# CGIAR RESEARCH PROGRAM PORTFOLIO REPORT FOR YEAR 2014

CGIAR
Science for a food-secure future

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CGIAR CONSORTIUM OFFICE

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Climbing beans in Rwanda © CIAT/Neil Palmer

# PREAMBLE

This fourth CRP Portfolio Report provides a brief synthesis and assessment of progress and achievements by the Genebanks program, and the portfolio of 15 CGIAR research programs (together, CRPs) in 2014. The 15 CRPs report against the four overarching objectives (or System Level Outcomes, 'SLO') in CGIAR's 2010 – 2015 Strategy and Results Framework (SRF) as follows:

SLO 1 - Reduction of rural poverty;
SLO 2 - Improved food security;
SLO 3 - Improved nutrition and health;
SLO 4 - Improved management of natural resources.

It follows the format approved by the Fund Council for the CRP Portfolio Report. It is based upon the 15 CRPs Annual Performance Reports submitted to the Consortium Office (CO), also following the format approved by the Fund Council.

This CRP Portfolio Report continues to use the typology of CRPs developed last year (see the Preamble of the 2013 Annual Portfolio Report for details). In summary:

- Type 1 CRPs are programs built upon a strong research base initiated decades ago by two or three Centers[1]. Each one of these CRPs focuses on a single cereal crop. This category includes: the Global Rice Science Partnership (GRiSP), Maize (MAIZE) and Wheat (WHEAT).
- Type 2 CRPs have a more fragmented historical basis and for them scientific integration is an imperative to meet new objectives and demands. This category includes Roots, Tubers and Bananas (RTB); Livestock and Fish (L&F); Grain Legumes; Dryland Cereals; Forests, Trees and Agroforestry (FTA); Water, Land and Ecosystems (WLE); and Policies, Institutions and Markets (PIM).
- Type 3 CRPs work in areas that have a smaller historical base of relevant "pre-reform" research and that cut across traditional research domains. Aquatic Agricultural Systems (AAS); Integrated Systems for the Humid Tropics (Humidtropics); Dryland Systems; Climate Change, Agriculture and Food Security (CCAFS); and Agriculture for Nutrition and Health (A4NH) fall into this category. These CRPs demand new methods for researching complex system issues, including ways of integrating climate change and nutrition research with agricultural research.

The CRPs were approved by donors at different points in times, and thus started implementation at diverse times. The more mature CRPs report on their fourth full year of operations in 2014 whilst the most recent CRPs report results only for their second full year of operations. These differences in length of functioning have been taken into account when assessing progress.

Progress of the current supporting research platform "Managing & Sustaining Crop Collections" (the Genebanks CRP) is summarized in Appendix 1.

1 A full list of Centers is provided in Appendix 2.

# CGIAR RESEARCH PROGRAMS

**Aquatic Agricultural Systems (AAS)**, in collaboration with national governments and partners, works with communities to find new approaches to realizing the agricultural potential of aquatic agricultural systems.

www.aas.cgiar.org

**Dryland Systems** engages in integrated agricultural systems research and innovative partnerships to improve food security, sustainable natural resource management and livelihoods in rural dryland communities.

www.drylandsystems.cgiar.org

**Agriculture for Nutrition and Health (A4NH)**, led by IFPRI, helps realize the potential of agricultural development to deliver gender-equitable health and nutritional benefits to the poor.

www.a4nh.cgiar.org

**Forests, Trees and Agroforestry (FTA)** aims to enhance the management and use of forests, agroforestry and tree genetic resources across the landscape from forests to farms.

www.foreststreesagroforestry.org

**Climate Change, Agriculture and Food Security (CCAFS)**, led by the International Center for Tropical Agriculture (CIAT), works to identify and address the most important interactions, synergies and trade-offs between climate change, agriculture and food security.

www.ccafs.cgiar.org

**The Global Rice Science Partnership (GRiSP)** fosters impact-oriented rice research and development to reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience in rice production systems.

www.grisp.net

**Dryland Cereals** is a global alliance for improving food security, nutrition and livelihoods of smallholder farmers dependent on climate-resilient, nutrient-rich dryland cereal crops.

www.drylandcereals.cgiar.org

**Grain Legumes** aims at improving health, food and nutritional security, environmental sustainability and increased smallholder income by increasing legume productivity, production and consumption.

www.grainlegumes.cgiar.org


**Integrated Systems for the Humid Tropics (Humidtropics)** seeks to transform the lives of the rural poor in tropical America, Asia and Africa, and uses integrated systems research and unique partnership platforms for better impact on poverty and ecosystems integrity.

www.humidtropics.cgiar.org


**Policies, Institutions and Markets (PIM)** leads action-oriented research to equip decision makers with the evidence required to develop food and agricultural policies that better serve the interests of the poor.

www.pim.cgiar.org


**Livestock and Fish** aims to increase the productivity of small-scale livestock and fish systems in sustainable ways, making meat, milk and fish more available and affordable across the developing world.

www.livestockfish.cgiar.org


**Roots, Tubers and Bananas (RTB)** focuses on exploiting the potential of RTB crops for improving nutrition and food security, increasing incomes and fostering gender equity.

www.rtb.cgiar.org


**Managing and Sustaining Crop Collections (Genebanks)** provides security in funding for the routine operations of the genebanks and works towards strengthening individual genebank's performance, quality management and use.

www.croptrust.org/what-we-do/supporting-the-global-system/global-genebank-partnership/


**Water, Land and Ecosystems (WLE)** promotes a new approach to sustainable intensification in which a healthy functioning ecosystem is seen as a perquisite to agricultural development, resilience of food systems and well-being.

www.wle.cgiar.org


**Maize** is an international collaboration led by CIMMYT and IITA that seeks to mobilize global resources in maize R&D to achieve a greater strategic impact on maize-based farming systems.

www.maize.org


**Wheat**, led by CIMMYT and ICARDA, couples advanced science with field research in developing countries, to raise productivity, production and availability for the 2.5 billion who depend on wheat as a staple crop.

www.wheat.org

Mato Grosso, Brazil © CIFOR/Icaro Cooke Vieira

# 1. KEY MESSAGES AND PORTFOLIO LEVEL 'TRAFFIC LIGHT' ANALYSIS

## 1.1 KEY MESSAGES

- In 2014 both the quality and quantity of outputs and outcomes produced by the CRP portfolio improved over their 2013 levels, as the traffic light assessment (figures 1 and 2) shows at a glance. After only 2 to 4 years following the creation of the CRPs, research outputs and development outcomes appear to have acquired a momentum.
- Positively, the scope of outputs and outcomes across the CRP portfolio was clearly relevant to CGIAR's strategic goals, or 'System Level Outcomes' (SLOs), that were adopted across the system for the 2010 – 2016 first phase of CRPs[2]. There is of course still room for improvement, in particular for demonstrating more achievement in regard to the 'nutrition and health' and 'natural resources management' SLOs (see section 6). However, the CRP portfolio is now embracing delivery against the SLOs in a more balanced manner than before, and end 2014 represents the first time that the portfolio was, as a whole, on track to deliver on the SLOs. Encouragingly, performance to end 2014 also shows good prospect to deliver outcomes that are relevant to the Sustainable Development Goals, newly adopted in September 2015, after considerable debate over the 2014 calendar year.
- Across the CRP portfolio strategic partnerships were consolidated and they increased in number to 3,100. These include research and capacity strengthening partnerships, partnerships with development implementers and value chain actors, with the private sector, with global, regional and national stakeholders, as well as the generalized participation of non-CGIAR partners and independent experts in the governance and management mechanisms of the CRPs.
- Not only did collaboration and linkages among the CRPs increase compared to last year but also they started to produce joint results across CRPs (see section 5). Such joint results are an excellent indicator of the increasing programmatic coherence of the CRP portfolio itself.
- A major highlight of the 2014 CRP portfolio is the noticeable momentum that has been reached, largely by four large CRPs, through their involvement and contributions to global fora and international policy arenas. FTA, PIM, WLE, CCAFS have thus been contributing new scientific evidence and analyses to the G20[3] (PIM), IPBES[4] (WLE), IPCC[5] (CCAFS), UNFCCC[6] (FTA, CCAFS) and the SDGs[7] (PIM, WLE). The capacity to influence policy-making at these levels is an excellent indicator of the relevance, robustness and credibility of the scientific evidence and associated analyses produced by these CRPs. It is also a very effective mean to 'scale up' results to the global scale.
- Type 1 CRPs have continued to facilitate the release of large numbers of new varieties of rice, wheat and maize in Asia, Africa and Latin America. Pre-breeding results expanded, including through high throughput genomic and phenomics approaches. These, together

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2 Whilst the current SRF was approved for 2010 – 2015, it will continue to guide CGIAR research during 2016 as a key transition year.

3 The G20 membership comprises a mix of the world's largest advanced and emerging economies, representing about two-thirds of the world's population, 85 per cent of global gross domestic product and over 75 per cent of global trade.

4 The Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) is an independent intergovernmental body established to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development. It was established in Panama City, on 21 April 2012 by 94 governments

5 The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts.

6 The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty (currently the only international climate policy venue with broad legitimacy, due in part to its virtually universal membership)[2] negotiated at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro in 1992

7 The 17 Sustainable Development Goals (SDGs) and 169 targets, as submitted to the UN General Assembly by the UN Open Working Group (OWG). It is a unique tool designed primarily for negotiators, technical support teams and other actors engaged in defining a universal, integrated and transformational set of global goals and targets for sustainable development and the political declaration on the post-2015 development Agenda.

with novel population development strategies (e.g., rice MAGIC populations), were used to identify new sources of resistance. Scaling up results through partnerships was reported to have led to significant numbers of adopters (e.g., 10.9 million farmers adopting new stress-tolerant rice varieties).

- Type 2 and type 3 CRPs produced a range of diverse and solid outputs and outcomes. These were noticeably more focused on balancing productivity and longer-term sustainability concerns, as well as on balancing nutrition, agricultural development and resources conservation than in previous years. They produced new open data access portals and systems, toolkits, decision support systems and numerous books and articles in ISI journals that bring to light new evidence, often disproving hypotheses previously held as scientifically valid (PIM, L&F, WLE) (see section 2). In addition to contributing to global level policy-making processes (mentioned above), they continued to leverage their partnerships to scale up their results. Because they do not have the long historical base that type 1 CRPs have, their scaling up is generally more modest. For instance, in Bangladesh, improvements in aquaculture production designed by L&F and AAS thus reached half a million farmers. There are however instances of significant numbers of adopters such as Dryland Systems facilitating the adoption of 58 sustainable land management technologies on more than 7.5 million hectares across dry lands in Africa, Asia and the Middle East.
- The number of CRP resources available in open access is impressive. Even though the CGIAR Open Access and Data Management Policy was ratified recently (in 2013), by 2014 most CRPs made substantial progress in making their databases and publications open access, with portals and repositories making publicly available content that spans disciplines, scales and geographic locations. The platforms chosen for data deposit are used widely across communities within and beyond CGIAR (e.g., Terra-i, tropiTree, AgTrials, NCBI). These are a further means for CRPs to reach research communities outside of CGIAR with their research results and gain further exposure.
- The major lesson learned in 2014, through the results-based management (RBM) pilots implemented by 5 CRPs, concerns the essentiality of having a robust monitoring and evaluation (M&E) system in place, in each CRP, before RBM can be implemented. The pilots showed that a prerequisite for a CRP to implement RBM is to set up a very robust M&E system, doing so jointly with partners, also paying attention to setting up an effective supporting information system. A corollary lesson is that CRPs must not underestimate the necessary budget and human resources investments.
- The major risk for the CRP portfolio at the end of 2014 is that of losing the momentum it has acquired through its strategic core research because of financial uncertainty. The 11% decrease in W1-2 funds that all CRPs experienced retroactively in 2014, followed by a further decrease of 19% in 2015 and a projected decrease of 35% for 2016, raise concerns about the financial sustainability of the CRP portfolio. Such decreases imply an increased reliance on bilateral funds and the curtailing of scientific positions by the CRPs. Since W1-2 funds are normally used to fund strategic core research, a significant decrease in these funds is a threat to the strategic core research. This would put the CRP portfolio in a situation comparable to that pre-reform, when a multiplicity of bilateral projects drove the research agenda (see section 6).

## 1.2 TRAFFIC LIGHT ASSESSMENT

Figures 1 and 2 assess progress at the CRP portfolio level through a 'traffic light' system for the same set of criteria. Figure 1 is the 2013 assessment and Figure 2 is the 2014 assessment. The figures show how the portfolio progressed in producing outputs and outcomes, mainstreaming gender, managing risks, and positioning itself to implement results-based management. The overriding conclusion of this comparison of results between 2013 and 2014 is that in 2014 there was a marked improvement in the fulfillment of all the criteria.

Output quality and quantity was fully satisfactory for 80% of the CRPs (versus 66% in

2013). 20% more CRPs produced a satisfactory quality and quantity of outcomes in 2014 than in 2013. Alignment of results with IDOs increased from 40% of the CRPs in 2013 to 60% of the CRPs in 2014. Gender research mainstreaming also improved as in 2014 only one CRP did not have fully satisfactory gender research implemented (see Section 3).

Most CRPs now demonstrate more mature and sounder risk assessment and mitigation strategies. Some CRPs are particularly expert at drawing lessons from their experiences and identifying potential risks limiting their capacity to deliver outputs and outcomes (e.g., A4NH, PIM, RTB, and CCAFS). These CRPs also design constructive contingency plans to mitigate risks. Others are less expert but compared with last year, in 2014 the portfolio did not have a single CRP with a totally unsatisfactory approach to risk management.

Finally, concerning the effectiveness of CRPs' internal organization for results-based management (RBM), progress has been made over last year, in particular through the 5 RBM pilots, but this is still a weak dimension of the portfolio. Some CRPs have made commendable efforts to improve their indicators and monitoring tools (e.g. CCAFS, GRiSP, RTB, Humidtropics and Dryland Systems). Additional effort is required across all CRPs to develop robust monitoring and evaluation tools appropriate to their research focus before the portfolio can credibly implement a RBM system (see section 7).

FIGURE 1: TRAFFIC LIGHT ASSESSMENT OF THE PERFORMANCE OF THE 2013 CRP PORTFOLIO (IN % OF CRPS)

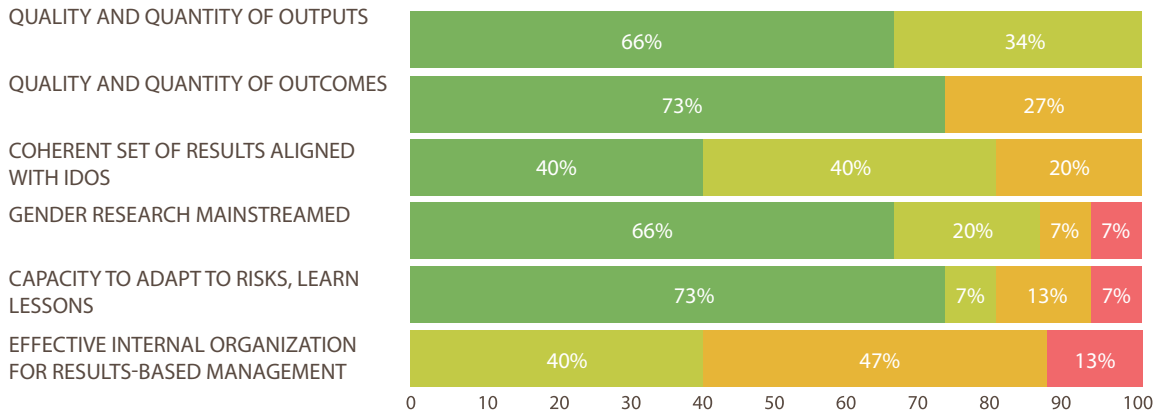
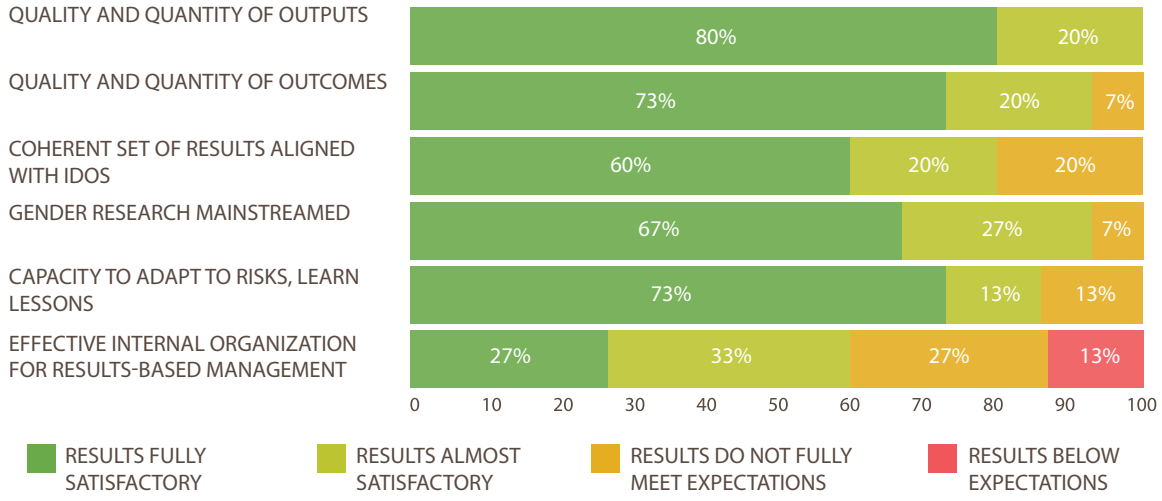



FIGURE 2 TRAFFIC LIGHT ASSESSMENT OF THE PERFORMANCE OF THE 2014 CRP PORTFOLIO (IN % OF CRPS)



# 2 SYNTHESIS OF THE MOST SIGNIFICANT RESULTS (OUTPUTS AND OUTCOMES) FROM THE CRP PORTFOLIO AND BEARING ON PROGRESS TOWARDS THE SLOS

## 2.1 TYPE 1[8] CRPS: GRISP, MAIZE, WHEAT

Type 1 CRPs have organized their work internally based on the concept of a powerful breeding pipeline and use modern molecular breeding technologies to speed up and step up the breeding of improved varieties of the three cereals.

Pre-breeding (molecular breeding technologies) is defined by FAO as the identification of desirable characteristics or genes from unadapted materials and the transfer of these traits to an intermediate set of materials that breeders can then use in producing improved varieties. It is a necessary first step in the use of the genetic diversity found in wild relatives and other unimproved materials. Pre-breeding facilitates the efficiency and effectiveness of breeding by enabling increased access to the genetic variations conserved in genebanks. Various relevant pre-breeding results are reported by type 1 CRPs, indicating the strength of their upstream scientific activities and of the breeding activities into which they feed.

### PRE-BREEDING RESULTS

The highly accessed SNP-SEEK database of GRiSP is a SNP public-domain database created in 2014 to identify new alleles for high-priority traits and accessions carrying trait-associated haplotypes. In a complementary approach, the Genotyping Services Lab at IRRI successfully processed more than 10,000 samples for SNP genotyping, resulting in more than 32 million SNP marker data points used for marker-assisted selection, genetic diversity analysis, SNP fingerprinting, QTL mapping, and for calculating genomic-estimated breeding values. A key output from the re-sequencing "3K rice genome project" is the corresponding paper in GigaScience which has been accessed 20,571 times since its publication.

To further explore phenotypic diversity (with emphasis on yield potential and abiotic stress tolerance), a GRiSP Global Rice Phenotyping Network was established. Gene validation pipelines were created to analyze potential candidate genes for disease resistance and abiotic stresses as cold, salt or drought-tolerance. New sources of resistance to major diseases (bacterial blight, sheath blight, rice ragged stunt and grassy stunt viruses) and abiotic stresses (salinity and drought) identified from distantly related wild Oryza species were transferred into elite cultivar backgrounds. The Multiparent Advanced Generation Inter-Cross (MAGIC) materials are now being used by national programs and the MAGIC approach has influenced the genetic and breeding strategy of other research programs, with an article on rice MAGIC population being accessed 9,608 times since its publication in May 2013.

WHEAT used information on photosynthetic and partitioning traits to design hybridization schemes to combine physiological traits and achieve cumulative gene action for yield potential. The resulting germplasm has produced superior yields and biomass in global, multi-location trials (the International Wheat Yield Consortium Yield Trial – WYCYT.

The Improved Maize for Africa Soils (IMAS) phenotyping network created by CIMMYT-MAIZE in 2011 expanded to over 120,000 research plots at 25 locations in 10 countries in Sub-Saharan Africa. Twenty percent of these phenotyping locations are at private sector research stations. A large population of DH lines derived through IMAS project has greatly accelerated breeding progress. In 2014, three confined field trial sites for testing nutrient use efficiency transgenics were in advanced stage of certification by regulatory agencies. Forty-one new three-way cross hybrids were submitted for release in partnership with private sector seed companies in 10 countries in Eastern and Southern Africa, along with 7 hybrids combining MLN tolerance with low N tolerance.

### RELEASE OF IMPROVED VARIETIES

Between them the 3 CRPs facilitated the release by national partners of a total of 57 new varieties of rice (21 in Africa, 30 in Asia and 6 in Latin

[8] The three types of CRPs are summarized in the Preamble of this report.

America) (GRiSP); 70 new maize varieties in 12 different countries (MAIZE) and more than 100 varieties of wheat in Asia and Africa (WHEAT). The outcomes of the release of these varieties are being assessed in a number of countries by MAIZE, WHEAT and GRiSP partners.

For instance, GRiSP facilitated the production of 10 tons of breeder seed of different varieties, at AfricaRice, that were delivered to national seed producers. An estimated 6 million rice farmers were thus reached with quality seed of improved varieties through an e-wallet and voucher system. By linking with the Emergency Rice Initiative for Africa, certified seed production increased from 2,155 tons in 2010 to 75,585 tons in 2014. 1,613 tons of certified seed were produced for varieties requested by each country and delivered to 109,306 farmers (30,410 were women) in 28 countries in sub-Saharan Africa. In South Asia, new stress-tolerant rice varieties are estimated to have reached about 10.9 million farmers and planted on about 4.6 million hectares.

In 2014 MAIZE and partners produced more than 135 tons of the aflatoxin bio-control agent AflasafeTM in IITA's Nigeria-based production unit, for deployment to Nigeria, Senegal, Zambia, Gambia, Ghana and Mozambique. Initial data from a separate ex ante study in Nigeria showed that farmers should receive a return of from 20 to 60 percent on investment in AflasafeTM. Currently, MAIZE supports Aspergillus strain identification/collection in Burkina Faso, Burundi, Rwanda, Tanzania and Malawi. The number of countries requesting AflasafeTM continues to expand, and in Kenya a new AflasafeTM production plant is scheduled to be constructed in 2015.

In Afghanistan, WHEAT supported the production of 24,000 tons of certified seed derived from high-yielding, disease resistant CGIAR germplasm – enough to sow 190,000 hectares. In this country, seed systems research has increased supply productivity by between 65% and 79%. In Kenya, Ethiopia and Pakistan (through the Wheat Production Enhancement Program (WPEP) involving the Pakistan Ministry of Agriculture and USDA and CIMMYT) almost 1,000 tons of seed of local disease resistant improved varieties were supplied to smallholder resource-poor farmers.

### DECISION-SUPPORT TOOLS, INNOVATION PLATFORMS

A last category of outcome produced by type 1 CRPs consist of decision support tools and the establishment of innovation platforms. In the Philippines for instance, GRiSP introduced a phone-based Rice Crop Manager decision support tool to the national extension service. This tool aims to provide farmers (22% women) with 290,000 printed one-page crop management guidelines, customized for the field-specific needs and conditions of farmers. In field trials switching from current farmers' practice to the Rice Crop Manager recommendations increased yield by an average of 0.4 t/ha and increased income by about US$100 per hectare. Similarly in Bangladesh, the distribution of 7,600 crop management guidelines to farmers increased income in field trials by US$79 to 97 per hectare and in Vietnam, 240,000 farmers implemented best practices with an ex ante estimated benefit ofUS$128/ha. The Sustainable Intensification strategy in MAIZE addresses challenges to maize-based farming systems through an increasing number of innovation platforms (51 in Africa, 40 in South Asia and 41 in Latin America) which aim to strengthen multi-stakeholder collaboration in Latin America, Africa and Asia.

Type 1 CRPs contributed mainly to the food security SLO by facilitating increases in the availability of improved rice, maize and wheat varieties through their partnerships and to the poverty reduction SLO by contributing to raising the income of resource-poor farmers as many of these varieties have been adapted to perform under the specific conditions of these farmers. They contributed, to a lesser extent, to the nutrition SLO by developing enriched cereal varieties. These CRPs have started to address the SLO on natural resource management by developing soil management and water management practices that mitigate some of the environmental impacts of cereal production.

Understanding adoption processes and bottlenecks to adoption, where they occur, as well as understanding impacts ex post would provide essential information and feedback to scientists and breeders in type 1 CRPs for the design of sustainable long-term improvements in cereal-based systems. National partners often have limited resources to engage in such work, and development partners may not have the necessary scientific skills among

their staff. The international public goods that would ensue from cross country analyses of adoption and its impacts on rural poverty, food security and the sustainability of the resource base of cereal systems would be tremendous for these CRPs.

## 2.2 TYPE 2 CRPS: RTB, GL, DC, FTA, WLE, PIM & L&F

All type 2 CRPs produced new tools and methods within their respective remits, new technologies, improved management practices and policies. They worked with development actors to consolidate the sustainability of the value chains they are involved with. Compared to previous years, the greater scope of many of the options they produced and their greater focus on balancing tradeoffs between productivity and sustainability concerns, from a pro-poor perspective is noteworthy. This, in turn, is leading to a strong demand for their results by national, regional and international partners and stakeholders.

### NEW TOOLS, METHODS, SCIENTIFIC EVIDENCE

PIM completely recoded the IFPRI IMPACT model version 3, and improved water and crop models components. The scientists enlarged the scope of the model to include livestock, fish, and sweet potato. Ex ante assessments were then completed for seventeen promising technologies related to drought and heat tolerance in maize, wheat, rice, potato, sorghum and groundnut, and pest control for cassava. In all these cases the new technologies are predicted to have beneficial effects on yields under climate change, and in the cases of maize, potato and groundnut, yields with the new technologies under climate assumptions for 2050 are higher than baseline yields in 2050 without climate change. These results are presented in an open access book by PIM scientists ***Food Security in a World of Natural Resource Scarcity: the Role of Agricultural Technologies*** that had more than 28,000 downloads in 2014.

PIM's research results have been informing the development of the Sustainable Development Goals and of strategies to achieve them. An example concerns the high impact and high cost of electricity, paved roads, and railways in reducing post-harvest losses. PIM showed that USD 239 billion invested over the next 15 years in roads and rails to connect farms to markets and in electrification to improve cold storage would yield benefits of USD 3.1 trillion in avoided loss. However, comparable increments in food supply could be achieved at lower cost through investment in agricultural research, with a benefit-cost ratio more than twice that of investment in infrastructure. Infrastructure to reduce loss and waste is needed for food security but it should be concurrent with investments in agricultural research to yield more significant returns.

FAO published in 2014 the first ***Report on the State of the World's Forest Genetic Resources and associated Global Plan of Action for Conservation, Sustainable Use and Development of Forest Genetic Resources*** (GPA FGR). Presented to the governments of the world, the 27 priority actions at national, regional and international levels integrate issues, priorities and recommendations derived from FTA research (Appendix F, pages 33- 56). The representatives to FAO of the 14 countries of the Asia Pacific Forest Genetic Resources Network (APFORGEN) have decided to implement the Global Plan of Action in Asia and the Pacific and have defined action plans to this effect.

To promote more inclusive and sustainable forestry and agricultural development FTA engaged 149 agriculture and forestry investors and 299 civil society, academic, and government stakeholders around innovative approaches to corporate governance and improved business models. They convened a seminar with Dutch policy makers, NGOs, and banks in collaboration with the Dutch Ministry of Foreign Affairs. FTA contributed analytical inputs to the LANDforum, a multi-stakeholder platform led by the Netherlands Academy for Land Governance (LANDac) aiming at promoting discussion on options for sustainable investment and business models, and in addition to inform the Land Governance Multi-stakeholder Dialogue (LG-MSD) in the Netherlands. These activities helped inform key groups of investors and decision makers, in both producer and consumer countries, on investment options that support sustainable supply of forest and tree products while simultaneously providing ways out of poverty for the rural poor.

L&F published in ***World Development*** results showing that investments to improve

Landscape near Rio Branco, Acre, Brazil. © CIFOR/Icaro Cooke Vieira

aquaculture have had beneficial impacts on the poor and extremely poor in Bangladesh. Improved aquaculture enhanced nutritional security for the very poor between 2001-2010, as this group had good access to greater amounts of fish protein, at a stable price, whilst the price of inland wild fish kept rising and was not affordable. This new evidence supports L&F's theory of change that pro-poor development of animal-source food value chains can enhance nutritional security of low-income consumers. This new evidence debunks a previous hypothesis that aquaculture produces large and high value fish, thereby excluding the poor from consumption.

### TECHNOLOGICAL INNOVATIONS

To increase global RTB productivity through more targeted use of global RTB genetic diversity RTB brought together all participating Centers and conservation biologists, breeders, molecular geneticists, molecular biologists, biochemists, and bioinformatics experts. This was to build a research platform that brings state-of-the-art biological tools (pre-breeding) to advance breeding for bananas, cassava, potatoes, sweet potatoes, and yams.

To tap the genetic potential of the RTB crop diversity nearly 6,500 RTB accessions from CGIAR genebanks and elite breeding pools were characterized using next-generation sequencing. This helped identify hundreds of thousands of single nucleotide variants that together will help RTB scientists in the near future to unravel genetic mechanisms behind key sustainability traits, including drought and pest/diseases tolerance, or those related to high productivity (e.g., heterosis), high quality (e.g., postharvest losses and consumer preferences), and high nutritional potential (e.g., high vitamin and micronutrient content).

Dryland Cereals completed the genome sequencing of pearl millet and Grain Legumes re-sequenced 300 accessions for chickpea and identified a "QTL-hotspot" for drought tolerance traits. In addition, Grain Legumes facilitated the release of 42 new varieties of pigeonpea hybrid, common bean, chickpea, faba bean, lentil, groundnut and soybean.

Grain Legumes and partners in Bangladesh, Nepal, India and Myanmar have developed low-cost technologies for cultivating 25% of the 14 million ha of fallow lands in South Asia. Extra-early maturing chickpea and lentil varieties (maturing in 80 days) were bred to perform under the specific constraints of these fallows (using residual moisture, adapted to rising temperatures). Combining these new varieties with appropriate crop management practices is being tested in farmers' fields in various countries. Preliminary results indicate that gains in income and in farming households' nutritional status can be expected. However, the longer-term consequences on soil fertility and on labor costs of not fallowing but planting nitrogen fixing legumes still need to be assessed.

L&F developed ICT tools to support livestock and fish value chain diagnosis and interventions. These are being tested in different countries, for different animals and fish. In one instance, to speed up the efficiency of selective breeding and gain information on livestock performance under farm conditions, a cell phone technology, "*Ng'ombe* planner", has been used on a trial basis in Kenya. It captures and feeds back cattle performance on real time basis to key actors, including farmers. The large data sets that result can be used by scientists to inform decision-making on future genetic improvement of livestock. Findings are fed into bio-economic simulation models that estimate genetic gains and profits under different scenarios. Such tools are being used by value chain actors and the intent is to facilitate effective and fair (pro-poor) value chains that rely on up to date genetic material.

L&F's work on decreasing the environmental footprint of agriculture produced a framework for environmental impact assessment in livestock value chains that considers environmental sustainability in terms of water, soil, biodiversity and greenhouse gas impacts. It was reported at the 6th All Africa Conference on Animal Agriculture; the framework has now been applied in Tanzania.

### ENGAGING WITH INTERNATIONAL POLICY-MAKING BODIES

In addition to its contributions to the SDGs process, already mentioned, PIM also provided scientific inputs into the G20 process. Its work on price volatility and its transmission from international to local markets contributes to the Agricultural Market Information Systems (AMIS) and the Food Security and Nutrition Indicators Network (FSIN). The work informed activities of the 2014 G20 meeting in

Australia. PIM researchers were co-authors of the recommendations of international organizations, specifically of the G20 Food Security and Nutrition Framework, and assisted with the design of the food security strategy for the G20 meeting led by Turkey in 2015.

WLE also contributed to the SDG process, providing inputs into the development of various indicators in water quality and water use efficiency in agriculture, agricultural biodiversity and sustainability. In addition, together with IWMI, FAO and UNESCO-IHE they established a Water Accounting Platform to support and monitor the implementation of the SDGs related to water in developing countries. Various institutions are interested in applying this water accounting framework. FAO requested implementation in the 32 Helmand Basin (Afghanistan); the Arab Water Council is discussing application in the MENA region and the Water Research Commission in South Africa to its national water accounting. Finally, the Asian Development Bank requested UNESCO-IHE to assist with the preparations of the Vietnam national water resources plan based upon this framework.

In addition, WLE engaged with the Intergovernmental Platform on Biodiversity and Ecosystems (IPBES), the biodiversity equivalent to the IPCC in climate change. WLE provided inputs into the scoping studies for the Africa Regional Assessment and the Thematic Assessment on Land Degradation, resulting in the inclusion of the food-energy-environment nexus in these reports.

As part of its involvement with the UNFCCC process FTA generated Terra-i, an open data access system to detect vegetation changes from human activities in Latin America in near real-time. In Peru, FTA partnered with the Ministry of Environment to implement Terra-i as an early warning system for land-cover change. In the Congo Basin, FTA research showed that the Forest Stewardship Council (FSC) voluntary certification scheme improved living and working conditions in commercial forest use. These results have received significant attention and are being used by international organizations such as FSC and WWF which use the data to improve current standards and support FSC campaigns. Terra-i also supplies Global Forest Watch with regionally verified data.

The outputs and outcomes produced by type 2 CRPs form a very solid set of results, to which a greater number of countries than before are requesting access and use (e.g., data bases, tools and methods). Engagement with global policy-making processes such as the SDGs (PIM and WLE), G20 (PIM), UNFCCC (FTA) and IPBES (WLE) is noteworthy. It is a strong indicator of the global recognition of the usefulness and relevance of the results produced by these CRPs (e.g., data base and analyses of issues). The strong pro-poor emphasis of these results and of the options type 2 CRPs devised to better balance the interests of resource poor farmers with sustainable development and the preservation of genetic and natural resources led to progress toward all four SLOs.

## 2.3 TYPE 3 CRPS: CCAFS, A4NH, HUMIDTROPICS, DS, AAS

Type 3 CRPs produced a multiplicity of new methods, new knowledge, and tool kits for various audiences as well as innovative technologies and they engaged with policy-makers internationally and nationally. Common features of these results are their pro-poor focus and their interdisciplinary, and sometimes transdisciplinary content.

### NEW SCIENTIFIC EVIDENCE, TOOLS

CCAFS contributed to the IPCC Fifth Assessment Report, in particular in two reports released in 2014: Working Group II (WGII) on impacts and adaptation, and Working Group III on mitigation. CCAFS scientists played multiple roles in the production of these reports, including as lead author, reviewer and contributor of critical new data on livestock emissions (ILRI). A CCAFS article, a meta-analysis of projections of future crop yields under climate change (Challinor et al. 2014 in Nature Climate Change), provided the central messages on future food availability under climate change in the WGII report. Within days of the release of the WGII report, CCAFS published a summary of findings relevant to smallholder farmers, subsequently downloaded over 18,000 times. In addition, a citation analysis found that over 14% of the papers cited in the agriculture sections of the Fifth Assessment Report were produced by CCAFS researchers, up from around 4% for the Fourth Assessment Report (2007).

A4NH published ***'Food Safety and Informal Markets: Animal products in sub-Saharan Africa'*** a book summarizing 10 years of research on food safety in informal markets. Meat, milk, egg, and fish are mainly sold on informal markets in developing countries. Most of these markets lack modern infrastructure and effective health and safety regulation and inspection. Using case studies from eight African countries the book offers policy makers and public health experts examples of challenges and solutions in managing food safety in informal markets. A4NH shows in particular how a participatory food safety risk assessment can be implemented by poor producers so they are not excluded from informal markets, while at the same time providing an effective strategy for reducing risks of food borne diseases for consumers.

A4NH researchers contributed to the 2013 Hunger and Nutrition Commitment Index (HANCI) Report, published in 2014 and led by the Institute for Development Studies (University of Sussex). This is a global report, which ranks governments on their political commitment to tackling hunger and under nutrition. It is used as a reference report by policy-makers and donors to developing countries.

The first ever Global Nutrition Report was published. A4NH co-chaired and contributed scientists to the group of international experts who put the report together. The Lancet undertook the refereeing process. The report is the first comprehensive summary and scorecard on both global and country level progress on nutrition for 193 countries. The Report points to ways to address malnutrition and to strengthen accountability. With formal endorsements from a wide range of policy-makers and government representatives, it is becoming a powerful tool for improving global, regional, and country-level policies, programs and investments for nutrition.

Humidtropics developed a geospatial tool to enable them to use remotely sensed data at different scales (farms - villages - landscapes), as inputs into a crop model for assessing actual crop yields and total factor productivity at these scales and within a broader systems context. The geospatial tool and the model will provide rapid and reliable field measures of the yield effects of scaled up adoption of different crop varieties and will do so over large expanses of land. It will provide a very effective tool for measuring extent of adoption and associated yield increases, at different spatial scales and within a systems context. A Proof of Concept was conducted by applying the model and its remotely sensed data to potato yield predictions. The model performed well, predicting potato yields with a high level of accuracy.

### SCALING UP RESULTS

AAS and L&F worked jointly with their partners to scale up the adoption of improved aquaculture production technologies in Bangladesh. This was through adoption of small fish and vegetable production at household level and a value chain approach for small fish, commercial tilapia and shrimp production. As a result, the income of half a million farmers in the polder zone of Bangladesh was increased.

The commercialization of the Aflasafe™ biocontrol product (resulting from the work of A4NH, Humidtropics and MAIZE) started in Nigeria. In its first year of production, an Aflasafe™ manufacturing and demonstration plant in Nigeria manufactured and supplied 218 tons of country-specific Aflasafe™ products to eight African countries. Interest from the private sector in the commercialization of Aflasafe™ is growing. In Kenya, the construction of a manufacturing plant, designed by IITA and USDA-ARS, started in 2014 at one of the Kenya Agriculture and Livestock Research Organization research stations.

CCAFS took advantage of a television reality show ***"Shamba Shape Up"*** to provide information on climate smart agricultural practices to more than 9 million viewers; this is benefiting Kenya's GDP by an estimated US$24 million through changes in practices. CCAFS also analyzed 18 case studies of weather and climate information advisory services for smallholders across Africa and South Asia. The analysis highlights what is needed to build effective national systems that produce, deliver, communicate and evaluate operational climate services for smallholders across the developing world. This and other research outputs from CCAFS' 266 publications shaped at least $16 million of new investments in climate services, including Nora's investment under the UN Global Framework for Climate Services (GFCS) in Tanzania and Malawi; World Bank investments in Myanmar and USAID seed grants to strengthen regional climate services.

Nine varieties of iron fortified beans (A4NH) with up to 94% of the target iron increment have been released in Rwanda and the Democratic Republic of Congo (DRC) has ten varieties of iron bean with up to 100% of the target iron increment. By end of 2014, an estimated total of 800,000 households in Rwanda and 350,000 households in eastern DRC were using iron beans. Innovative marketing campaigns were implemented to stimulate urban consumers' awareness. A music video and outreach tour by Rwanda's top musicians touting the benefits of growing and consuming iron beans were launched, including live performances to more than 30,000 people alongside exhibitions on iron beans.

Dryland Systems analyzed the results of more than 750 on-farm trials in South Asia. These evaluations showed that new combinations of improved crop varieties and integrated soil nutrient management practices can increase crop yield from 10% to 150%, depending on crops and site condition. More than 120 on-farm trials in different areas in Malawi showed that cereal-legume rotations using new bean varieties and soil fertility management practices yielded 189% higher than the long term national average.

### ENGAGING WITH POLICY-MAKERS

Humidtropics has been implementing a project in Uganda on: Policy Action for Sustainable Intensification of Ugandan Cropping systems (PASIC). The Uganda's Ministry of Agriculture, Animal Industry and Fisheries decided to use the project's investment planning approach and cognitive mapping tool to draft the 2015-2019 agricultural strategy of the Government of Uganda.

CCAFS helped establish the Global Alliance for Climate-Smart Agriculture (GACSA), with climate smart agriculture likely to become a major investment area in agriculture. It continued to play a role in establishing agriculture as a negotiating topic in the UNFCCC and at regional level, CCAFS has been actively engaged in major policy initiatives with NEPAD, ECOWAS, COMESA, CAC, ASEAN and OECD.

The outcomes produced by type 3 CRPs indicate progress toward all four SLOs. All type 3 CRPs contributed to the poverty alleviation and food security SLOs. Whist A4NH contributed very strongly to the nutrition SLO, the three systems CRPs (AAS, Dryland Systems and Humidtropics) also contributed to this SLO as they address nutrition challenges within a systems perspective, in their respective regions. All type 3 CRPs, finally, contributed to the natural resources management SLO, including A4NH through its approach to biodiversity management for nutritive landscapes. CCAFS contributed new outputs and outcomes to strengthen agriculture's adaptation to and mitigation of climate change.

# 3 GENDER RESEARCH MAINSTREAMING

CGIAR research aims to deliver clear explanations of gender relations that provide a sound basis for developing innovations that are more gender responsive or transformative. Putting these innovations to work through development partners to empower poor women and men, CGIAR aims for the adoption and sustained use of agricultural and natural resources innovations that result in a gender equitable distribution of food and income.

Working across CGIAR Research Programs (CRPs), the CGIAR Gender and Agriculture Research Network defined a shared theory of change. Based on indicators agreed for the common gender theory of change, the Network contributed to the definition of gender outcomes for the CGIAR's Strategic Results Framework. This shared framework of accountability for improving gender equity is important in the process of mainstreaming gender in research, to which the CGIAR first committed in 2010.

There was a notable increase in the collection of sex-disaggregated data in household and farm surveys by all CRPs, as recommended in the guidelines promoted by the Network. Furthermore, while in the 2013 Portfolio Report gender studies challenges were not sufficiently well addressed, this year it is one of the strengths since all CRP Annual Reports now clearly include Gender as one of their IDOs.

A women pastoralist milks her goat. Borena, Ethiopia. © ILRI\Zerihun Sewunet

Gender-responsive research has increased in CRPs. Advances in diagnostic analyses in 2014 show that agricultural innovations can change the balance of power in gender relations and require careful targeting to benefit women equitably. A wide ranging analysis of gender aspects of asset ownership provides new perspectives on the significance of the gender gap in ownership with a set of eight case studies (IFPRI and ILRI). Diagnostic studies looked at the status of women in production systems, access to seed and farm mechanization. As an example, one study analyzes the process of feminization of agriculture in rural Tajikistan (WLE). Roll-out of the Women's Empowerment in Agriculture Index (designed by PIM) expanded to cover more than 19 countries, demonstrating the utility of the Index for establishing a baseline at aggregate, country scale in terms of female and male empowerment and for measuring future impact. The baseline analysis (PIM) identified excessive workload as one of three important factors contributing to low levels of female empowerment.

L&F has helped address program needs by partnership in 2014 with The Royal Tropical Institute (KIT) and the testing of gender tools and approaches. L&F conducted extensive new work on gender, seeking to ensure that women have more equitable access to affordable and nutritious animal source foods. L&F collaborates with A4NH on gender and nutrition by focusing on consumption in Ethiopia and Egypt and on drawing lessons related to gender from other parts of their work. A Gender, Agriculture and Assets Project (GAAP, led by IFPRI and ILRI) conceptual framework has been developed and previous goals have been reviewed for their sufficient inclusion of the gender dimension.

An advance that will improve targeting is modeling climate smart technologies to benefit small-scale women farmers, a component of CCAFS' Climate Smart Villages. Another research approach of relevance in numerous CRPs for improving targeting involves consideration of gender differentiated varietal preferences in setting breeding objectives. RTB has broken ground with its identification of gender preferences in varietal traits for cassava.

A meta-analysis of 170 IRRI participatory rice varietal evaluations showed gender-related varietal preferences: female farmers were more concerned about good grain quality, straw for livestock fodder, thatching material, and farmyard manure; ease of harvesting and competitiveness with weeds. A4NH/Harvest Plus conducted a gender assessment that can be expected to augment the level of attention to gender-differentiated preferences in bio-fortification research.

Another diagnostic research advance in 2014 was the implementation by 11 CRPs of a standard, qualitative method for conducting case studies of gender norms, agency and innovation. Over 50 cases were conducted in various sites and regions where these CRPs have ongoing work, in preparation for cross-case, comparative analysis.

CRPs also progressed with the interchange of approaches and coordination of gender research on cross-cutting themes. Value chain analysis is a cross-cutting theme of significance for the majority of CRPs. Thus work on understanding and improving gender equity in value chains is an important aspect of mainstreaming gender in research. The set of guidelines for gathering sex-disaggregated data is a very relevant output from PIM that all the other CRPs will find useful. The Gender, Agriculture, and Assets Project produced relevant results further demonstrating PIM's important role in designing gender research tools and methods directly relevant to all CRPs. A clear outcome directly related to PIM's work is the decision to hire more women than men as extension agents by the National Smallholder Farmers Association of Malawi.

FTA has developed research designed to empower women in value chains for forest, tree and agroforestry products. Findings target policy change, as for example, policy recommendations from work on indigenous women, forests and value chains in Latin America that the Peruvian Environment Ministry has used for formulating collective land rights and climate change policy with a gender focus. A4NH continued its leadership for cross-program capacity development and knowledge–sharing on the theme of gender and nutrition impact.

Gender research has produced many new analytic tools in use with partners to improve diagnosis and design of interventions. These

include CCAFS' Gender and Social Inclusion toolbox in use by 61 partners in 19 countries, PIM's Women's Empowerment in Agriculture Index WEIA, PIM-A4NH-L&F Gender and Value chains toolkit on collecting gender and assets data in qualitative and quantitative program evaluations, and WLE's tools to assess gender performance on irrigation projects and for gendered landscape analysis. Authors of tools are actively disseminating these to CGIAR researchers and partners through training, as in RTB and DC .

# 4 OVERALL EFFECTIVENESS OF PARTNERSHIPS STRATEGIES

Partnerships are critical to the achievement of the SLOs, given the disparity between the magnitude of the problems addressed and the resources that CGIAR working alone can bring to bear on these challenges. In 2014 strategic partnerships increased to a total of some 3,100 partnerships that were essential to the results produced by the CRPs and synthesized in section 2.

**Research and capacity strengthening partnerships:** the institutions with which the CRPs collaborate for their research and for capacity building purposes are essentially similar. They are the numerous and better known public and private research institutions and universities, from the South and from the North. CRP Annual Reports provide details.

**Scaling up and scaling out with development implementers and value chain actors:** Partnerships with development and value chain actors vary across countries and development areas. They include national extension services, farmers' organizations, national, regional and international development organizations including NGOs, and the private sector particularly in value chain contexts. Tracking of adoption at a significant spatial scale requires extensive monitoring, which is very costly and requires the expertise of specialists; most CRPs rely on partners that have developed such monitoring systems and have the resources to implement them. In 2014, A4NH (HarvestPlus) and its partners delivered iron beans to more than 1 million farming households. Delivery partnerships for wider dissemination have largely been developed in the context of individual countries (e.g., Nirmal Seeds in India) but NGOs with a global reach (e.g., World Vision for African countries) are also partnering with CRPs to deliver improved technologies and practices at scale.

**Engagement with stakeholders at global, regional and national levels:** these partnerships also increased in quality and intensity by comparison with previous years. Specific examples are provided in section 2. The global stakeholders with which the CRPs engaged in 2014 include the G20, the SDGs, IPPC, UNFCCC, IPBES, the World Food Program, and FAO in addition to large development banks such as the World Bank, IFAD, the Asian Development Bank, and the African Development Bank. At the regional level, many CRPs engaged with a continental organization (FARA) and sub-regional organizations (e.g., CORAF, ASARECA, APAARI). Most CRPs worked to ensure alignment of their work in Africa with the Comprehensive Africa Agriculture Development Program (CAADP) of the African Union, to make certain their research is driven by the demands of the national agricultural agenda in African countries. The steps taken by some CRPs to align their work with CAADP's priorities were noted in the 2013 CRP Portfolio Report. In 2014 a majority of CRPs thus engaged in the dialogue with CAADP, so alignment was strengthened. Contributing to this momentum, PIM hosted a meeting of representatives from the Africa Union Commission and regional bodies with CRPs to discuss how CGIAR can support the new Science Agenda for African Agriculture.

**Public Private Partnership (PPP):** These became an important feature of the CRP portfolio as all CRPs have now forged such partnerships. They include partnerships with the private seed sector (e.g., Pioneer, Syngenta, Monsanto, private seed companies in more than 80 countries) for all the CRPs producing improved crop varieties; fertilizer companies for many crop improvement CRPs; the commercial vaccine sector ( L&F), and the specialized private sector companies working

in the varied domains of relevance to type 2 and type 3 CRPs. Examples include FTA's PPP with Unilever to launch the first product based on Allanblackia oil in Europe, with Mars Inc. (for cocoa) and with Clarins for Chinese tree products used in cosmetics. L&F (CIAT) has forged a partnership with Dow Agrosciences and Papalotla (Tropical seed) to introduce improved hybrid forage seed from Latin America to Africa. L&F (WorldFish) also has formal links to Merck Animal health to assess tilapia diseases in Egypt and Bangladesh and with Skretting Feeds and Aller Aqua for joint development of fish feeds and producers training.

Finally, the involvement of partners in the governance and decision-making mechanisms of CRPs has progressed. Nearly all CRPs had an independent Steering Committee (or equivalent body) with independent scientific experts (non-CGIAR, not involved with the CRP), chaired by one such independent individual and including representatives of key non-CGIAR partners (including from the private sector). The opening up of the CRPs to the different ideas and ways of doing business that this represents is noteworthy. It should result in strengthening CRPs research, mode of functioning and partnerships.

The CRP Annual Reports 2014 provide many additional examples of outputs and outcomes successfully produced through these wide ranging partnerships.

# 5 INTER-CRP LINKAGES

Strategic collaboration among CRPs has strengthened overtime, resulting in scientific synergies that became manifest in 2014 in the number and significance of jointly produced outputs and outcomes (section 2). Naturally, when different CRPs work jointly to produce results, attribution of these results to the different CRPs, in particular for RBM purposes, becomes difficult. It is similarly difficult to attribute to different partners the results produced by a CRP.

One of the advantages of cross CRP collaborations is that the tools developed by a CRP can be used by other CRPs and that a well-connected set of CRPs can progress towards their IDOs and the SLOs more effectively than a disconnected set of CRPs by drawing lessons from one another and not repeating the same mistakes. PIM has continued to be particularly active in this respect. For instance, its value chains portal, which became fully operational in 2014, is being used by a majority of CRPs. The successful biofortified crops developed by A4NH (HarvestPlus) are the result of a close collaboration between A4NH, Grain Legumes, Dryland Cereals and WHEAT. A4NH also collaborated with WHEAT, MAIZE and L&F on feed quality of wheat and maize varieties within the Agricultural Innovation Program for Pakistan. The aflatoxin results reported in section 2 reflect the joint work of many CRPs, as reported last year.

Wider cross CRP partnerships are found in the CCAFS Climate Smart Villages where several CRPs (WHEAT, MAIZE, GRiSP, RTB, Grains Legumes, Dryland Cereals, Livestock & Fish, WLE, Dryland Systems, and FTA) are jointly testing technologies, practices and institutional arrangements. FTA combined forces with WLE and CCAFS to develop a monitoring instrument that enables implementers of development interventions to monitor changes in resilience mapping. WLE also collaborated with Humidtropics to develop participatory methods to assess how ecosystem services are valued by men and women. GRiSP, AAS and WLE are jointly testing innovative ways to improve water management for rice and aquaculture production. MAIZE, Humidtropics and RTB collaborate on maize/cassava intercropping in the Democratic Republic of Congo. Active collaboration among the systems CRPs (Humidtropics, AAS and Dryland Systems) continued, with regular consultative meetings and a jointly organized International Conference on Integrated Systems Research for Sustainable Intensification.

# 6 WHETHER THE PORTFOLIO IS ON TRACK TO DELIVER ON THE SLOS AND WHETHER IT IS FINANCIALLY SUSTAINABLE

At the end of 2014 the CRP portfolio is more on track towards achieving the SLOs than it had been in previous years. Whilst the CRP portfolio has always delivered a large majority of outputs and outcomes addressing the food security and poverty alleviation SLOs, significantly fewer outputs and outcomes were produced at CRP portfolio level concerning the nutrition and natural resources SLOs. For the first time, in 2014, outputs and outcomes concerning these others SLOs reached a noticeable momentum.

**Food security and poverty reduction:** the portfolio is on track and well positioned to deliver on the SLOs on food security and rural poverty reduction. The CRP portfolio continues to be scientifically robust in terms of cutting edge crop breeding; climate change research to better mitigate change and adapt agricultural systems and crops to climate change; gender research targeting gender equity in access to the benefits of agricultural development; value chain approaches and relevant partnerships with the private sector for scaling up and scaling out. Gender research mainstreaming has progressed in all the CRPs leading to more gender equity in options for reducing poverty and improving food security.

**Improved nutrition and health:** the portfolio now appears better positioned than it was in the past to deliver significant outcomes towards this SLO. A4NH is of course the CRP most involved with this SLO but a good number of other CRPs are now contributing to it (from all 3 types of CRPs). A4NH demonstrated previously that diversity and quality of food are essential to nutritional content and health and the other CRPs have taken on board this evidence. Many CRPs now pay special attention to the nutritional dimension of the crops, fruits, animal and fish that is their focus. They also pay more attention to nutritional diversity, for instance through a specific emphasis on managing landscapes for their nutritional dimensions (Bioversity with A4NH, Humidtropics, AAS, WLE). The relationship between food quality and health is now being recognized widely and the results of the development and rapid scaling up of AflasafeTM (resulting from collaboration across various CRPs and Centers) is a good illustration.

**Sustainable natural resource management:** The portfolio's delivery on the SLO on sustainable natural resource management improved compared to previous years. In addition to WLE, FTA, CCAFS, PIM, DS, HT and AAS that have been working toward this SLO since their inception, a number of other CRPs have started to produce results concerning sustainable intensification that contribute to this SLO. There is however still room for progress at portfolio level, to more systematically address the ecological and environmental footprints of new technologies in agriculture, forestry, livestock and fisheries to contribute innovative results to this SLO. Work on in situ biodiversity management as a potential pathway to balancing productivity, profitability and resilience is yet to be developed sufficiently to produce concrete outcomes.

## FUNDING MIX OF THE PORTFOLIO

As table 1 (following) depicts, a majority of CRPs succeeded in increasing their initially allocated total budget by attracting more bilateral funds than originally envisaged and approved, thereby increasing their spent budget above the initially approved level. Allocation of bilateral projects and W3 funds to a CRP follows different rules across the Centers and CRPs, so it is not possible to infer from the figures in Table 1 that all the CRPs with a seemingly higher bilateral and W3 allocations have automatically been more successful than the others in obtaining such funds. Small discrepancies between initially approved budgets and spent budgets since CRP inception were explained in the 2013 CRP Portfolio Report (e.g., delays in receiving W1-2 allocated funds; late approval and inception of the CRP).

## WHETHER THE PORTFOLIO IS FINANCIALLY SUSTAINABLE

As already emphasized in 2013, financial sustainability for CRPs is impossible to assess in the current short-term funding environment. In 2014 all CRPs had to manage retrospectively

an 11% decrease in W1-2 funds (announced in October 2014). This decrease was followed by a 19% decrease for 2015 and a projected 35% decrease for 2016. Not only is the concept of a financially sustainable CRP portfolio hard to pin down at this point in time, but even the less demanding concept of financial stability is turning out to be elusive for the CRPs.

TABLE 1: APPROVED BUDGET, BUDGET SPENT DURING 2014 AND TOTAL SPENT AT THE END OF 2014[9] (IN USD THOUSANDS)

| NOTES | CRP | START | APPROVED/ REVISED BUDGET | | | SPENT DURING 2014 | | | TOTAL SPENT SINCE START TO END 2014 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DATE | W1/2 | W3/BIL | TOTAL | W1/2 | W3/BIL | TOTAL | W1/2 | W3/BIL | TOTAL |
| 1 | DS | JAN. 2012 | 70,333 | 62,392 | 132,725 | 18,129 | 25,703 | 43,832 | 38,934 | 70,182 | 109,116 |
| | HT | JULY 2012 | 69,192 | 75,225 | 144,417 | 14,654 | 19,199 | 33,853 | 33,643 | 45,775 | 79,418 |
| 2 | AAS | JULY 2011 | 37,822 | 47,202 | 85,024 | 15,254 | 16,154 | 31,408 | 38,158 | 45,508 | 83,666 |
| | PIM | JAN. 2012 | 140,830 | 124,403 | 265,233 | 24,691 | 62,164 | 86,855 | 66,936 | 187,631 | 254,567 |
| | WHEAT | JAN. 2012 | 40,966 | 186,583 | 227,549 | 17,208 | 21,436 | 38,644 | 40,311 | 71,489 | 111,800 |
| 2,3 | MAIZE | JULY 2011 | 51,055 | 125,400 | 176,455 | 19,137 | 41,181 | 60,318 | 49,094 | 169,317 | 218,411 |
| | GRISP | JAN. 2011 | 382,690 | 210,700 | 593,390 | 35,186 | 58,716 | 93,902 | 139,603 | 241,187 | 380,790 |
| 3 | RTB | JAN. 2012 | 135,600 | 47,500 | 183,100 | 31,112 | 43,969 | 75,081 | 82,751 | 108,623 | 191,374 |
| | GL | JULY 2012 | 95,173 | 43,962 | 139,135 | 16,396 | 29,622 | 46,018 | 43,580 | 72,507 | 116,087 |
| | DC | JULY 2012 | 55,898 | 28,430 | 84,328 | 8,552 | 12,744 | 21,296 | 19,602 | 25,320 | 44,922 |
| 3 | L&F | JAN. 2012 | 49,783 | 49,800 | 99,583 | 15,232 | 16,388 | 31,620 | 34,335 | 37,717 | 72,052 |
| | A4NH | JAN. 2012 | 93,631 | 97,769 | 191,400 | 26,671 | 65,939 | 92,610 | 61,949 | 137,859 | 199,808 |
| | WLE | JAN. 2012 | 163,781 | 82,472 | 246,253 | 25,084 | 29,308 | 54,392 | 70,990 | 96,482 | 167,472 |
| 2 | FTA | JULY 2011 | 99,200 | 167,070 | 266,270 | 30,395 | 48,019 | 78,414 | 98,143 | 154,098 | 252,241 |
| | CCAFS | JAN. 2011 | 323,900 | 68,600 | 392,500 | 44,997 | 23,873 | 68,870 | 164,784 | 82,591 | 247,375 |
| 4 | GENEBANKS | JAN. 2012 | 94,310 | 15,900 | 110,210 | 15,983 | 5,082 | 21,065 | 55,372 | 15,744 | 71,116 |
| | | TOTAL | **1,904,164** | **1,433,408** | **3,337,572** | **358,681** | **519,497** | **878,178** | **1,038,185** | **1,562,030** | **2,600,215** |

**Notes**

1. The Dryland Systems PIA included an inception year, and ran from 2012 for four years.

2. Three PIAs expired in June 2014, and were therefore extended by an extra six months to bring them into line with the other CRPs. The additional value of their extension contract (included in the amounts above) were:

| CRP | W1/2 | W3/BiL | TOTAL |
|---|---|---|---|
| AAS | 5,549 | 20,055 | 25,604 |
| MAIZE | 6,355 | - | 6,355 |
| FTA | 8,900 | 24,470 | 33,370 |

3. Three CRP Contracts included an expanded component. The expanded component is an additional amount of W3/Bilateral to allow for extra resource mobilization. This expanded component has not been included in the table above. These amounts are:

| CRP | TOTAL |
|---|---|
| MAIZE | 67,700 |
| RTB | 24,300 |
| L&F | 20,125 |

4. Genebanks is included in the above table for completeness, although not strictly a CRP.

[9] The actual CRP expenses in the table above have been compiled from the CGIAR Financial Report, which is an aggregation of the audited Financial Statements of the Centers.

# 7 LESSONS LEARNT AND IMPLICATIONS FOR THE FUTURE EVOLUTION OF THE PORTFOLIO

The major lessons learned in 2014 concern the need for the CRPs to ensure that they are fully prepared to implement an effective RBM (Results-Based Management). These lessons were learned in particular through the experience of five CRPs piloting RBM projects.

In 2014 the Consortium Office managed a competitive call for RBM pilot projects and five CRPs (CCAFS, GRiSP, RTB, HT and AAS) received a supplementary W1 allocation (approved by the CB and the FC), to implement their proposed pilot RBM project.

CCAFS developed a Monitoring and Evaluation (M&E) strategy, approved by its Independent Science Panel, and it set up a web-based system that facilitates project and CRP planning, reporting, M&E and RBM, all on one platform. GRiSP started its pilot by designing a monitoring and evaluation framework and starting to design a supporting Management Information System (MIS). Humidtropics' pilot led to developing and demonstrating a Theory of Change at the level of R4D platforms, following a project logic that fits within the Humidtropics IDOs. Data collection and management protocols were introduced and a software program, DevResults was introduced to guide data organization in order to measure progress towards IDOs across all projects. Through its RBM pilot RTB organized stakeholder planning workshops for two of its clusters of activities. In these workshops, stakeholders and RTB scientists co-constructed more realistic, nonlinear Impact Pathways and agreed on a framework of indicators for monitoring jointly expected changes.

These RBM pilots demonstrated for the benefits of all CRPs that RBM has a number of prerequisites. None of these issues is particularly new, but the pilots provided a proof of concept, which is more convincing than abstract recommendations. The main lessons from these pilots follow.

- A prerequisite to implement RBM is for each CRP to have robust M&E systems, with an effective supporting information system. Some of the CRPs which managed RBM pilots initially assumed that their existing M&E system were adequate, but realized that they had to strengthen their systems before they could proceed with RBM. Associated with this realization is the recognition of the need to mainstream M&E in the entire research for development agenda of a CRP. In other words, M&E has to be fully integrated in the planning and implementation of the CRP's activities. Only then can it provide the necessary learning and feedback to scientists and CRP leadership on the performance of their activities. The importance of having an appropriate information system, which can cope with big data and is open access, in keeping with the CGIAR Open Access strategy must be stressed. Some of the CRPs piloting RBM projects had information systems they deemed relevant, but realized through the pilots that the robustness of their systems had to be stepped up to deal with big data and open access.
- In order to design and effectively implement such robust M&E systems, each CRP needs appropriate senior level expertise in M&E and need to invest in M&E training for all the non-specialists who have to be involved in the implementation of M&E, including the change in mindset that is needed to set up a scientific activity from the perspective of results-based management.
- This implies that within the overall budget of each CRP M&E should have appropriate budgets and staff allocations. To date it is difficult to appreciate, in CRPs budgets, whether M&E has a sufficient budget allocation to provide the measures of progress toward delivery of outputs and outcomes required by RBM. The 'reward' is the strengthening of the research agenda of the CRP through the feedback such systems provide on the performance of research for development activities in a CRP. The second call for proposals will need to provide sufficient guidelines to the CRPs in this respect.

- To work effectively in a multi-institutional context therefore with scientists who have different 'cultures' and different disciplines, across a number of sites in different continents requires robust facilitation skills, which many scientists may need additional training to acquire. Adoption of a ToC/IP framework requires, additionally, new skills to organize and facilitate face to face and virtual meetings to:
    i. co-design impact pathways with partners to arrive at a shared understanding of objectives, priorities, expected results and respective roles of the partners
    ii. agree on indicators and targets with clear metrics at different aggregating levels, and
    iii. budget time to learn from and analyze the data being collected so that a continuing learning process ensues. The evidence from the pilots and CRPs' individual experiences with these processes is that considerable investment (time and budget) is needed for implementing such changes in research culture at multiple levels, from the relatively small projects in one country to the entire CRP level, globally.

The setting-up of a voluntary Community of Practice on monitoring and learning (MEL) in 2015 is expected to support the momentum acquired through these pilots and facilitate the design of RBM frameworks in all CRPs. It will bring together M&E specialists with multidisciplinary backgrounds and interest in MEL from the CRPs, Centers, Consortium Office and very probably IEA and ISPC. The MEL COP will organize its activities in synergy and efficient coordination with the IEA Evaluation Community of Practice (ECoP).

# 8 RISKS TO PORTFOLIO PROGRESS AND THEIR MITIGATION

The following six major risks can potentially constrain the portfolio's progress toward the IDOs and the SLOs. The second call for proposals and the guidance for preparing proposals constitute strategic opportunities to mitigate these risks over the coming years.

### RISKS OF A CRP PORTFOLIO BIASED TOWARDS SHORT-TERM PRIORITIES AND RESULTS

Given the lag time required for outcomes to become manifest in an outcome-based approach to research for development, donors' expectations for quick results could lead CRPs to prioritizing short term over long term results, undermining the delivery of high-quality outcomes. This would undermine the capacity of the CRP portfolio over the medium and long term to deliver high-quality outcomes and IDOs and it would slow down progress toward the SLOs. The lag time that is required before research can be translated into significant outputs and outcomes needs more explicit recognition and explanation. This problem is particularly worrisome for the CRPs that have a relatively short historical base (type 2 and 3). It is essential that the CO, Centers and CRPs better manage donors' expectations by providing much clearer communication on this point.

### NEW FINANCIAL RISK

A major risk to the portfolio is the persistence of the current lack of synchrony between timing and duration of funding and the long term nature of CGIAR's research-for-development agenda. CRPs have been requested to provide proposals for multiyear research programs in keeping with an outcome-based research approach. Funding from W1-2 is however announced on a yearly basis and it started to decline in 2014. Following a retrospective decrease in W1-2 funds of 11% in 2014, CRPs experienced a shortfall of 19% in these funds in 2015. CRPs absorbed these two decreases in different manners and it is estimated that about 750 scientific positions were closed

across the portfolio of CRPs. A likely decrease of W1-2 funds of 35% has been announced for 2016.

There are three particularly worrisome knock on effects of budget cuts in W1-2 of such amplitude. First, funding from W1-2 provides crucial support for the core strategic research and the longer term research of the CRPs. Cuts and uncertainty in funding from W1-2 shift attention of researchers to more reliably funded bilateral projects, and undermine multiyear research planning and the continuity of core research. Second, CRP Management Committees are seriously weakened by the loss of flexibility because of the increased reliance on W3 and bilateral projects that are constrained by the agreement between the funder and the recipient Center. This leads to an increased focus on bilateral projects and a fragmentation of the research agenda of the CRP, reverting to pre-reform modes of functioning. Third, announcements of significant decreases in budgets for strategic core research with relatively short notice damage the credibility of CRPs with their non-CGIAR partners, including the private sector, which are not used to this yearly and hard to predict funding system. The phase II CRPs will need a more stable and longer commitment of funding from W1 and W2 if the CGIAR is to pursue long term mission orientated research.

### RISK OF CONTINUED DISCONNECTION BETWEEN FINANCIAL AND PROGRAMMATIC PLANNING AND MANAGEMENT

In many CRPs management teams are handicapped by the difficulties in linking programmatic research activities and financial requirements. CRP management teams have in most cases no access to real time views of expenditure. Previous CRP Portfolio Reports, and CRP Directors, have stressed the need for a system-wide project management and reporting system with real-time access to data on burn rates and deliverables. From an accounting perspective, 9 Centers and the Consortium Office have started to use the 'One Corporate System' (OCS) platform, with three Centers having fully completed the implementation phase. What is missing is the integration of program management aspects with the financial aspects, and then across the system as a whole. Such a system has been discussed over the last four years, with the Consortium advocating its strengths, yet the system is still not yet in place. Consequently this risk has not diminished relative to 2013. To date, linking programmatic and financial requirements at CRP level remains difficult as financial systems in the Centers were never set up to do this. Despite efforts to harmonize budget categories at CRP portfolio level, these are still interpreted differently in the different Centers.

It will be necessary to have a standardized and aligned financial and programmatic monitoring system across the CRP portfolio in place for the second call to address this particular risk.

### RISK OF MOBILIZING INSUFFICIENT HUMAN RESOURCES TO UNDERTAKE RESEARCH ON COMPLEX SYSTEMIC APPROACHES

The uncertain funding from W 1-2 may result in a curtailed ability to mobilize sufficient human resources with skills in interdisciplinary and transdisciplinary research, to provide a necessary complement to the solid cadre of more time-honored disciplines that the CGIAR has acquired over time. The new SRF recognizes the complexity of the challenges ahead, the interconnections between productivity, sustainability and resilience with environmental factors and the consequences of globalization. A transformative integration of many scientific fields (life, natural, social, human health, mathematical) through trans-disciplinary approaches has been shown to produce major improvements for and truly innovative solutions to large–scale, complex problems (e.g., National Academy of Sciences, 2014). One way to mobilize such skills is through appropriate collaborations, and a number of CRPs recognize this is a viable option. However, a minimum of funding stability is necessary for CRPs to successfully engage in such collaborations and partnerships.

### RISK OF A CRP LEADERSHIP NOT FULLY EMPOWERED

CRP and Flagship Project (FP) leaders ensure that appropriate outputs and outcomes are produced by their FP and CRP. Their level of authority does not often match this level of responsibility. Both CRP and FP leaders should have the managerial authority to allocate resources (staff, budget) within the CRP and across FPs components. They should also have a key role in

staff supervision and performance assessment. Without this level of managerial authority it is extremely difficult for them to successfully deliver on their own responsibilities and to be champions of a culture of results. This recommendation is supported by the findings of the first external evaluation of a CRP (FTA) by the IEA in 2014.

### RISK OF A PATCHY APPROACH TO INTEGRITY AND ETHICS IN RESEARCH FOR DEVELOPMENT AT PORTFOLIO LEVEL

This risk, already discussed last year, is linked to questions of integrity and ethics in research for development. Different CRPs deal with these issues in diverse manners and it is not clear whether all CRPs have an adequate strategy to deal with integrity and ethics in their specific research for development activities. For instance, the CRPs that rely principally upon development partners for monitoring rates of adoption and evaluating the impacts of adoption need to ensure that these partners use methods of measurement of adoption and impacts that meet the highest international scientific standards. This is even though development actors may not be familiar with such standards and influencing them to adopt these standards may be quite challenging. A scoping study or baseline of where the portfolio as a whole stands in this respect, as was done for gender research, would provide a good point of departure to determine whether there is room for improvement on a system wide basis through relevant holistic policies and procedures.

Plant samples in the gene bank at CIAT's Genetic Resources Unit, at the institution's headquarters in Colombia. © CIAT/ Neil Palmer

# APPENDIX 1: CRP ON CGIAR RESEARCH PROGRAM ON MANAGING AND SUSTAINING CROP COLLECTIONS 2014 RESULTS

**The CGIAR Centers have an obligation to the world to conserve and make available the 35 ex situ crop and tree collections under their management according to the provisions of the International Treaty of Plant Genetic Resources for Food and Agriculture (ITPGRFA). The Genebanks "CGIAR Research Program" (Genebanks CRP) provides security in funding for the routine operations of the genebanks and works towards improving individual performance standards and strengthening quality and risk management systems in all genebanks.**

A total of 124,319 germplasm samples was provided by the CGIAR genebanks to users in 2014 (Figure 1); 35,258 distinct accessions were provided to CGIAR Research Programs (CRPs) and 33,240 accessions were distributed outside the CGIAR directly to advanced research institutes & universities (45%), NARS (37%) and to farmers and the private sector (18%) in 112 countries (Figure 2).

Although the total number of distributions is lower than in 2013, the number of requests from and distributions to external users continues to rise steadily (Figure 1) and may be predicted to continue increasing and become more targeted as the availability of good quality data improves over the next five years.

FIGURE 1. NUMBERS OF SAMPLES DISTRIBUTED ACROSS YEARS

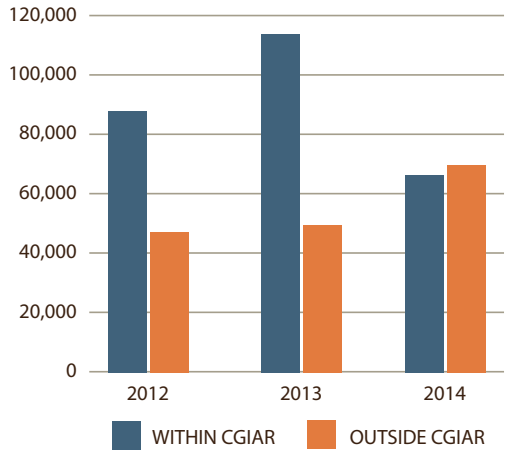
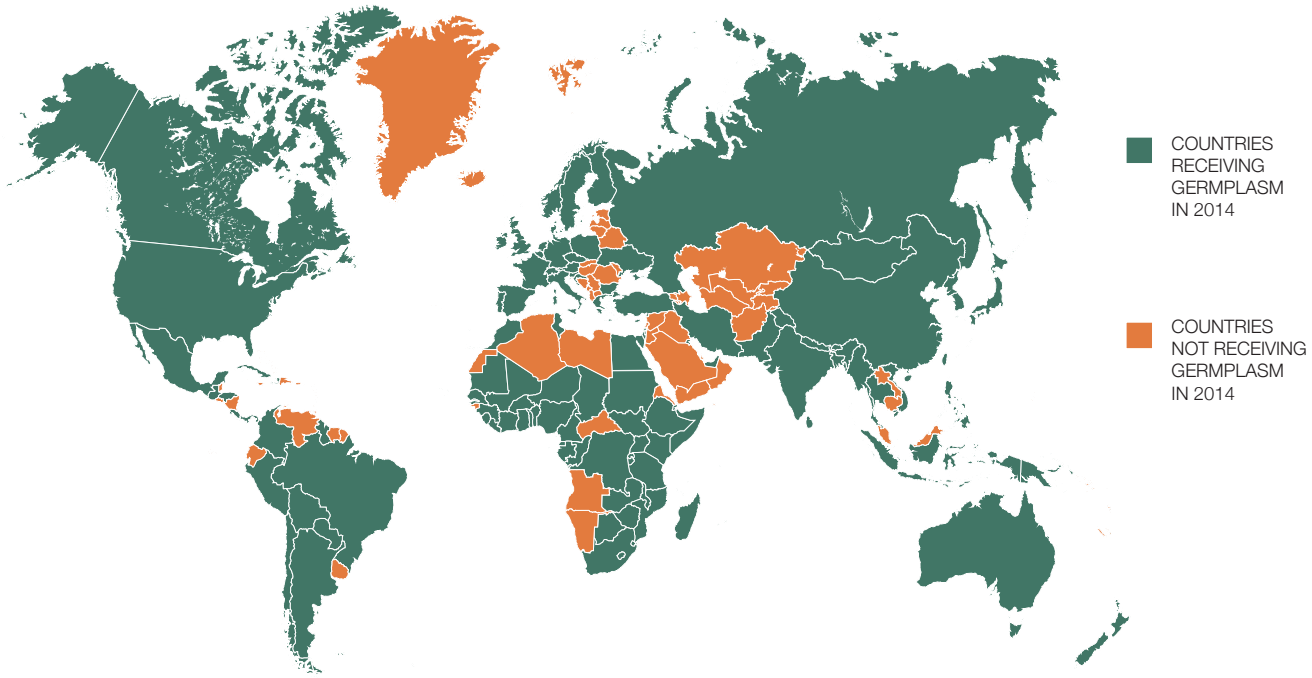



FIGURE 2. COUNTRIES RECEIVING GERMPLASM IN 2014



The CGIAR genebanks presently manage 738,215 accessions, including 31,681 in vitro accessions and 27,763 accessions of crops and trees held as plants in the field. Approximately 71% of total accessions are immediately available for international distribution under SMTA. Of the seed accessions, 59% are secured in safety duplication at two levels and, 55% of accessions from clonal crop collections are safety duplicated in the form of tissue culture in vitro or in cryopreservation or as seed. Currently, 73% of the accessions have passport and characterization data accessible online.

The status of individual seed and clonal crop genebanks is illustrated in Table 1. All genebanks are actively working towards improving the percentage availability and safety duplication of the collections through seed increase, viability testing and disease cleaning, as well as through

TABLE 1. STATUS OF GENEBANKS ACCORDING TO PERFORMANCE TARGETS


* 58% accessions in ICARDA's collections are viable, healthy and in sufficient seed number and 79% are safety duplicated on two levels. However physical access to the collections remains severely limited.

PERFORMANCE TARGETS

1. Availability: % collection which is clean, viable, in sufficient seed number to be made immediately available for international distribution from medium term storage (90% target)
2. Security: % collection which is held in long term storage conditions in two locations and also in the Svalbard Global Seed Vault or for clonal crops % collection in vitro in two locations (90% target seed collections; 90% clonal crop collections)
3. Data availability: % collection with minimum passport and characterization data available online (90% target)
4. QMS: Stage of development (from 1 to 5) of quality and risk management system
5. Distribution: diversity: % collection disseminated over 10 year period (tentative target 10% per year)
6. Distribution: quantity: number of samples disseminated/year as a proportion of the total collection size (tentative target 20% per year)

more strategic acquisition and curation. In 2014, a specialist in Quality Management Systems (QMS) for genebanks was hired. A custom-made QMS has been developed to incorporate all genebank operations, and the minimum elements of QMS for implementation by 2016 have been agreed by the genebank managers. All genebanks are now investing staff time in drafting comprehensive standard operating procedures, which is also providing a valuable mechanism for a number of retiring staff to transfer their unique knowledge and practices.

A significant step has been made in the development of more robust data management systems. CIMMYT has adopted GRIN-Global and, for the first time, has been able to provide integrated accession data online. At least two other CGIAR genebanks are planning to adopt GRIN-Global before 2016. Adopting Centers are working together as "Frontrunners" in improving the software and sharing advances. The global portal for accession data, Genesys, now provides updated information, maps and meta-data on 2.8 million accessions.

A process of determining a strategy for the conservation of tropical forages was launched in 2014, coordinated by an external consultant. The process aims to bring together the views of the tropical forage community to develop and implement a more strategic approach to conservation, ensuring that diversity of priority species are available and promoted for use, while lesser priority species or accessions are safely archived. The process will help provide direction and support to CIAT, ILRI and ICARDA in developing a coherent and rationalized approach to forages conservation and a coordinated interface with the users.

Eight of 11 genebanks have been reviewed by external experts and six of them have developed workplans to address key recommendations. CIAT and CIMMYT commenced work in 2014 on improving and increasing the rate of regeneration of accessions with insufficient viability or seed number, especially more difficult-to-conserve accessions such as high-altitude Andean maize varieties. IRRI is pilot-testing an automated, high-throughput seed phenotype sorting system that will allow what has until now been an intensely manual activity to be undertaken overnight. ICARDA received funding at the end of 2014 to initiate the building and furbishing of genebanks and field stations in Morocco and Lebanon as part of the Center's decentralization plan. Remaining Center genebanks will be reviewed and launch their individual workplans in 2015. Continued pronounced improvements in the status of several collections are expected to be evident in 2015 and 2016 as a result of the implementation of these workplans.

# APPENDIX 2: CGIAR CONSORTIUM MEMBER CENTERS

**The Africa Rice Center (AfricaRice)** is a pan-African organization dedicated to reducing poverty, hunger and under-nutrition, ensuring sustainable management of natural resources and developing capacity in Africa through rice research, development and partnership activities.

www.AfricaRice.org

**The International Maize and Wheat Improvement Center (CIMMYT)** is the global leader on publicly-funded maize and wheat research. CIMMYT works to sustainably increase the productivity of maize and wheat cropping systems, thus improving global food security and reducing poverty.

www.cimmyt.org

**Bioversity International** delivers scientific evidence, management practices and policy options to use and safeguard agricultural and tree biodiversity to attain sustainable global food and nutrition security.

www.bioversityinternational.org

**The International Potato Center (CIP)** aims at achieving food security, well-being and gender equity for poor populations in the developing world through research and innovation in science, technology and capacity strengthening.

www.cipotato.org

**The International Center for Tropical Agriculture (CIAT)** develops new technologies and knowledge that help make agriculture more eco-efficient – that is, competitive and profitable as well as sustainable and resilient.

www.ciat.cgiar.org

**The International Center for Agricultural Research in the Dry Areas (ICARDA)** is a global agricultural research organization working with countries in the world's dry and marginal areas to deliver sustainable systems solutions that increase productivity, improve rural nutrition, and strengthen national food security.

www.icarda.org

**The Center for International Forestry Research (CIFOR)** is a non-profit, scientific facility that conducts research to inform policy and decision making on the use and management of forests and landscapes around the world.

www.cifor.org

**The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)** works across the drylands of Africa and Asia, making farming profitable for smallholder farmers while reducing malnutrition and environmental degradation.

www.icrisat.org

**The International Food Policy Research Institute (IFPRI)** was established in 1975. The Institute conducts research, communicates results, optimizes partnerships, and builds capacity to sustainably reduce poverty and end hunger and malnutrition. Gender is a cross-cutting theme.

www.ifpri.org

**The International Water Management Institute (IWMI)** researches the sustainable use of water and land to develop scalable agricultural water management solutions that impact poverty reduction, food security and ecosystem health.

www.iwmi.org

**The International Institute of Tropical Agriculture (IITA)** aims to improve the food security, income, and well-being of the poor in sub-Saharan Africa. We work with partners to enhance agricultural production, improve food systems, and promote sustainable livelihoods from agriculture.

www.iita.org

**The World Agroforestry Centre (ICRAF)** increases the use of trees in agricultural landscapes to improve food security and incomes, and to advance policies and practices that benefit the poor and the environment.

www.worldagroforestry.org

**The International Livestock Research Institute (ILRI)** works to improve food, nutritional, economic and environmental security in developing countries through research on sustainable livestock systems – ensuring better lives through livestock.

www.ilri.org

**WorldFish** is an international, nonprofit research organization that harnesses the potential of fisheries and aquaculture to reduce hunger and poverty.

www.worldfishcenter.org

**The International Rice Research Institute (IRRI)** is the world's premier research organization dedicated to reducing poverty and hunger through rice science, improving the health and welfare of rice farmers and consumers, and protecting rice-growing environments for future generations.

www.irri.org

COVER PHOTO: Local market © CIAT/Manon Koningstein

CGIAR is a global research partnership for a food-secure future. CGIAR research is dedicated to reducing rural poverty, strengthening food security, improving human health and nutrition, and sustainably managing natural resources. Research is carried out by the 15 Centers, members of the CGIAR Consortium, in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector.

For more information, visit www.cgiar.org

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