, M., Annor, B., Talabi, A. O., Akaogu, I. C., Oyekunle, M., Akinwale, R., Fasanmade, Y. (2016). Heterotic patterns of IITA and CIMMYT early-maturing yellow maize inbreds under contrasting environments. Agronomy Journal, 108(4): 1321-1336.	1.86
Badu-Apraku, B., Yallou, C., Haruna, A., Talabi, A. O., Akaogu, I. C., Annor, B., Adeoti, A. (2016). Genetic improvement of extra-early maize cultivars for grain yield and Striga resistance during three breeding eras. Crop Science, 56(5): 2564-2578.	1.758
Bathfield, B., Gasselin, P., García-Barrios, L., Vandame, R., Lopez-Ridaura, S. (2016). Understanding the long-term strategies of vulnerable small-scale farmers dealing with markets' uncertainty. The Geographical Journal, 182(2): 165-177.	3.206
Bentley, J.W.,Van Mele, P.,Harun-Ar-Rashid,Krupnik, T.J. (2016). Distributing and showing farmer learning videos in Bangladesh. Journal of Agricultural Education and Extension, 22(2): 179-197.	0.99
Beyene, Y., Semagn, F.K., Crossa, J., Mugo, S.N., Atlin, G.N., Tarekegne, A.T., Meisel, B., Sehabiague, P., Vivek, B., Oikeh, S.O., Alvarado, G., Machida, L., Olsen, M., Prasanna, B.M., Banziger, M. (2016). Improving maize grain yield under drought stress and non-stress environments in Sub-Saharan Africa using marker-assisted recurrent selection. Crop Science, 56: 1-10.	1.758
Beyene, Y., Semagn, F.K., Mugo, S.N., Prasanna, B.M., Tarekegne, A.T., Gakunga, J., Sehabiague, P., Meisel, B., Oikeh, S.O., Olsen, M., Crossa, J. (2016). Performance and grain yield stability of maize populations developed using marker-assisted recurrent selection and pedigree selection procedures. Euphytica, 208 (2): 285-297.	1.618
Brown, R. L., Williams, W. P., Windham, G., Menkir, A., Chen, Z. (2016). Evaluation of African-bred maize germplasm lines for resistance to aflatoxin accumulation. Agronomy, 6(2): 24.	-
Camacho Villa, C.T., Almekinders, C., Hellin, J., Martinez-Cruz, T.E., Rendon-Medel, R., Guevara-Hernández, F., Beuchelt, T.D., Govaerts, B. (2016). The evolution of the MasAgro hubs: responsiveness and serendipity as drivers of agricultural innovation in a dynamic and heterogeneous context. The Journal of Agricultural Education and Extension, 22 (5): 455-470.	0.99
Chaikam, V., Martinez, L., Melchinger, A.E., Schipprack, W., Prasanna, B.M. (2016). Development and validation of red root marker-based haploid inducers that effectively complement R1-nj (Navajo) marker-based in vivo haploid identification in maize. Crop Science, 56: 1678–1688.	1.758
Chamberlin, J., Ricker-Gilbert, J. (2016). Participation in rural land rental markets in Sub-Saharan Africa: who benefits and by how much? Evidence from Malawi and Zambia. American Journal of Agricultural Economics, 98 (5): 1507-1528.	1.436
Cheesman, S., Thierfelder, C., Eash, N.S., Kassie, G.T., Frossard, E. (2016). Soil carbon stocks in conservation agriculture systems of Southern Africa. Soil and Tillage Research, 156: 99-109.	3.371
Chen, J., Shrestha, R., Ding, J., Zheng, H., Mu, C., Wu, J., Mahuku, G. (2016). Genome-wide association study and qtl mapping reveal genomic loci associated with fusarium ear rot resistance in tropical maize germplasm, G3: Genes, Genomes, Genetics, 6(12): 3803-3815.	2.91
Chen, J., Zavala, C., Ortega, N. Petroli, C.D., Franco-Barrera, J., Burgueño, J., Costich, D.E., Hearne, S. (2016). The development of quality control genotyping approaches: A case study using elite maize lines. PLoS One, 11 (6): e0157236.	3.234

Chiuraise, N., Derera, J., Yobo, K.S., Magorokosho, C., Nunkumar, A., Qwabe, N.F.P. (2016). Progress in stacking aflatoxin and fumonis in contamination resistance genes in maize hybrids. Euphytica, 207(1): 49-67.	1.618
Choudhary, K.M., Nandal, D.P., Jat, M.L., Hooda, J.S., Verma, K.C. (2016). Impact of conservation agriculture on growth and development of rice-wheat and maize-wheat cropping system in western Indo-Gangetic plains. Annals of Biology, 32(2): 174-177.	2.103
Cortes-Soriano, I., Buendía-González, M.O., Palacios-Rojas, N., Martinez Cruz, E., Villaseñor Mir, H.E., Hortelano Santa Rosa, R. (2016). Evaluación de la calidad de tortilla de maíz adicionada con harina de avena (Avena Sativa L.) nixtamalizada = Quality assessment corn tortilla added with oatmeal (*Avena sativa* L.) nixtamalized. Revista Mexicana de Ciencias Agrícolas, 7(7): 1715-1725.	0.211
De Groote, H., Gitonga, Z., Kimenju, S.C., Keter, F., Ngigi, O. (2016). But what do rural consumers in Africa think about GM Food? AgBioForum, 19(1): 54-65.	0.83
De Groote, H., Gunaratna, N.S., Fisher, M., Kebebe, E.G., Mmbando, F., Friesen, D. (2016). The effectiveness of extension strategies for increasing the adoption of biofortified crops: the case of quality protein maize in East Africa. Food Security, 8(6): 1101-1121.	1.557
De Groote, H., Narrod, C., Kimenju, S.C., Bett, C., Scott, R.P.B., Tiongco, M.M., Gitonga, Z. (2016). Measuring rural consumers' willingness to pay for quality labels using experimental auctions: the case of aflatoxin-free maize in Kenya. Agricultural Economics, 47: 33-45.	1.739
De Groote, H., Oloo, F., Tongruksawattana, S., Das, B. (2016). Community-survey based assessment of the geographic distribution and impact of maize lethal necrosis (MLN) disease in Kenya. Crop Protection, 82: 30-35.	1.652
Díaz-José, J., Rendon-Medel, R., Govaerts, B., Aguilar-Ávila, J., Muñóz-Rodríguez, M. (2016). Innovation diffusion in Conservation Agriculture: a network approach. European Journal of Development Research, 28(2): 314-329.	0.72
Dinesh, A., Patil, A., Zaidi, P.H., Kuchanur, P.H., Vinayan, M.T., Seetharam, K. (2016). Genetic diversity, linkage disequilibrium and population structure among CIMMYT maize inbred lines, selected for heat tolerance study. Maydica, 61: 1-7.	0.484
Dinesh, A., Patil, A., Zaidi, P.H., Kuchanur, P.H., Vinayan, M.T., Seetharam, K. (2016). Line x testers analysis of tropical maize inbred lines under heat stress for grain yield and secondary traits. Maydica, 61: 1-4.	0.484
Dinesh, A., Patil, A., Zaidi, P.H., Kuchanur, P.H., Vinayan, M.T., Seetharam, K., Ameragouda. (2016). Dissection of heat tolerance mechanism in tropical maize. Research on Crops, 17(3): 462-467.	0.1
Du, Q., Wang, K., Xu, C., Zou, C., Xie, C.X., Xu, Y., Li, W-X. (2016). Strand-specific RNA-Seq transcriptome analysis of genotypes with and without low-phosphorus tolerance provides novel insights into phosphorus-use efficiency in maize. BMC Plant Biology, 16: 222.	3.631
Duncan, A.J., Bachewe, F., Mekonnen, K., Valbuena, D., Rachier, G., Lule, D., Bahta, M., Erenstein, O. (2016). Crop residue allocation to livestock feed, soil improvement and other uses along a productivity gradient in Eastern Africa. Agriculture, Ecosystems and Environment, 228: 101-110.	3.564

Fantaye, K.T., Seid, J., Getnet, M., Mamo, G. (2016). Agriculture under a changing climate in Ethiopia: challenges and opportunities for research. Ethiopian Journal of Agricultural Sciences. Special Issue: 67-86.	-
Fantaye, K.T., Sonder, K., Cairns, J.E., Magorokosho, C., Tarekegne, A.T., Kassie, G., Getaneh, F., Abdoulaye, T., Tsedeke Abate., Erenstein, O. (2016). Targeting drought-tolerant maize varieties in Southern Africa: a geospatial crop modeling approach using big data. The International Food and Agribusiness Management Review, 19(Special issue A): 75-92.	0.81
Farnworth, C.R., Baudron, F., Andersson, J.A., Misiko, M., Badstue, L., Stirling, C. (2016). Gender and conservation agriculture in East and Southern Africa: towards a research agenda. International Journal of Agricultural Sustainability, 14(2): 142-165.	1.538
Faux, A-M., Gorjanc G., Chris Gaynor, R., Battagin, M., Edwards, S.M., Wilson, D.L., Hearne, S.J., Gonen, S., Hickey, J.M. (2016). AlphaSim: Software for Breeding Program Simulation. The Plant Genome, 9(3): 1-14.	3.509
Frelat, R., Lopez-Ridaura, S., Giller, K.E., Herrero, M., Douxchamps, S., Andersson Djurfeldt, A., Erenstein, O., Henderson, B., Kassie, M., Paul, B., Rigolot, C., Ritzema, R.S., Rodriguez, D., Asten, P. van., Wijk, M.T. van. (2016). Drivers of household food availability in sub-Saharan Africa based on big data from small farms Africa based on big data from small farms. Proceedings of the Natural Academy of Sciences, 113(2): 458-463.	9.423
Glover, D., Sumberg, J., Andersson, J.A. (2016). The adoption problem; or why we still understand so little about technological change in African agriculture. Outlook on Agriculture, 45(1): 3-6.	0.437
Gorjanc, G., Jenko, J., Hearne, S., Hickey, J.M. (2016). Initiating maize pre-breeding programs using genomic selection to harness polygenic variation from landrace populations. BMC Genomics, 17: 30.	3.867
Gunaratna, N.S., Bosha, T., Belayneh, D., Fekadu, T., De Groote, H. (2016). Women's and children's acceptance of biofortified quality protein maize for complementary feeding in rural Ethiopia. Journal of the Science of Food and Agriculture, 96(10): 3439-3445.	2.076
Haileslassie A, Craufurd, P., Thiagarajah, R., Shalander Kumar, Whitbread, A., Rathor, A., Blummel, M., Ericsson, P., Krishna Reddy Kakumanu. (2016). Empirical evaluation of sustainability of divergent farms in the dryland farming systems of India. Ecological indicators, 60: 710-723.	3.19
Hassan, M. B., Baiyegunhi, L. J., Ortmann, G. F., Abdoulaye, T. (2016). Adoption of Striga (*Striga hermonthica*) management technologies in northern Nigeria. Agrekon, 55 (1): 168-188.	0.25
Hellin, J., Lopez-Ridaura, S. (2016). Soil and water conservation on Central American hillsides: if more technologies is the answer, what is the question? AIMS Agriculture and Food, 1(1): 194-207.	-
Hu, H., Schrag, T.A., Peis, R., Unterseer, S., Schipprack, W., Chen, S., Lai, J., Yan, J., Prasanna, B.M., Nair, S.K., Chaikam, V., Rotarenco, V., Shatskaya, O.A., Zavalishina, A., Scholten, S., Schön, C.C., Melchinger, A.E. (2016). The genetic basis of haploid induction in maize identified with a novel Genome-Wide Association method. Genetics, 202: 1267-1276.	5.963

Ittersum, M.K. van., Bussel, L.G.J. van.,Wolf, J., Grassini, P., Wart, J. van., Guilpart, N., Claessens, L., De Groote, H., Wiebe, K., Mason-D'Croz, D., Haishun Yang, Boogaard, H., Oort, P.J.A. van., Van Loon, M.P., Saito, K., Adimo, O., Adjei-Nsiah, S., Agali, A., Bala, A., Chikowo, R., Kaizzi, K., Kouressy, M., Makoi, J.H., Ouattara, K., Kindie Tesfaye Fantaye, Cassman, K.G. (2016). Can sub-Saharan Africa feed itself? Proceedings of the Natural Academy of Sciences, 113(52): 14964-14969.	9.423
Jaleta D.M., Kassie, M., Fantaye, K.T., Teklewold, T., Jena, P.R., Marenya, P., Erenstein, O. (2016). Resource saving and productivity enhancing impacts of crop management innovation packages in Ethiopia. Agricultural Economics, 47: 513-52.2	1.739
Jat, M.L., Balyan, J.K., Kumar, S., Dadhich, S.K. (2016). Effect of in situ moisture conservation practices on environmental, energetics and economic comparisons on maize + blackgram cropping system in dryland ecosystem. Annals of Biology, 32(2): 158-163.	-
Jayne, T.S., Chamberlin, J., Traub, L., Sitko, N.J., Muyanga, M., Yeboah, K., Anseeuw, W., Chapoto, A., Ayala Wineman, Nkonde, C., Kachule, R. (2016). Africa's changing farm size distribution patterns: the rise of medium-scale farms. Agricultural Economics, 47 (Suppl.): 197-214.	1.739
Kathage, J., Shiferaw, B., Qaim, M., Kassie, M. (2016). Big constraints or small returns? explaining non-adoption of hybrid maize in Tanzania. Applied Economic Perspectives and Policy, 38 (1): 113-131.	1.148
Kebede, A.T., Graaff, J., Kassie, M. (2016). Household-level determinants of soil and water conservation adoption phases: evidence from North-Western Ethiopian Highlands. Environmental Management, 57(3): 620-636.	1.857
Kihara, J., Huising, J. E., Nziguheba, G., Waswa, B., Njoroge, S., Kabambe, V. H., Iwuafor, E., Kibunja, C., Esilaba, A. O., Coulibaly, A. (2016). Maize response to macronutrients and potential for profitability in sub-Saharan Africa. Nutrient Cycling in Agroecosystems, 105(3): 171-181.	1.49
Ladha, J.K., Rao, A.N., Raman, A.K., Padre, T., Dobermann, A., Gathala, M.K., Kumar, V., Saharawat, Y.S., Sharma, S., Piepho, H.P., Alam, M.M., Liak, R., Rajendran, R., Reddy, C.K., Parsad, R., Sharma, P.C., Singh, S.S., Saha, A., Noor, S. (2016). Agronomic improvements can make future cereal systems in South Asia far more productive and result in a lower environmental footprint. Global Change Biology, 22(3): 1054-1074.	8.444
Likhayo, P., Bruce, A.Y., Mutambuki, K., Tadele Tefera, Mueke, J. (2016). On-farm evaluation of hermetic technology against maize storage pests in Kenya. Journal of Economic Entomology, 109 (4): 1-8.	1.847
López-Torres, J., Rendon-Medel, R., Camacho Villa, C.T. (2016). La comercialización de los maíces de especialidad en México: condiciones actuales y perspectivas = The marketing of specialty corns in Mexico: current conditions and prospects. Revista Mexicana de Ciencias Agrícolas, 15: 3075-3088.	-
Mabuza, M.L., Ortmann, G.F., Wale, E., Mutenje, M.J. (2016). The effect of major income sources on rural household food (in)security: Evidence from Swaziland and implications for policy. Ecology of Food and Nutrition, 55: 209-230.	-

Mafongoya, P., Rusinamhodzi, L., Siziba, S., Thierfelder, C., Mvumi, B.M., Nhau, B., Hove, L., Chivenge, P. (2016). Maize productivity and profitability in Conservation Agriculture systems across agro-ecological regions in Zimbabwe: A review of knowledge and practice. Agriculture, Ecosystems and Environment, 220: 211-225.	3.564
Mahuku, G., Jiafa Chen, Shrestha, R., Narro, L., Osorio Guerrero, K.V., Arcos, A.L., Yunbi Xu. (2016). Combined linkage and association mapping identifies a major QTL (qRtsc8-1), conferring tar spot complex resistance in maize Theoretical and Applied Genetics, 129: 1217-1229.	3.90
Manda, J., Alene, A.D., Gardebroek, C., Kassie, M., Tembo, G. (2016). Adoption and impacts of sustainable agricultural practices on maize yields and incomes: evidence from rural Zambia. Journal of Agricultural Economics, 67 (1): 130-153.	1.545
Manda, J., Gardebroek, C., Khonje, M. G., Alene, A.D., Mutenje, M., Kassie, M. (2016). Determinants of child nutritional status in the eastern province of Zambia: the role of improved maize varieties. Food Security, 8 (1): 239-253.	1.557
Mbuge, D. O., Negrini, R., Nyakundi, L. O., Kuate, S. P., Bandyopadhyay, R., Muiru, W. M., Torto, B., Mezzenga, R. (2016). Application of superabsorbent polymers (SAP) as desiccants to dry maize and reduce aflatoxin contamination. Journal of Food Science and Technology, 53(8): 3157-3165.	-
Mehar, M., Mittal, S., Prasad, N. (2016). Farmers coping strategies for climate shock: Is it differentiated by gender? Journal of Rural Studies, 44: 123-131.	2.206
Menkir, A., Crossa, J., Meseka, S., Bossey, B., Ado, S., Obengantiwi, K., Yallou, C., Coulibaly, N., Olaoye, G., Alidu, H. (2016). Comparative performance of top-cross maize hybrids under managed drought stress and variable rainfed environments. Euphytica, 212: 455-472.	1.618
Meseka, S. K., Menkir, A., Olakojo, S. A., Jalloh, A., Coulibaly, N., Bossey, B. (2016). Yield stability of yellow maize hybrids in the Savannas of west Africa. Agronomy Journal, 108(4): 1313-1320.	1.86
Mhlanga, B., Chauhan, B.S., Thierfelder, C. (2016). Weed management in maize using crop competition: a review. Crop Protection, 88: 28-36.	1.652
Mhlanga, B., Cheesman, S., Chauhan, B.S., Thierfelder, C. (2016). Weed emergence as affected by maize (*Zea mays* L.)-cover crop rotations in contrasting arable soils of Zimbabwe under conservation agriculture. Crop Protection, 81: 47-56.	1.652
Mhlanga, B., Cheesman, S., Maasdorp, B., Mupangwa, W., Munyoro, C., Sithole, C., Thierfelder, C. (2016). Effects of relay cover crop planting date on their biomass and maize productivity in a sub-humid region of Zimbabwe under conservation agriculture. NJAS - Wageningen Journal of Life Sciences, 78: 93-101.	0.89
Micheni, A.N., Kanampiu, F., Kitonyo, O., Mburu, D.M., Mugai, E.N., Makumbi, D., Kassie, M. (2016). On-farm experimentation on Conservation Agriculture in maize-legume based cropping systems in Kenya: water use efficiency and economic impacts. Experimental Agriculture, 52 (1): 51-68.	0.973
Midingoy, S.G., Affognon, H.D., Macharia, I., Ong'amo, G., Abonyo, E., Ogola, G., De Groote, H., LeRu, B. (2016). Assessing the long-term welfare effects of the biological control of cereal stemborer pests in East and Southern Africa: Evidence from Kenya, Mozambique and Zambia. Agriculture, Ecosystems and Environment, 23: 10-23.	3.564

Mignouna, D. B., Abdoulaye, T., Akinola, A., Kamara, A., Oluoch, M. (2016). Understanding market participation choices and decisions of maize and cowpea farmers in northern Nigeria. Tropicultura, 34: 26-39.	-
Misiko, M., Halm, E. (2016). ABCs of diversifying information resources among rice smallholders of Ghana. The Journal of Agricultural Education and Extension, 22 (3): 271-289.	0.99
Mittal, S. (2016). Role of mobile phone enabled climate information services in gender-inclusive agriculture. Gender, Technology and Development, 20 (2): 200-217.	-
Mittal, S., Hariharan, V.K. (2016). Crop diversification by agro-climatic zones of India-trends and drivers. Indian Journal of Economics and Development, 12 (1): 123-131.	4.532
Mujuru, L., Rusinamhodzi, L., Nyamangara, J., Hoosbeek, M.R. (2016). Effects of nitrogen fertilizer and manure application on storage of carbon and nitrogen under continuous maize cropping in Arenosols and Luvisols of Zimbabwe. Journal of Agricultural Science, 154: 242-257.	1.26
Mupangwa, W.|Twomlow, S.|Walker, S. (2016). Reduced tillage and nitrogen effects on soil water dynamics and maize (*Zea mays* L.) yield under semi-arid conditions. International Journal of Agricultural Sustainability, 14 (1): 13-30.	1.538
Mutenje, M., Kankwamba, H., Mangisonib, J., Kassie, M. (2016). Agricultural innovations and food security in Malawi: gender dynamics, institutions and market implications. Technological Forecasting and Social Change, 103: 240-248.	2.678
Mutsamba, E.F., Nyagumbo, I., Mafongoya, P. (2016). Termite prevalence and crop lodging under conservation agriculture in sub-humid Zimbabwe. Crop Protection, 82: 60-64.	1.652
Ndegwa, M.K., De Groote, H., Gitonga, Z., Bruce, A.Y. (2016). Effectiveness and economics of hermetic bags for maize storage results of a randomized controlled trial in Kenya. Crop Protection, 90: 17-26.	1.652
Ndjomatchoua, F.T., Tonnang, H., Plantamp, C., Campagne, P., Tchawoua, C., Le Ru, B.P. (2016). Spatial and temporal spread of maize stem borer *Busseola fusca* (Fuller) (Lepidoptera: Noctuidae) damage in smallholder farms. Agriculture, Ecosystems and Environment, 235: 105-118.	3.564
Neiff, N., Trachsel, S., Valentinuz, O.R., Balbi, C.N., Andrade, H.F. (2016). High temperatures around flowering in maize: effects on photosynthesis and grain yield in three genotypes. Crop Science, 56: 1-11.	1.758
Neondo, J. O., Alakonya, A., Matheka, J. M., Masanga, J. O., Kasili, R. W. (2016). Transformation and regeneration protocol for two farmer preferred open pollinated tropical maize (*Zea mays*) varieties. Journal of Plant Sciences, 4 (4): 80-87.	0
Nyagumbo, I., Mkuhlani, S., Pisa, C., Kamalongo, D., Dias, D., Mekuria, M. (2016). Maize yield effects of conservation agriculture based maize–legume cropping systems in contrasting agro-ecologies of Malawi and Mozambique. Nutrient Cycling in Agroecosystems, 105: 275-290.	1.49
O'Brien, C., Gunaratna, N.S., Gebreselassie, K., Gitonga, Z., Tsegaye, M., De Groote, H. (2016). Gender as a Cross-Cutting Issue in Food Security: The NuME Project and Quality Protein Maize in Ethiopia. World Medical & Health Policy, 8 (3): 263-286.	0.13
Okebalama, C. B., Safo, E. Y., Yeboah, E., Abaidoo, R., Logah, V. (2016). Fertilizer use and management practices among maize and cowpea smallholder farmers in Ghana.Tropicultura, 34 (2): 113-126.	-

Okebalama, C.B., Safo, E. Y., Yeboah, E., Abaidoo, R., Logah, V. (2016). Identification and molecular characterization of a novel sugarcane streak mastrevirus and an isolate of the A-strain of maize streak virus from sugarcane in Nigeria. Soil Science Society of America Journal, 80 (5): 1254-1261.	2.05
Onyango, S. O., Roderick, H., Tripathi, J., Collins, R., Atkinson, H. J., Oduor, R., Tripathi, L. (2016). The ZmRCP-1 promoter of maize provides root tip specific expression of transgenes in plantain. Journal of Biological Research-Thessaloniki, 23 (1): 4.	0.574
Parihar, C.M., Jat, S.L., Singh, A.K., Kumar, B., Singh, Y., Pradhan, S., Pooniya, V., Dhauja, A., Chaudhary, V., Jat, M.L., Jat, R.K., Yadav, O.P. (2016). Conservation agriculture in irrigated intensive maize-based systems of north-western India: effects on crop yields, water productivity and economic profitability. Field Crops Research, 193: 104-116.	3.541
Parihar, C.M., Yadav, M.R., Jat, S.L.,Singh, A.K., Kumar, B., Pradhan, S., Chakraborty, D., Jat, M.L., Jat, R.K., Saharawat, Y.S., Yadav, O.P. (2016). Long term effect of conservation agriculture in maize rotations on total organic carbon, physical and biological properties of a sandy loam soil in north-western Indo-Gangetic Plains. Soil and Tillage Research, 161: 116-128.	3.371
Rahut, D.B., Ali, A., Imtiaz, M., Mottaleb, K.A., Erenstein, O. (2016). Impact of irrigation water scarcity on rural household food security and income in Pakistan. Water Science and Technology: Water Supply, 16 (3): 675-683.	0.532
Rahut, D.B., Behera, B., Ali, A. (2016). Do forest resources help increase rural household income and alleviate rural poverty? Empirical evidence from Bhutan. Forests, Trees and Livelihoods 23(3): 1-11.	1.24
Reynolds, M.P., Quilligan, E., Aggarwal, P.K., Bansal, K.C., Cavalieri, A.J., Chapman, S., Chapotin, S.M., Datta, S.K., Duveiller, E., Gill, K.S., Jagadish, K.S.V., Joshi, A.K., Koehler, A.K., Kosina, P., Krishnan, S., Lafitte, R., Mahala, R.S., Muthurajan, R., Paterson, A.H., Prasanna, B.M., Rakshit, S., Rosegrant, M.W., Sharma, I., Singh, R.P., Sivasankar, S., Vadez, V., Valluru, R., Prasad, V.P.V., Yadav, O.P. (2016). An integrated approach to maintaining cereal productivity under climate change. Global Food Security, 8: 9-18.	3.745
Rivers, A., Barbercheck, M., Govaerts, B., Verhulst, N. (2016). Conservation agriculture affects arthropod community composition in a rainfed maize–wheat system in central Mexico. Applied Soil Ecology, 100: 81-90.	3.103
Rosales-Nolasco, A., Agama-Acevedo, E., Bello-Pérez, L.A., Gutiérrez-Dorado, R., Palacios-Rojas, N. (2016). Effect of traditional and extrusion nixtamalization on carotenoid retention in tortillas made from provitamin A biofortified maize (*Zea mays* L.). Journal of Agricultural and Food Chemistry 64: 8229-8295.	2.857
Rusinamhodzi, L., Corbeels, M., Giller, K.E. (2016). Diversity in crop residue management across an intensification gradient in southern Africa: system dynamics and crop productivity. Field Crops Research, 185: 79-88.	3.541
Rusinamhodzi, L., Dahlin, S., Corbeels, M. (2016). Living within their means: Reallocation of farm resources can help smallholder farmers improve crop yields and soil fertility. Agriculture, Ecosystems and Environment, 216: 125-136.	3.564

Sanchez-Bragado, R., Araus, J.L., Scheerer, U., Cairns, J.E., Rennenberg, H., Ferrio, J.P. (2016). Factors preventing the performance of oxygen isotope ratios as indicators of grain yield in maize. Planta, 243(2): 355-368.	3.239
Sesay, S., Ojo, D., Ariyo, O. J., Meseka, S. K. (2016). Genetic variability, heritability and genetic advance studies in topcross and three-way cross maize (*Zea mays* L) hybrids. Maydica, 61: 1-7.	0.484
Setimela, P.S., Warburton, M.L., Erasmus, T. (2016). DNA fingerprinting of open-pollinated maize seed lots to establish genetic purity using simple sequence repeat markers. South African Journal of Plant and Soil 33 (2): 1-8.	0.51
Singh, V.K., Singh, Y., Dwivedi, B.S., Singh, S.K., Majumdar, K., Mishra, R.P., Rani, R., Jat, M.L. (2016). Soil physical properties, yield trends and economics after five years of conservation agriculture based rice-maize system in north-western India. Soil and Tillage Research, 155: 133-148.	3.371
Sitko, N.J., Chamberlin, J. (2016). The geography of Zambia's customary land: assessing the prospects for smallholder development. Land Use Policy, 55: 49-60.	2.768
Sserumaga, J.P., Oikeh, S.O., Asea, G., Otim, M., Abalo, G., Kikafunda, J., Mugo, S.N., Beyene, Y. (2016). Genotype by environment interactions and agronomic performance of doubled haploids testcross maize (*Zea mays* L.) hybrids. Euphytica, 207 (2): 353-365.	1.618
Tefera, T., Mugo, S.N., Beyene, Y. (2016). Developing and deploying insect resistant maize varieties to reduce pre-and post-harvest food losses in Africa. Food Security, 8 (1): 211-220.	1.557
Tefera, T., Mugo, S.N., Mwimali, M., Anani, B., Tende, R., Beyene, Y., Gichuki, S., Oikeh, S.O., Nang'ayo, F., Okeno, J., Njeru, E., Pillay, K., Meisel, B., Prasanna, B.M. (2016). Resistance of Bt-maize (MON810) against the stem borers *Busseola fusca* (Fuller) and *Chilo partellus* (Swinhoe) and its yield performance in Kenya. Crop Protection, 89: 202-208.	1.652
Teshome, A., Graaff, J. de., Ritsema, C., Kassie, M. (2016). Farmer's perceptions about the influence of land quality, land fragmentation and tenure systems on sustainable land management in the North Western Ethiopian highlands. Land Degradation & Development, 27(4): 884–898.	8.145
Tessema, M., Gunaratna, N.S., Donato, K., Cohen, J.L., McConnell, M., Belayneh, D., Brouwer, I.D., Belachew, T., De Groote, H. (2016). Translating the impact of quality protein maize into improved nutritional status for Ethiopian children: study protocol for a randomized controlled trial. BMC Nutrition, 2: 54.	-
Thierfelder, C., Bunderson, W.T., Jere, Z.D., Ngwira, A., Mutenje, M. (2016). Development of Conservation Agriculture (CA) systems in Malawi: Lessons learned from 2005 to 2014. Experimental Agriculture, 52: 579-604.	0.973
Thierfelder, C., Matemba-Mutasa, R., Bunderson, W.T., Mutenje, M., Nyagumbo, I., Mupangwa, W. (2016). Evaluating manual conservation agriculture systems in southern Africa. Agriculture, Ecosystems and Environment, 222: 112-124.	3.564
Thierfelder, C., Rusinamhodzi, L., Setimela, P.S., Walker, F., Eash, N.S. (2016). Conservation agriculture and drought-tolerant germplasm: reaping the benefits of climate-smart agriculture technologies in central Mozambique. Renewable Agriculture and Food Systems, 31 (5): 414-428.	6.798

Trachsel, S., Dapeng Sun, Hongjian Zheng, Atlin, G.N., Suarez, E.A., Babu, R., San Vicente, F.M., Zhang, X. (2016). Identification of QTL for early vigor and Stay-Green conferring tolerance to drought in two connected advanced backcross populations in Tropical Maize (*Zea mays* L.). PLoS One, 11 (3): e0149636.	3.234
Trachsel, S., Leyva, M., Lopez, M., Suarez, E.A., Mendoza, A., Gomez, N., Sierra-Macias, M., Burgueño, J., San Vicente, F.M. (2016). Identification of tropical maize germplasm with tolerance to drought, nitrogen deficiency, and combined heat and drought stresses. Crop Science, 56: 1-15.	1.758
Vega-Rojas, L.J., Contreras-Padilla, M., Rincon-Londoño, N., Real López, A. del., Lima-Garcia, R.M., Rodriguez-Garcia, M.F., Palacios-Rojas, N. (2016). The effect of maize grain size on the physicochemical properties of isolated starch, crude maize flour and nixtamalized maize flours. Agricultural sciences, 7: 114-125.	0.88
Vergara-Diaz, O., Zaman-Allah, M., Masuka, B., Hornero, A., Zarco-Tejada, P.J., Prasanna, B.M., Cairns, J.E. Araus, J.L. (2016). A novel remote sensing approach for prediction of maize yield under different conditions of nitrogen fertilization. Frontiers in Plant Science, 7 (666): 1-13.	4.495
Wallace, J.G., Zhang, X., Beyene, Y., Fentaye Kassa Semagn, Olsen, M., Prasanna, B.M., Buckler, E. (2016). Genome-wide association for plant height and flowering time across 15 tropical maize populations under managed drought stress and well-watered conditions in Sub-Saharan Africa. Crop Science, 56 (5): 2365-2378.	1.758
Worku, M., Makumbi, D., Beyene, Y., Das, B., Mugo, S.N., Pixley, K.V., Banziger, M., Owino, F., Olsen, M., Asea, G., Prasanna, B.M. (2016). Grain yield performance and flowering synchrony of CIMMYT's tropical maize (*Zea mays* L.) parental inbred lines and single crosses. Euphytica, 211 (3): 395-409.	1.618
Wu, Y., Huang, K., Costich, D.E., Semagn, F.K., Babu, R., San Vicente, F.M., Prasanna, B.M., Nair, S.K., Olsen, M., Dhliwayo, T., Zhang, X. (2016). Molecular characterization of CIMMYT maize inbred lines with genotyping-bysequencing SNPs. Theoretical and Applied Genetics, 129 (4): 753-765.	3.9
Xu, D., Yang, H., Zou, C., Li, W-X., Xu, Y., Xie, C. (2016). Identification and functional characterization of the AGO1 ortholog in maize. Journal of Integrative Plant Biology, 58(8): 749-758.	3.67
Xu, Y. (2016). Envirotyping for deciphering environmental impacts on crop plants. Theoretical and Applied Genetics, 129 (4): 653-673.	3.9
Yadav, M.R., Parihar, C.M., Jat, S.L., Singh, A.K., Kumar, D., Pooniya, V., Parihar M.D., Saveipune, D., Parmar, H., Jat, M.L. (2016). Effect of long-term tillage and diversified crop rotations on nutrient uptake, profitability and energetics of maize (*Zea mays*) in north-western India. Indian Journal of Agricultural Sciences, 86 (6): 743-749.	0.28
Yadav, O.P., Prasanna, B.M., Yadava, P., Jat, S.L., Kumar, D., Dhillon, B.S., Solanki, I.S., Sandhu, S.J. (2016). Doubling maize (*Zea mays*) production of India by 2025 – Challenges and opportunities. Indian Journal of Agricultural Sciences, 86(4): 427-434.	0.28
Zaidi, P.H., Seetharam, K., Krishna, G., Krishnamurthy, S.L., Gajanan Saykhedkar, Babu, R., Zerka, M., Vinayan, M.T., Vivek, B. (2016). Genomic regions associated with root traits under drought stress in tropical maize (*Zea mays* L.). PLoS One, 11 (10): e0164340.	3.234

Zhang, Z., Qiang, H., He, J., Li, H., Wang, Q., Lu, Z., McHugh, A. (2016). Effect of conservation farming practices on soil organic matter and stratification in a mono-cropping system of Northern China. Soil and Tillage Research, 156: 173-181.	3.371
Zhao, Y., Zhang, C., Liu, W., Gao, W., Liu, C., Song, G., Li, W-X., Mao, L., Chen, B., Xu, Y., Li, X., Xie, C.X. (2016). An alternative strategy for targeted gene replacement in plants using a dual-sgRNA/Cas9 design. Nature Scientific Reports, 6: 23890.	5.525
Zou, C., Wang, P., Xu, Y. (2016). Bulked sample analysis in genetics, genomics and crop improvement. Plant Biotechnology Journal, 14(10): 1941-1955.	6.09

Annex 10: MAIZE financial highlights

Figure 7: 2016 Budget/expenditure per funding source.

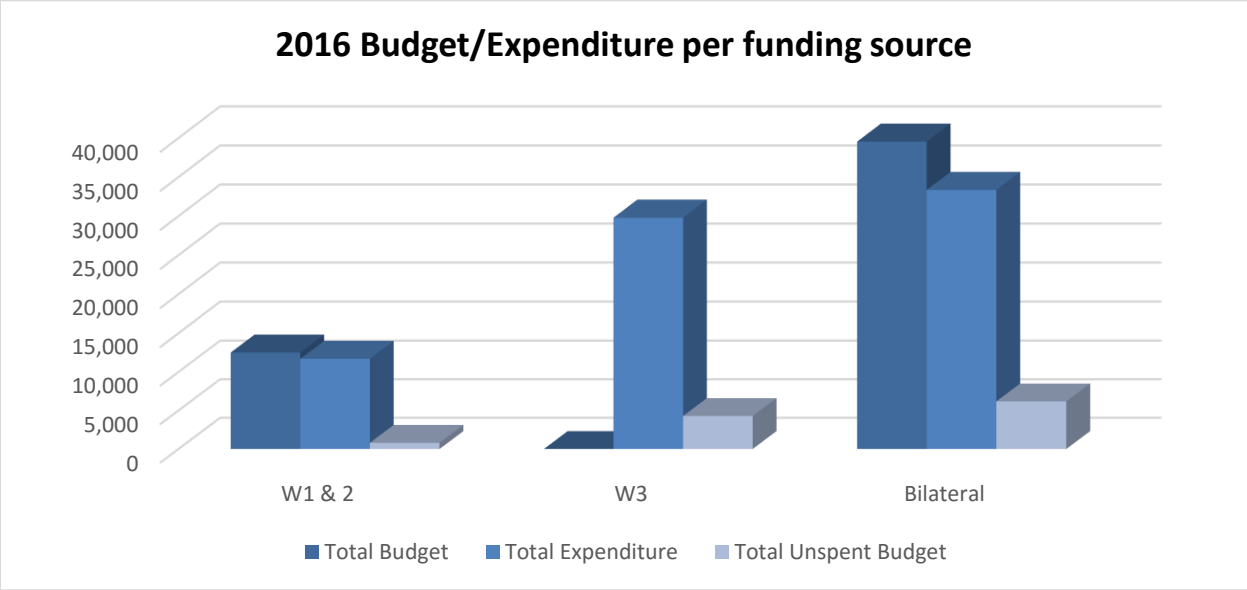


Figure 8: 2016 Financial summary by flagship.

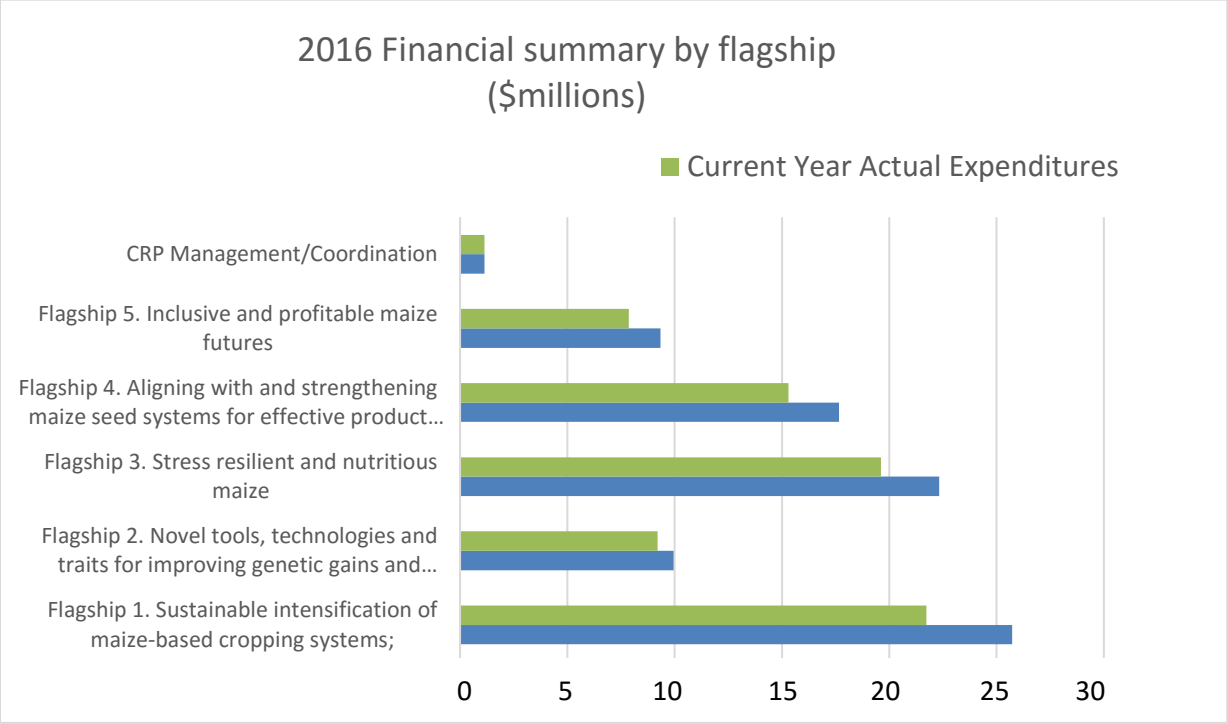
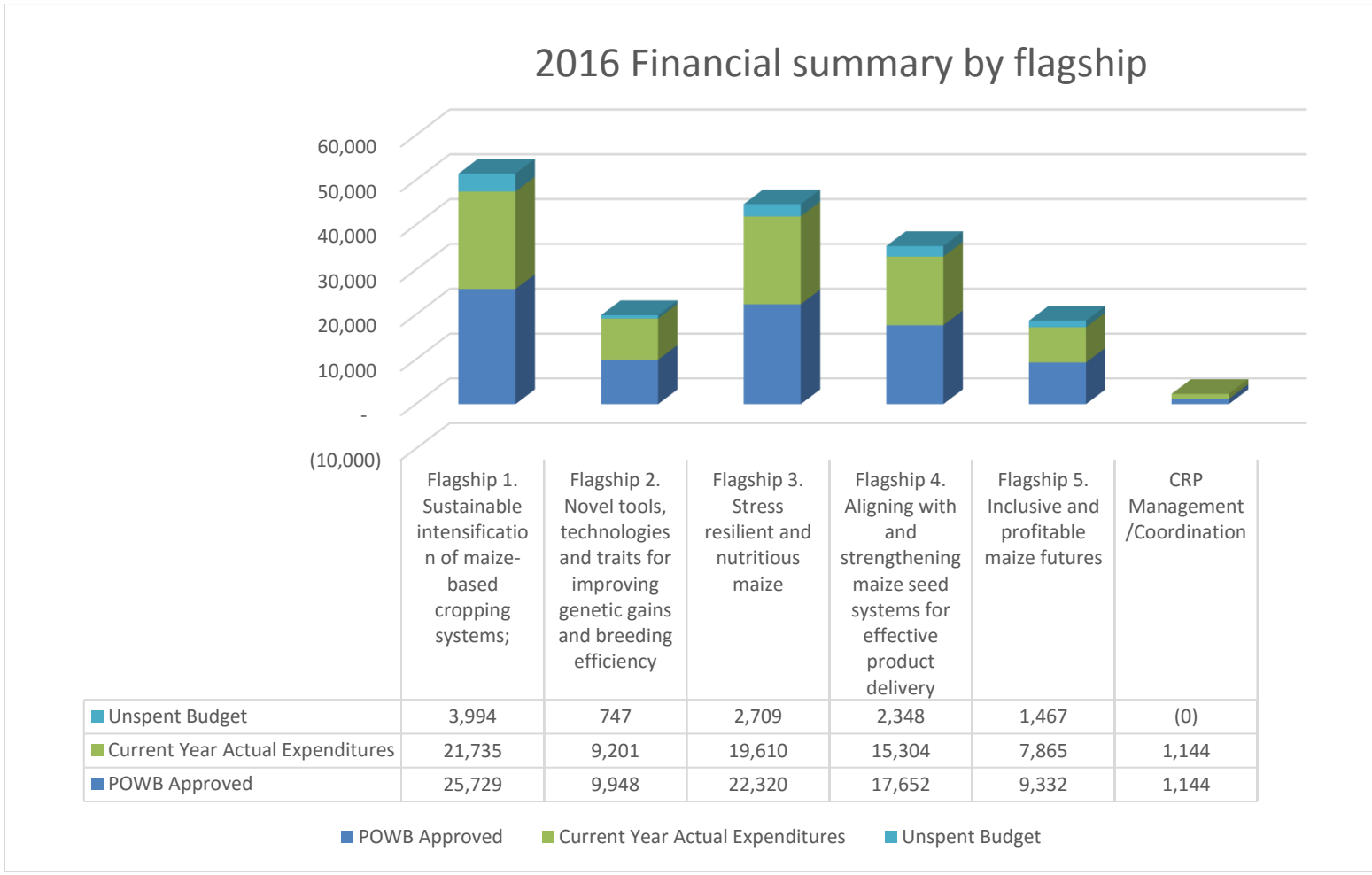
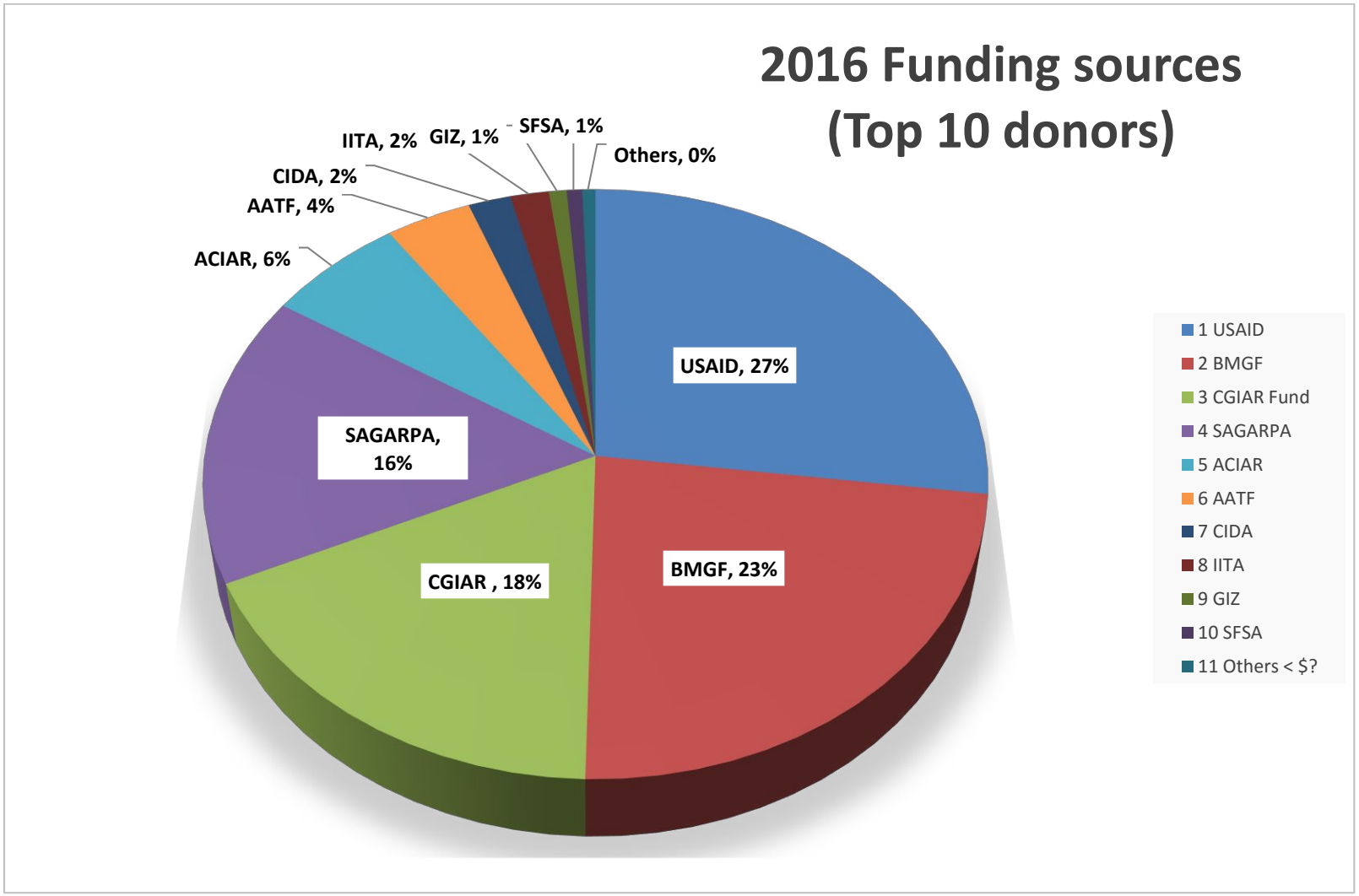


Figure 9: 2016 Financial summary by flagship.



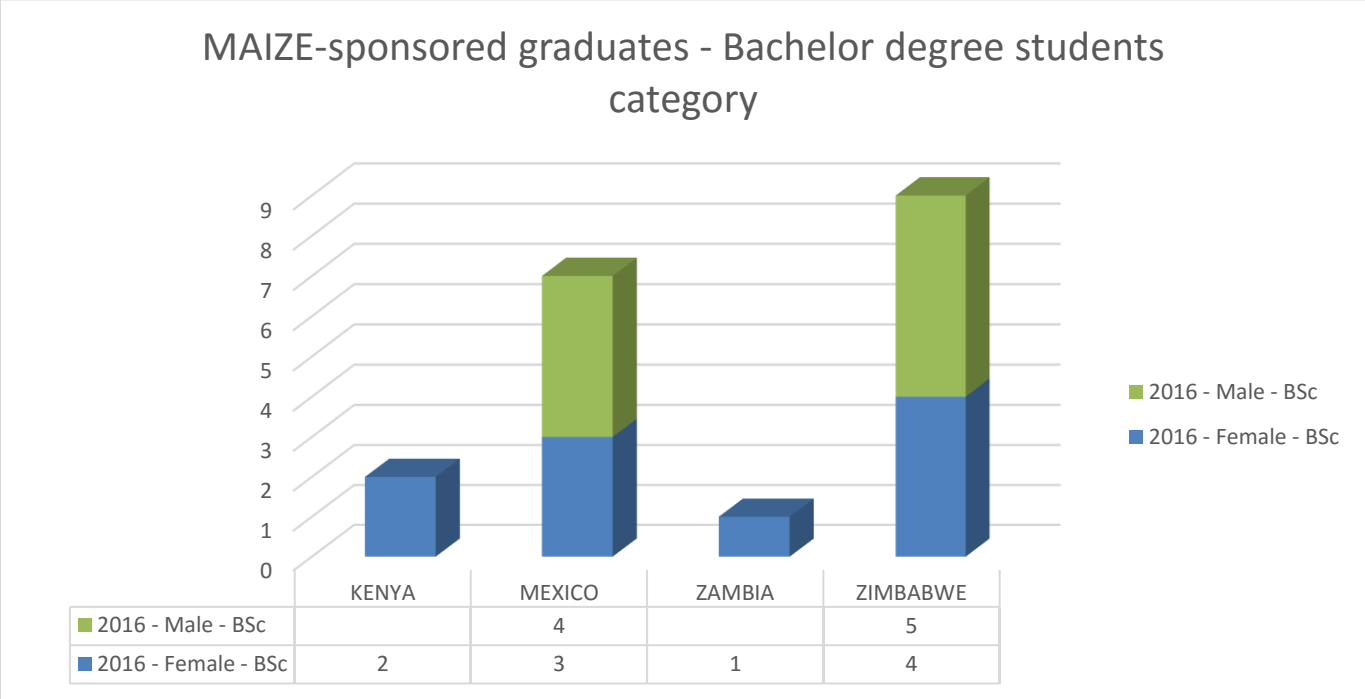
	Flagship 1. Sustainable intensification of maize-based cropping systems;	Flagship 2. Novel tools, technologies and traits for improving genetic gains and breeding efficiency	Flagship 3. Stress resilient and nutritious maize	Flagship 4. Aligning with and strengthening maize seed systems for effective product delivery	Flagship 5. Inclusive and profitable maize futures	CRP Management /Coordination
Unspent Budget	3,994	747	2,709	2,348	1,467	(0)
Current Year Actual Expenditures	21,735	9,201	19,610	15,304	7,865	1,144
POWB Approved	25,729	9,948	22,320	17,652	9,332	1,144

Figure 10: 2016 Funding sources (Top 10 donors).

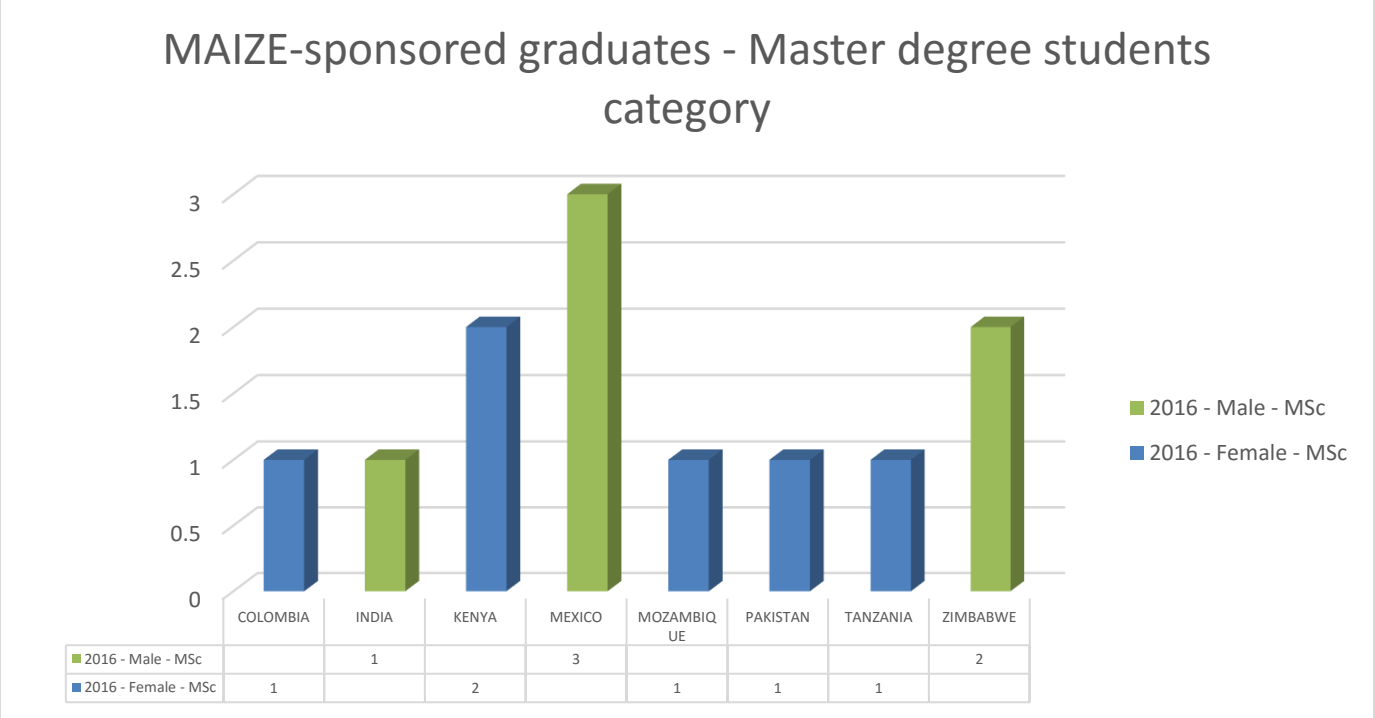


Annex 11: Capacity development

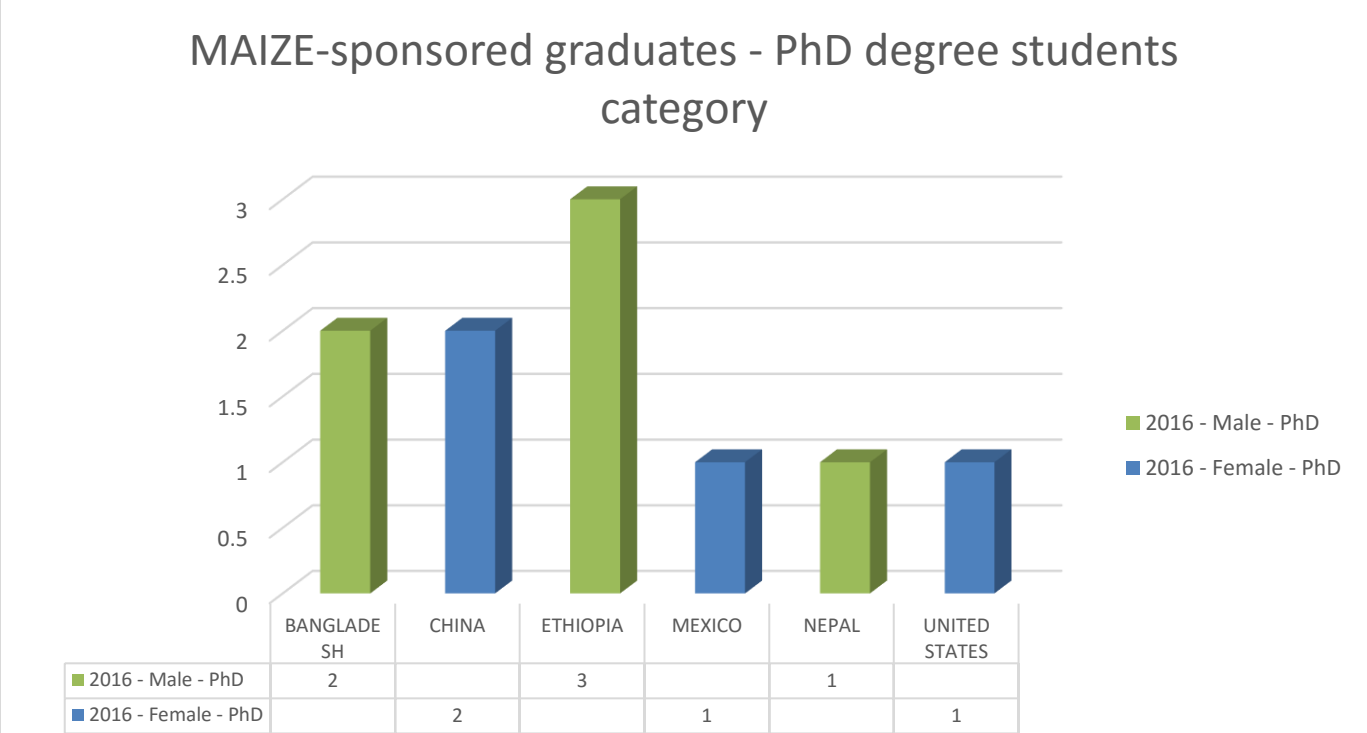
Figure 11: MAIZE-sponsored graduates by category, 2016.



	KENYA	MEXICO	ZAMBIA	ZIMBABWE
2016 - Male - BSc		4		5
2016 - Female - BSc	2	3	1	4

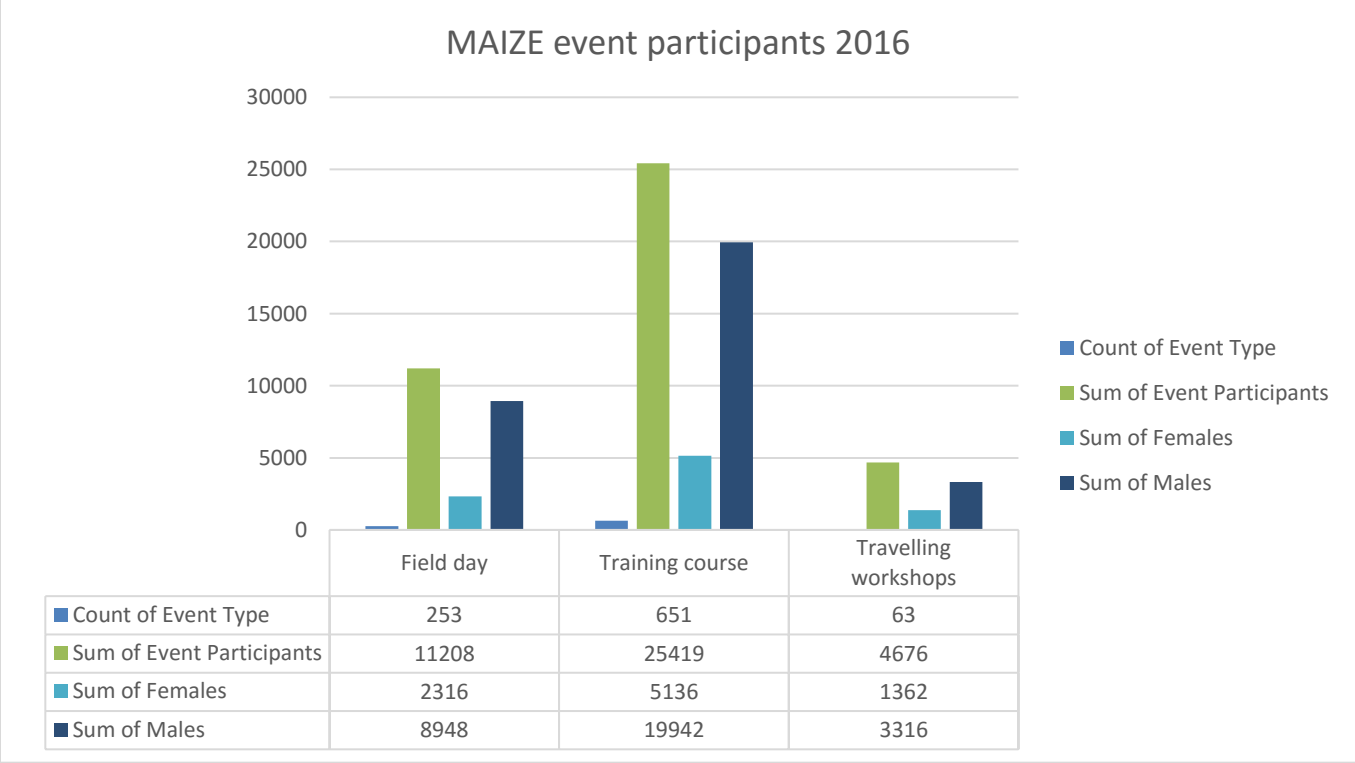


	COLOMBIA	INDIA	KENYA	MEXICO	MOZAMBIQUE	PAKISTAN	TANZANIA	ZIMBABWE
2016 - Male - MSc		1		3				2
2016 - Female - MSc	1		2		1	1	1	



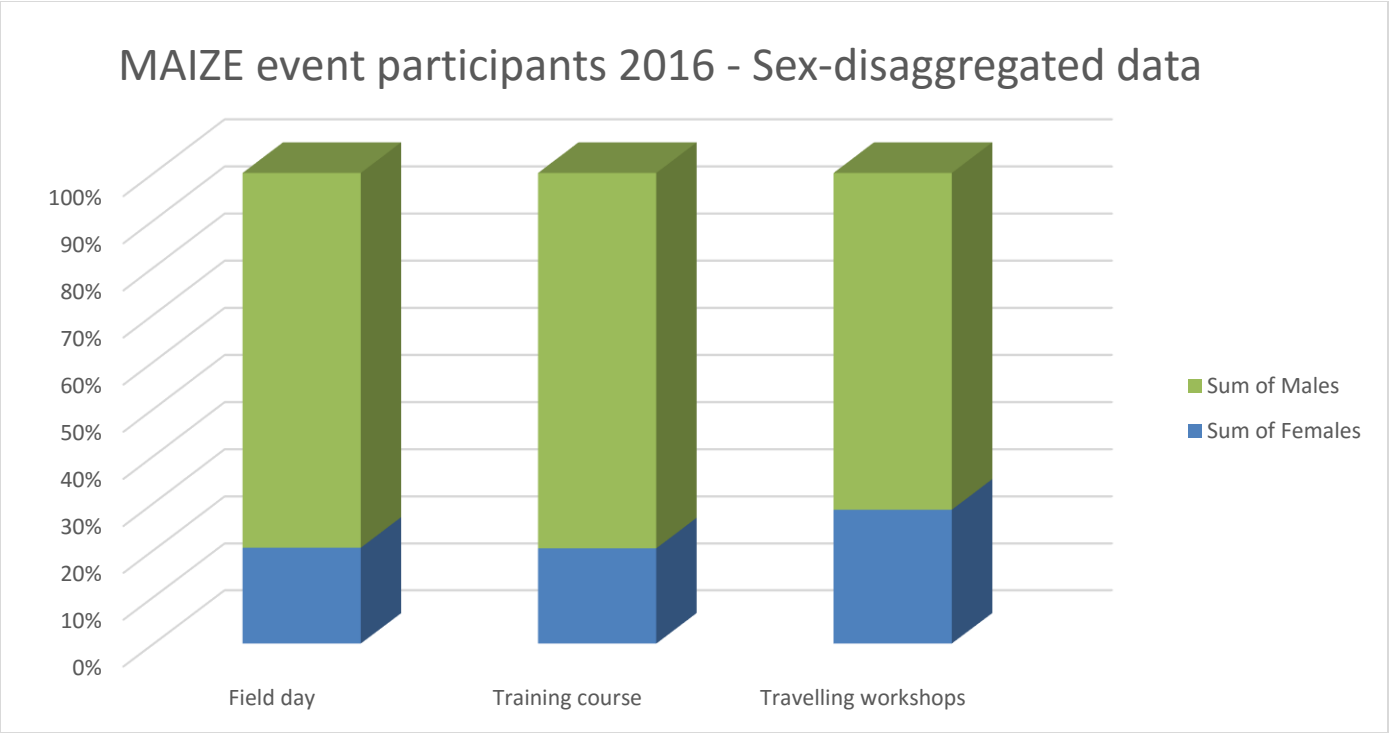
	BANGLADESH	CHINA	ETHIOPIA	MEXICO	NEPAL	UNITED STATES
2016 - Male - PhD	2		3		1	
2016 - Female - PhD		2		1		1

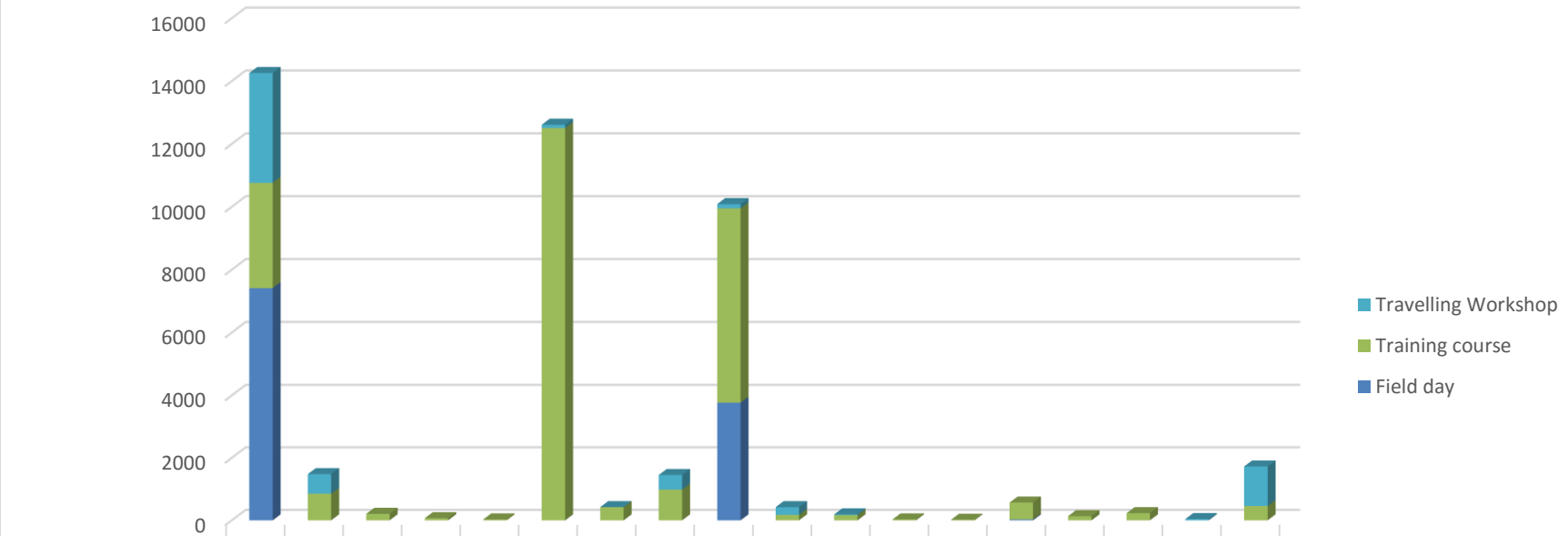
Figure 12: MAIZE event participants 2016*.



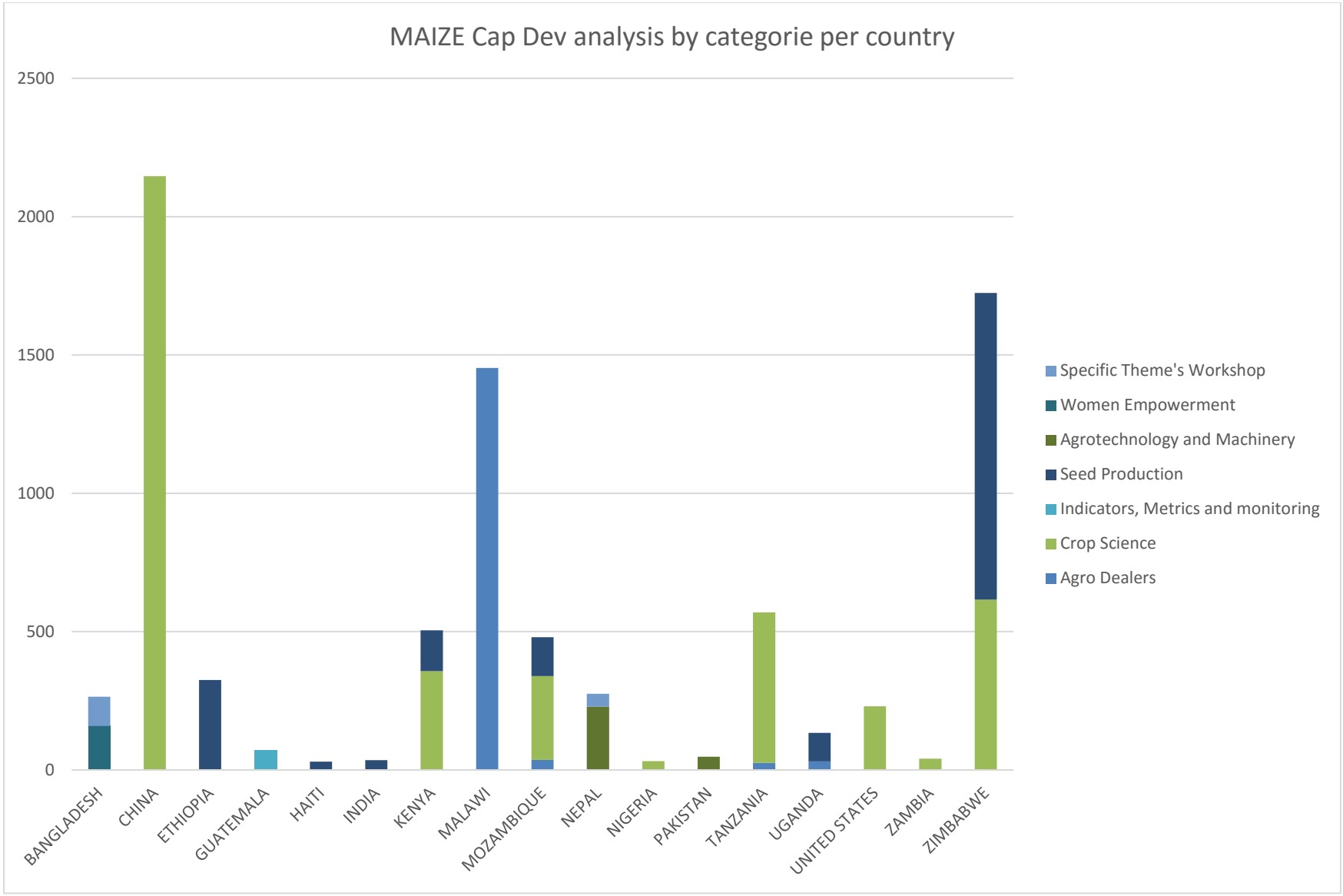
	Field day	Training course	Travelling workshops
Count of Event Type	253	651	63
Sum of Event Participants	11208	25419	4676
Sum of Females	2316	5136	1362
Sum of Males	8948	19942	3316

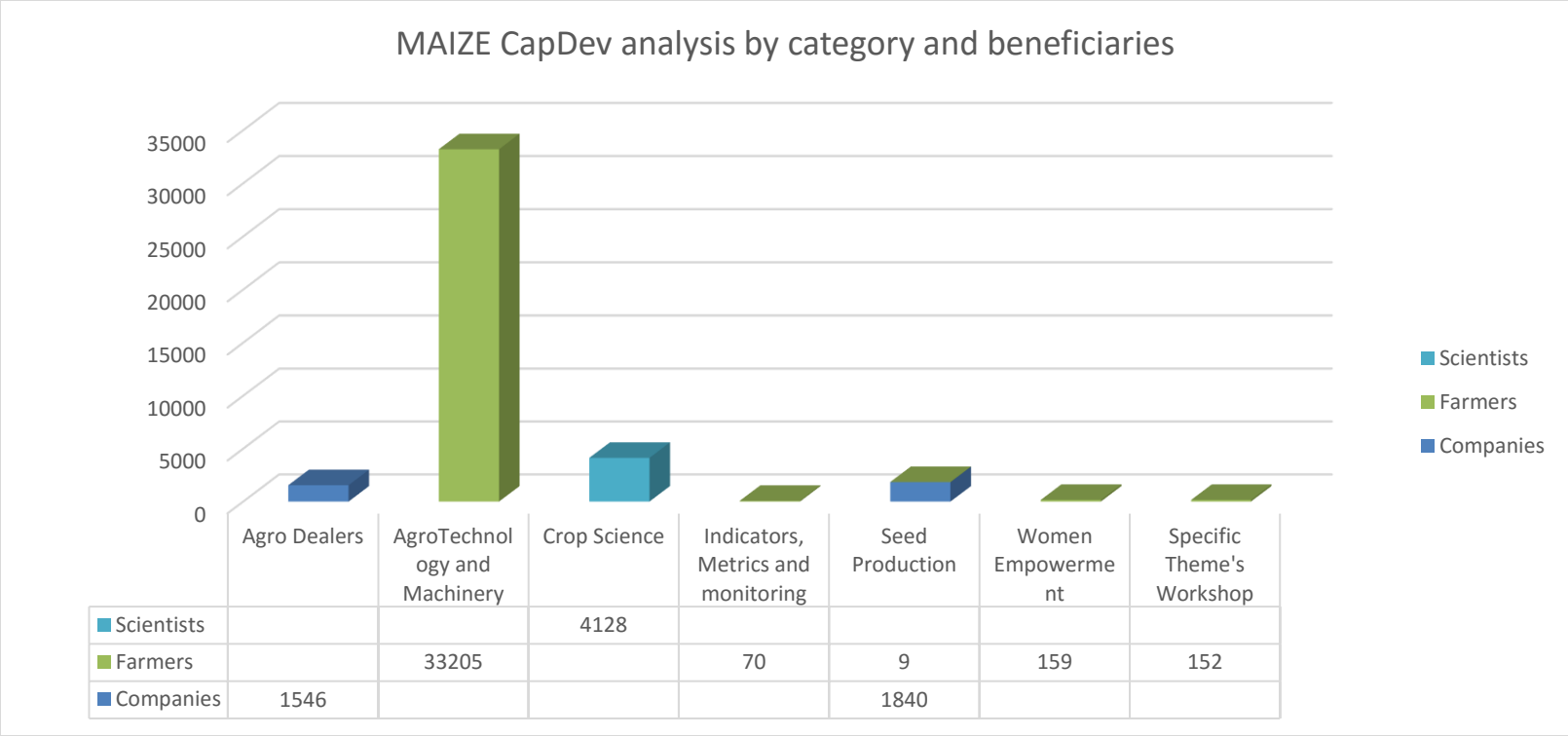
*Meetings and seminars were not considered for the formulation of this diagram.


MAIZE event participants 2016 - Sex-disaggregated data
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Field day
Training course
Travelling workshops
Sum of Males
Sum of Females

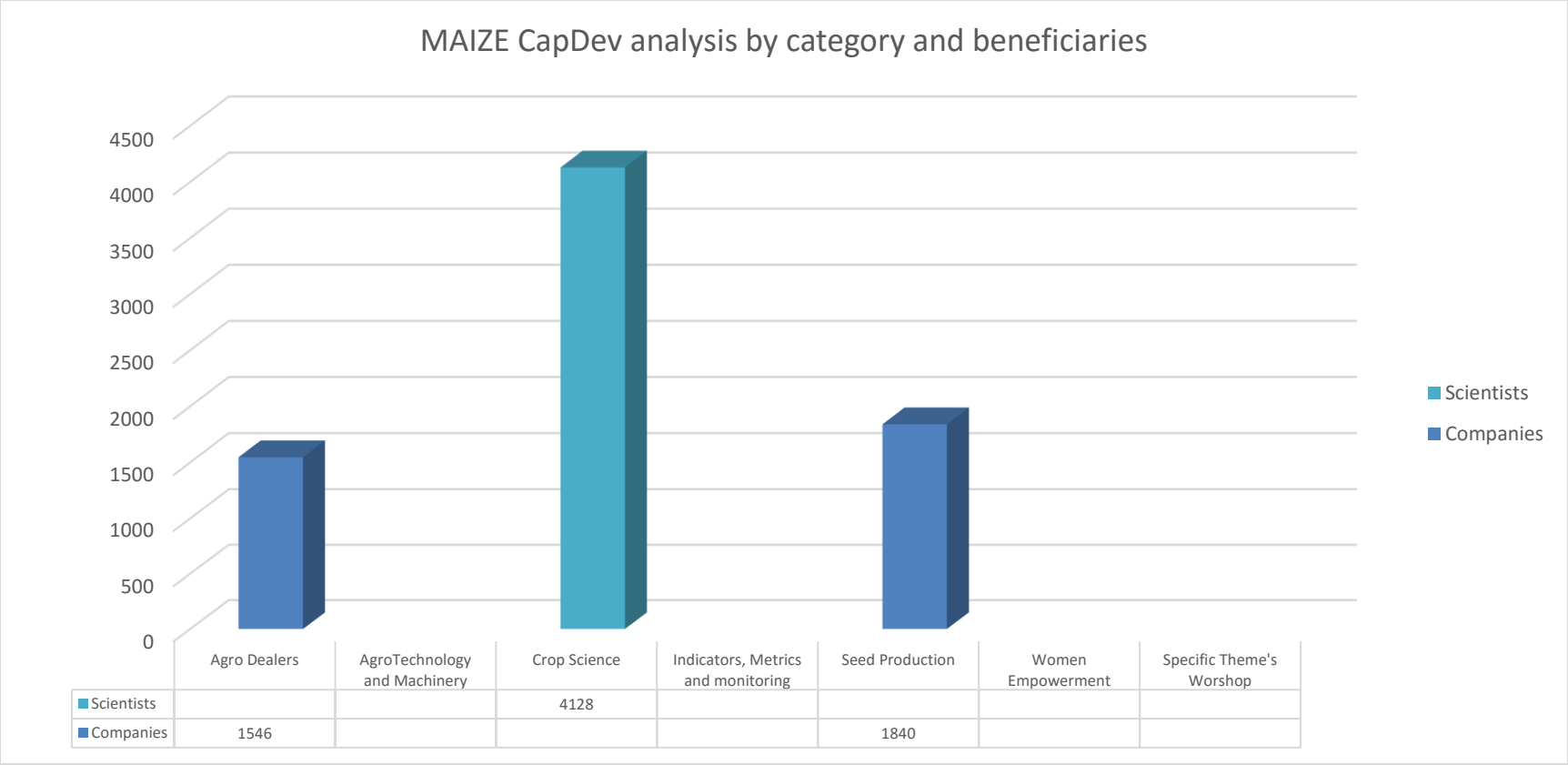


	BANGLADESH	CHINA	ETHIOPIA	GUATEMALA	HAITI	INDIA	KENYA	MALAWI	MEXICO	MOZAMBIQUE	NEPAL	NIGERIA	PAKISTAN	TANZANIA	UGANDA	UNITED STATES	ZAMBIA	ZIMBABWE
Travelling Workshop	3495	627				104	0	470	134	245	22						41	1266
Training course	3351	854	208	70	30	12507	424	983	6184	177	169	32	20	540	134	230		458
Field day	7411								3767					30				


MAIZE Cap Dev analysis by categorie per country
2500
2000
1500
1000
500
0
BANGLADESH
CHINA
ETHIOPIA
GUATEMALA
HAITI
INDIA
KENYA
MALAWI
MOZAMBIQUE
NEPAL
NIGERIA
PAKISTAN
TANZANIA
UGANDA
UNITED STATES
ZAMBIA
ZIMBABWE
Specific Theme's Workshop
Women Empowerment
Agrotechnology and Machinery
Seed Production
Indicators, Metrics and monitoring
Crop Science
Agro Dealers

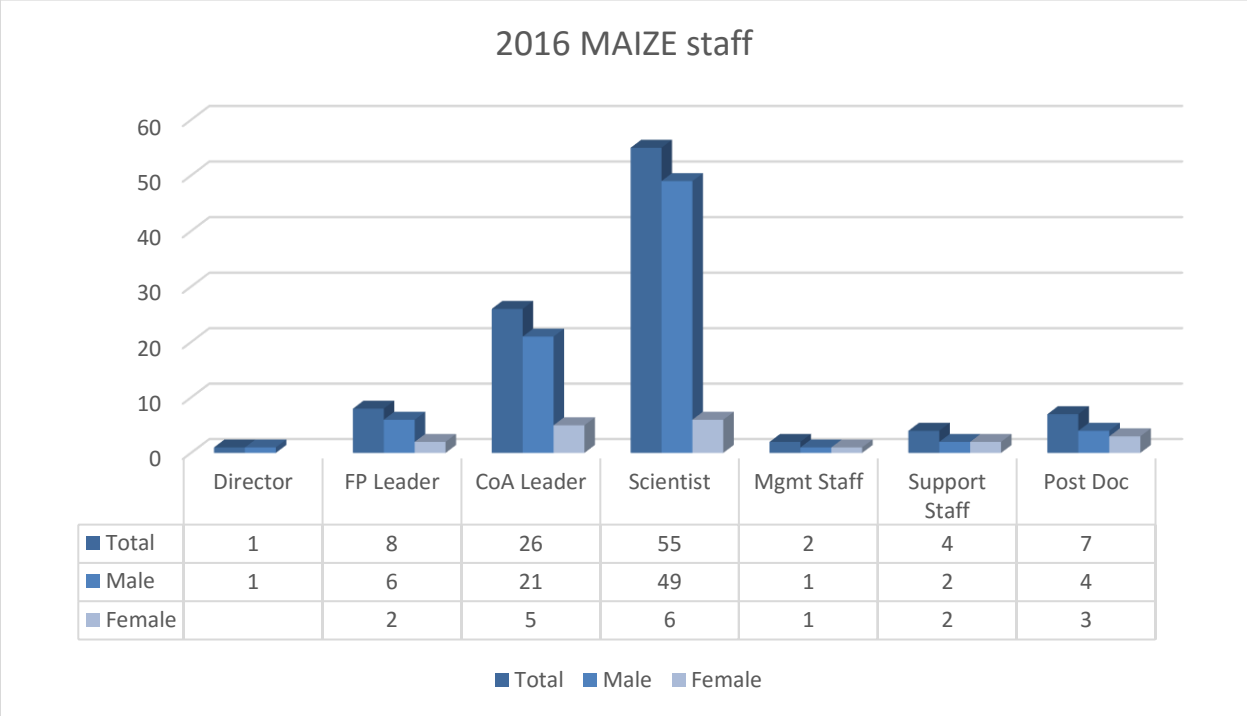


	Agro Dealers	AgroTechnology and Machinery	Crop Science	Indicators, Metrics and monitoring	Seed Production	Women Empowerment	Specific Theme's Workshop
Scientists			4128				
Farmers		33205		70	9	159	152
Companies	1546				1840		


MAIZE CapDev analysis by category and beneficiaries
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Scientists
Companies
Agro Dealers
AgroTechnology and Machinery
Crop Science
Indicators, Metrics and monitoring
Seed Production
Women Empowerment
Specific Theme's Worshop
Scientists
4128
Companies
1546
1840

Annex 12: MAIZE staff

Figure 13: MAIZE staff by position and gender.



Role	Total	Male	Female
Director	1	1	
FP Leader	8	6	2
CoA Leader	26	21	5
Scientist	55	49	6
Mgmt Staff	2	1	1
Support Staff	4	2	2
Post Doc	7	4	3
Total	103	84	19

CGIAR

RESEARCH PROGRAM ON Maize

MAIZE is an alliance of more than 300 research and development partners worldwide.