1.1. 2014 Annual report GENEBANKS CRP

A. Key Messages

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 until 2016 to enable the CGIAR to fulfill this obligation and to support the routine operations of the genebanks. It is a CRP only in name; it is not a research program nor does it have strong influence on shaping the pathway to development by which the CGIAR achieves its impact. Instead the genebanks provide the raw genetic materials with which the commodity and other CRPs achieve genetic gain in the new products that they develop. Importantly, the genebanks also have a direct channel themselves to NARs, ARIs and the private sector, providing in most cases the sole source of healthy, well-documented germplasm for breeding, research and use. In order to provide this service to international standards, the genebanks process annually thousands of accessions through routine operations (such as viability testing, health testing, disease cleaning, regeneration, multiplication, distribution, etc.). The Genebanks CRP is managed in a partnership between the Global Crop Diversity Trust (CropTrust), which provided 16% of the routine costs in 2013, and the CGIAR Consortium Office. Fund-raising for the CropTrust's endowment fund to provide long-term financial support for the management of the collection is one of the important goals of the CRP proposal.

A total of 124,319 germplasm samples was provided by the CGIAR genebanks to users in 2014; 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. 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.

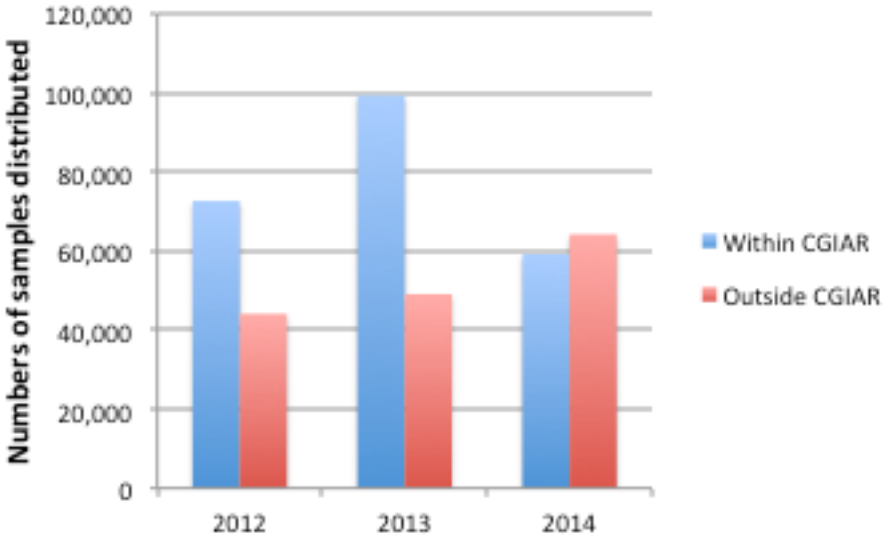

Figure 1. Numbers of samples distributed across years

Three genebanks, Africa Rice, IITA and ICRISAT, hosted external expert reviews in 2014. All three genebanks were recognized to have adequately functioning genebanks and compentent staff. Facilities, data management systems and seed management processes were highlighted as requiring improvement. Review recommendations are being addressed through costed Recommendation Action Plans (RAPs), which are in the process of being reviewed and funded through the Genebanks CRP. CIAT was the first Center to propose and implement an upgrading plan in 2014. It is focussed on the regeneration of an additional 3,000 accessions of forages and beans in order to accelerate progress towards reaching performance targets. The achievement of this objective will depend on CIAT expanding its technical capacity to produce adequate seed for a highly diverse set of accessions.

Of particular note this year was the expansion and launch of Genesys v.2.0, which now includes data, analyses and maps on 2.8 million accessions in 7 languages, and a number of other achievements and events concerning the management of data, including the launch of DivSeek and major progress on GRIN-Global use. CIMMYT has taken up a role as 'frontrunner' in testing and adapting GRIN-Global software for use as the accession data management software for both wheat and maize genebanks. The significance of this achievement is reflected in the reviewers' recommendation in their 2013 review:

> "*It is critically important that all information associated with the PGR collections be maintained in a single database that is interoperable with other information systems, and that this much of the accession information be available online. Following testing of GRIN-Global (GG), we recommend that CIMMYT concludes the piloting of different software options and implements a consolidated information management strategy within 18 months to avoid further delay of this vital effort.*"

Also in 2014, IRRI embarked on a major project to introduce automated seed processing. Through support from the Genebank CRP, it has entered into a partnership with a private company, SeQSo, based in the Netherlands to develop a rice seed phenotype analyzing and sorting machine that will potentially end the need for manual sorting of rice seed. The machine uses spectral imaging and robotics to sort pure seed from damaged, diseased or immature seed. Given the diversity of genotypes and nature of rice seed this project requires extensive testing and fine-tuning. The sophisticated robotics for the machine will be constructed over the next 12-18 months and the final machine will be ready for shipping to IRRI in 2015. Given a successful outcome the time and staff input required for seed sorting will be reduced dramatically.

B. Progress along the Impact Pathway

C.1 Narrative of major achievements, by Theme (1 ½ pages)

Well-resourced, active genebanks work towards targets of maximum security, availability and use of unique and valuable accessions according to international standards. Genebank activities are not heavily targeted towards specific users or uses, and it is important that they remain flexible to changing needs and demands. The composition, security, availability and use of the collections are, thus, key indicators for the success of the Genebanks CRP.

Security and composition

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. 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. Cryobanking projects are ongoing in Bioversity and CIP. Materials have been introduced from collecting missions, breeding programs, and NARS (12,893 accessions in 2014).

Availability

Routine genebank operations continued in 2014 to ensure germplasm is available for distribution, involving viability testing of 99,341 accessions, regeneration of 73,493 accessions, health testing of 38,898 accessions, and disease cleaning of 12,102 accessions.

Currently, of the 738,215 accessions recorded in the genebanks, 71% are immediately available for use as viable, healthy accessions. The remaining 29% can be made available only after seed increase, health testing or cleaning; or they may be made available locally only (e.g. some field collections); or, in some cases, cannot be legally distributed at all.

Use

The CGIAR continues to be the primary source of crop diversity to users worldwide. A total of 35,258 accessions were provided by the CGIAR genebanks to users within the CGIAR and 33,240 accessions were provided to NARS and other external users in response to 2,054 requests.

Currently, 73% of the accessions have passport and characterization data accessible online. The Genebanks CRP is working to improve access to good quality information through GeneSys, the global web portal for accession data.

C.2 Progress towards outputs

The CRP has now collected three years of data on accession numbers in the genebanks. Several indicators have more solidity and value than others. It is still difficult to determine indicators of efficiency in germplasm management or in ensuring maximum seed longevity, given the range of crop and collection types and different approaches of Centers. Current targets are consolidated around four key parameters:

1. % availability (a compound indicator taking account of seed viability, seed health, seed number and legal availability),

2. % security (a compound indicator taking account of seed accessions being held in long term storage and in safety duplication in the Svalbard Global Seed Vault and one other location, and of clonal accessions being held either in vitro or in cryopreservation in two locations),

3. % data availability (a compound indicator taking account of a minimum amount of passport data or characterization data to describe the accession).

4. Minimum essential elements of QMS being in place.

The current status of the genebanks against these performance targets was presented to the DGs and Center Board Chairs by Marie Haga, Executive Director of the Crop Trust, and Charlotte Lusty, Crop Trust Senior Scientist, at their annual meeting in Dar es Salaam, Tanzania. There was support from the group for the targets and a commitment expressed by the Center management to reach them. Further, it was recognized that there would be a challenge to reach the endowment target and that the Centers should work in partnership with the Crop Trust to determine how ongoing funding to the genebanks may be sustained, looking at a range of options.

In 2014, the CRP hired a full time specialist, Janny van Beem, to focus on strengthening QMS in the nine genebanks, which have not adopted ISO standards. Her first task was to propose what essential elements of QMS should be adopted as a minimum by 2016. Core to the approach will be the comprehensive documentation of genebank operations as standard operating procedures (SOPs) by those genebank staff who are responsible for those areas of work. The process will build on existing guidelines and published procedures but the significance of QMS is its grounding in how operations are carried out in actuality, which may differ from how operations *should* be carried out according to guidelines. Elements for the minimum QMS, agreed at the AGM2014, for putting into place by the end of 2016 are:

- SOPs on Acquisition, storage/conservation, Regeneration, Distribution and Safety duplication
- Controlled access to facilities
- Risk management strategy
- Staff succession
- Barcoded labelling

C. PARTNERSHIPS BUILDING ACHIEVEMENTS

An Expert Working Group for Wheat Genetic Resources Conservation and Use was formally established under the auspices of the International Wheat Initiative. The aim of the group is to bring a number of private and public sector experts together to provide inputs into the Global Wheat Conservation Strategy, give guidance to the CGIAR Centers in their management of wheat collections, and enable a coordinated and more widely reaching engagement in data exchange.

A process was initiated to bring together the community of users and conservers of tropical and subtropical forages. After several decades of collecting, it is recognized that collections have become large and expensive to manage without resulting in greater use of diversity. The strategy process aims to determine shared priorities and provide direction to the investment of resources in conservation activities, research and use. CIAT, ILRI and ICARDA are key partners in the process, involving genebank managers and representatives from breeding programs.

The AGM2014, which took place in Arusha, Tanzania, involved participants from Kenya, Tanzania and Uganda national genebanks, the Secretariat of the Pacific Community, World Vegetable Center (AVRDC), USA Department of Agriculture (USDA), South African Development Community Plant Genetic Resources Center (SPGRC) in Zambia and representatives of the ITPGRFA and IPPC. Aside from resolving regular issues concerning the refinement of the performance targets and indicators, the meeting made recommendations on strengthening partnerships with national institutes and on strengthening phytosanitary procedures and the CGIAR's relationship with the IPPC to facilitate the safe movement of germplasm. Discussions helped to clarify policy issues concerning the introduction of the Nagoya Protocol and genebank managers were able to agree a process to improve reporting and representation to the IRPGRFA

RISK MANAGEMENT

1. ***Risk Management Strategies***: Nearly all of the eight genebank reviews so far have included recommendations to improve the risk management strategy involving the genebank and collections. While all Centers have institutional risk management strategies in place, these rarely focus to an adequate degree on the specificities of the genebank. This includes the need for comprehensive thinking on the potential evacuation of the collection in the event of a disaster. Efforts are

under way to strengthen the strategies through the process of strengthening QMS.

2. ***Natural disasters and civil unrest***: ICARDA have continued their process of withdrawal from Syria and are now setting up permanent facilities for the collections in Lebanon and Morocco. A proposal has been submitted to and approved by the CGIAR Fund Council to build facilities and purchase essential equipment for the management of the collection in these two locations. Ultimately a decision will be made as to how to reconstruct the collection if it continues to be difficult to access germplasm in Syria. Fortunately, ICARDA has safety duplicated 80% of its collections in the Svalbard Global Seed Vault.

3. ***Cryobanking***: In the process of reviewing QMS in cryobanking, Crop Trust consultants, Erica Benson and Keith Harding, highlighted a number of important areas requiring urgent attention concerning health and safety of staff handing liquid Nitrogen. As a result of their review the Centers concerned have put measures in place. In particular, Bioversity have put in place oxygen monitors and alarms.

H. LESSONS LEARNED

Analysis of variance from what was planned:

i. There are one or two areas where genebanks continue to revise or validate reported accession figures for a number of reasons. In the case of ICRAF, levels of availability decreased because genebank staff gained a better understanding of the number of seed in each accession and set new thresholds for what is an acceptable amount. CIAT has modified its data on availability also because of inventory work. The availability of clonal material at CIAT has been affected by the development of diagnostics for frogskin virus, which has obliged the genebank to retest the entire cassava collection. The genebank manager at CIP has taken a serious measure to hold back the availability of all accessions that have not been verified in the field and through molecular characterization as being true-to-type. The levels of safety duplication of the clonal collections varies from year to year and is somewhat at the whim of national phytosanitary authorities, allowing the movement of in vitro duplicates between Colombia and Peru.

ii. Not applicable.

iii. The situation with ICARDA has put some focus on safety duplication. Many Centers safety duplicated their collections several years ago and in some cases in circumstances that have not since been fully formalized. There are two lessons to learn here: firstly, that Centers contact host institutes to inventory safety duplicates and request reports on any events that may have affected their long-term conservation or ideally request samples to be sent back for viability testing; secondly, that formal agreements are in place with all host institutes and the responsibilities of each institute for monitoring the duplicates are clear.

Annex 1: CRP indicators of progress, with glossary and targets

Indicator	Glossary/guidelines for measuring the indicator	2012	2013	2014	2021
		Actual	Actual	Actual	Target
1. Total number of accessions	Base number of accessions in the collections of the genebanks. This number was used as the basis of the 2010 Costing Study. It does not include the barley collection at CIMMYT, rice collection at CIAT, Rhizobium collection at ICARDA, nor regional collections of ICRISAT.	710,001	725,244	738,215	No target
2. Total number accessions that are currently available	Numbers of accessions that are viability tested, disease-free and in sufficient numbers for immediate distribution.	465,358	492,654	525,410	>90% of total
3. Number seed accessions held in LTS and safety duplicated at two levels	Numbers of accessions in seed collections held in long-term storage and also safety duplicated in long-term storage in a major genebank in another country and represented in the Svalbard Global Seed Vault.	386,037	375,271	413,448	>90% of total
4. Number RTB accessions held in safety duplication in vitro	Number of vegetative-propagated accessions held in vitro in slow growth conditions and also safety duplicated in a second location.	-	-	13,057	>50% by 2025
5. Stage (from 1 to 5) in QMS development	A qualitative assessment of where the genebanks are in the development of their quality and risk management system. Five stages will be described and the Centers will assess themselves.		New indicator		4 or 5

6. Number accessions with passport and characterization data available (online)	Number of accessions with passport and characterization data available online and/or through the GeneSys web portal	392,959	540,241	542,197	>90% of total
7a. Average time from seed harvest to storage	As an illustration of the efficiency of seed processing and conservation, this indicator measures one of the most critical factors affecting seed longevity: the average number of days between last day of harvest and first day of storage in LTS.		New indicator		
7b. Average time between tissue subculture	A parallel efficiency indicator for clonal crop collections: average number of days between first day of previous culture and day of initiation of new culture.		New indicator		
8. Number countries receiving germplasm	Aggregated number of countries receiving germplasm from the genebanks	105	102	112	-
9. Number germplasm requests	Total number of legitimate external requests made to the genebank for germplasm. This indicator is intended to illustrate trends in outside interest in the collections but does not include requests where lack of necessary follow up on the side of the requester resulted in the request being dropped.	2,221	1436	2,054	-
10. Number accessions distributed within CGIAR	Number of distinct accessions provided to the host institute or other CGIAR Centers. This indicator reflects the diversity of germplasm being requested.	61,645	67,800	35,258	-
11. Number accessions distributed	Number of distinct accessions provided	27,538	30,965	33,240	-

outside CGIAR	to users outside the CGIAR. This indicator reflects the diversity of germplasm being requested.				
12. Total number of samples distributed	Number of samples provided to all users. This number reflects the overall quantity of germplasm being requested. Some accessions are requested multiple times. This number does not include DNA samples, which are disseminated by some genebanks (e.g. Bioversity, CIP, etc).	131,181	154,894	124,319	xx% of the total collection is disseminated in 10 year period
13. Average overall satisfaction of genebank users	This represents the average score for overall satisfaction (scale of 1 to 7) with genebank services according to surveys returned.		New indicator		5-7
14. Number accessions in GeneSys	Number of accessions currently held in the GeneSys web portal.	2.35 million	2.35 million	2.8 million	
15. Number users of GeneSys	Number of visitors on the GeneSys web site.	>1000/ mnth	>1000/ mnth	>1000/ mnth	
16. % genebank routine operating costs covered by Trust endowment	Funds provided by the Trust as a proportion of the total routine costs of the 10 genebanks (excluding ICRAF)	18%	16%	15%	