CGIAR | INITIATIVE ON Genebanks

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CGIAR Research Initiative on **Genebanks**

Annual Technical Report 2024

Author: CGIAR Research Initiative on Genebanks

Title: Annual Technical Report 2024: CGIAR Research Initiative on Genebanks

Suggested citation: CGIAR Research Initiative on Genebanks. 2025. Annual Technical Report 2024: CGIAR Research Initiative on Genebanks. Montpellier, France: CGIAR System Organization. https://hdl.handle.net/10568/174193

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The Artificial Intelligence (AI) software ChatGPT was used to support the editing of parts of this report, specifically to improve clarity, grammar, and style. ChatGPT was not used to generate the content of the report. All edits made with AI assistance were reviewed and validated by the authors to ensure accuracy, coherence, and alignment with the original intent.

Acknowledgements

This work is part of the CGIAR Research Initiative on Genebanks. We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: https://www.cgiar.org/funders.

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CGIAR Technical Reporting 2024

CGIAR Technical Reporting has been developed in alignment with CGIAR's Technical Reporting Arrangement. This annual report ("Type 1" Report) constitutes part of the broader CGIAR Technical Report. Each CGIAR Research Initiative/Impact Platform/Science Group Project (SGP) submits an annual "Type 1" Report, which provides assurance on progress towards end of Initiative/Impact Platform/SGP outcomes.

As 2024 marks the final year of this CGIAR Portfolio and the 2022-24 business cycle, this Type 1 Report takes a dual approach to its analysis and reporting. Alongside highlighting key achievements for 2024, the report also provides a cumulative overview of the 2022-24 business cycle, where relevant. This perspective captures the evolution of efforts over the three-year period. By presenting both annual and multi-year insights, the report underscores the cumulative impact of CGIAR's work and sets the stage for the transition to the 2025-30 Portfolio.

The 2024 CGIAR Technical Report comprises:

- **Type 1 Initiative, Impact Platform, and SGP Reports:** These annual reports present progress towards end of Initiative/Impact Platform/SGP outcomes and provide quality-assured results accessible via the CGIAR Results Dashboard.
- **Type 3 CGIAR Portfolio Practice Change Report:** This report provides insights into CGIAR's progress in Performance Management and Project Coordination.
- **Portfolio Narrative:** Drawing on the Type 1 and Type 3 reports, as well as data from the CGIAR Results Dashboard, the Portfolio Narrative synthesizes insights to provide an overall view of Portfolio coherence. It highlights synergies, partnerships, country and regional engagement, and collective progress.
- **Type 2 CGIAR Contributions to Impact in Agrifood Systems: evidence and learnings from 2022 to 2024:** This report offers a high-level summary of CGIAR's contributions to its impact targets and Science Group outcomes, aligned with the Sustainable Development Goals (SDGs), for the three-year business cycle.

The Portfolio Narrative informs the 2024 CGIAR Annual Report – a comprehensive summary of the organization's collective achievements, impacts, and strategic outlook.

Elements of the Type 2 report are integrated into the CGIAR Flagship Report, released in April 2025 at CGIAR Science Week. The Flagship Report synthesizes CGIAR research in an accessible format designed specifically to provide policy- and decision-makers at national, regional, and global levels with the evidence they require to formulate, develop, and negotiate evidence-based policies and investments.

The diagram below illustrates these relationships.

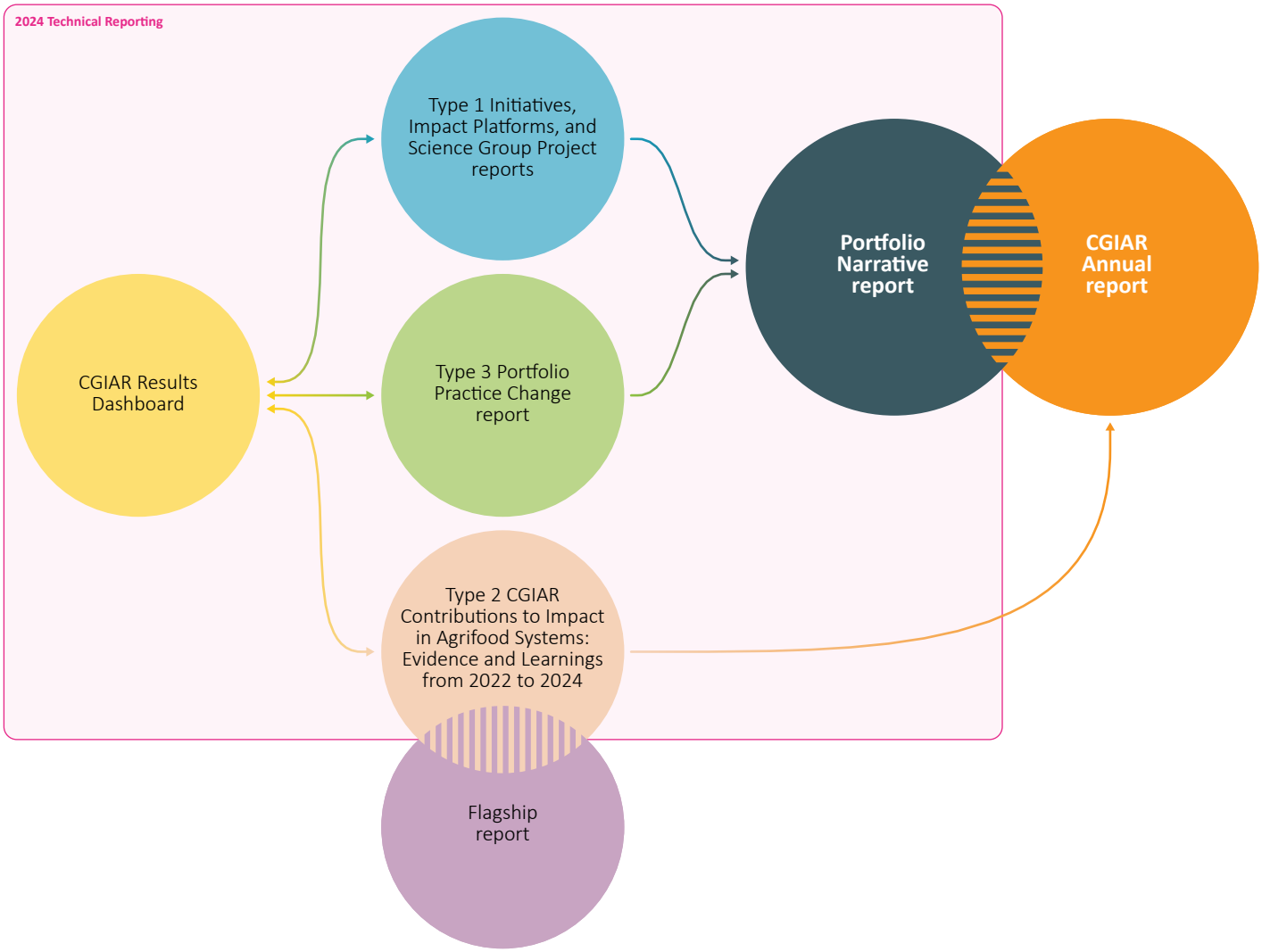


Figure 1. CGIAR's 2024 Technical Reporting components and their integration with other CGIAR reporting products.

Section 1: **Fact sheet, executive summary and budget**

Initiative name	Genebanks
Initiative short name	Genebanks
Initiative Lead	Charlotte Lusty- c.lusty@cgiar.org
Initiative Co-lead	
Science Group	Genetic Innovation
Start – end date	01 January 2022 – 31 December 2024
Geographic scope	Global
OECD DAC Climate marker adaptation score[1]	**Score 2: Principal** The activity is principally about meeting any of the three CGIAR climate-related strategy objectives—namely, climate mitigation, climate adaptation, and climate policy—and would not have been undertaken without this objective.
OECD DAC Climate marker mitigation score[1]	**Score 1: Significant** The activity contributes in a significant way to any of the three CGIAR climate-related strategy objectives—namely, climate mitigation, climate adaptation and climate policy—even though it is not the principal focus of the activity.
OECD DAC Gender equity marker score[2]	**Score 0: Not targeted** The Initiative/project has not been found to target gender equality. However, as a minimum requirement for all Initiatives/projects, (1) a gender analysis was conducted, (2) its findings should be used to ensure at minimum that the Initiative activities/interventions do no harm and do not reinforce gender inequalities, and (3) data that are collected are gender disaggregated.
Website link	https://www.cgiar.org/initiative/03-conservation-and-use-of-genetic-resources-genebanks/

[1] The Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) markers refer to the OECD DAC Rio Markers for Climate and the gender equality policy marker. For climate adaptation and mitigation, scores are: 0 = Not targeted; 1 = Significant; and 2 = Principal.
[2] The CGIAR Gender Impact Platform has adapted the OECD gender marker, splitting the 1 score into 1A and 1B. For gender equality, scores are: 0 = Not targeted; 1A = Gender accommodative/aware; 1B = Gender responsive; and 2 = Principal.
These scores are derived from Initiative proposals, and refer to the score given to the Initiative overall based on their proposal.

EXECUTIVE SUMMARY

The genebanks operated by CGIAR Centers are custodians of the world's most diverse publicly available crop germplasm collections. Located in diversity hotspots, they hold more than 700,000 accessions of more than 3,000 plant species. The genetic material is freely available to researchers, breeders, local communities, and farmers under the terms of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty), helping them find their own solutions for a more resilient, sustainable agriculture.

During the three-year lifecycle of the CGIAR Research Initiative on Genebanks, significant progress was made in the sustainable conservation of these precious resources. Four CGIAR Centers (AfricaRice, Alliance of Bioversity and CIAT [the Alliance], IITA, and IRRI) now manage seed collections that meet performance targets for availability, safety duplication, documentation, and quality management. Another two (ICRISAT and CIMMYT wheat) were expected to reach these targets by 2026. Improvements in seed quality management systems (QMS) laid the groundwork for a single Genebank Process Model to cover all operational steps in seed, tissue culture, and field collections.

Eighty-seven percent of the aggregate collections were made available, compared to 66 percent when data were initially collected. From 2022 to 2024, the genebanks distributed 337,330 germplasm samples to 123 countries. Forty-six percent went to users outside CGIAR, primarily to advanced research institutes, universities, and national breeding programs. All distributions underwent rigorous controls in Germplasm Health Units (GHUs) and were compliant with national and international laws and policies.

The Genebanks Initiative pioneered the use of cutting-edge technologies to enhance conservation and increase the relevance of collections to users. This included using genomics to identify desirable traits, artificial intelligence to screen samples for resilience to stressors, and cryopreservation for crops that cannot be conserved as seed. AfricaRice led work to establish a protocol for the automated characterization of rice grains using a multispectral videometer. Work is now underway to develop a unified digital portal to provide seamless information on the diversity held across all CGIAR genebanks.

Significant progress was also made in phytosanitary services, ensuring that material from genebanks and breeding programs was healthy and safe to use. The GHUs worked together to harmonize services, standardize procedures, and optimize techniques (genomic-based molecular methods, multispectral imaging, AI/bioinformatics) to diagnose and eradicate quarantine threats. In 2024, GHUs in 10 CGIAR Centers processed 369,878 samples to facilitate 1,741 import/export events involving 125 countries.

The genebanks have intensified efforts to strengthen the global system for the conservation and exchange of plant genetic resources. In 2024, CGIAR scientists engaged more than 50 national partners in capacity building on activities including cryopreservation, phytosanitary health, and the use of genomic tools for collection management and use.

The Genebanks Initiative policy team also worked with national partners to help strengthen implementation of the Plant Treaty's Multilateral System of Access and Benefit Sharing. Their science and advocacy helped negotiators at the UN Biodiversity Conference (COP16) agree on a mechanism for sharing benefits derived from digital sequence information (DSI). This represented a major step toward the development of a robust, fair system that allows for continued open access to data for researchers.

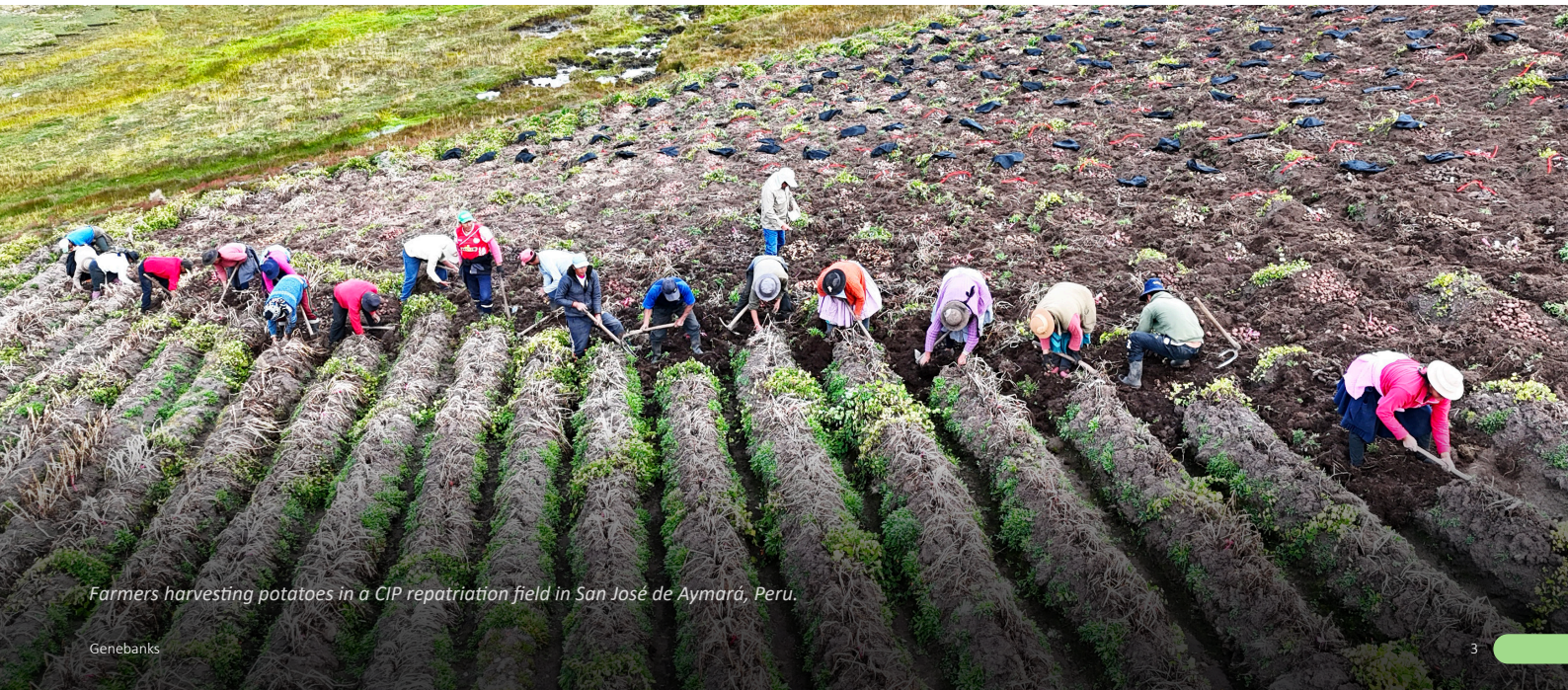
Several projects enabled communities on the frontlines of food insecurity and climate crises to benefit from genebank resources. In 2024, more than 3,400 samples were sent to farmers, NGOs, and farmer organizations across the world. A project funded by the UK government and led by the Crop Trust supported communities in Madagascar and Zambia to send unique sweet potato landraces for disease-cleaning at the regional hub at KEPHIS in Kenya and long-term conservation at CIP's cryobank in Lima.

These achievements leave CGIAR genebanks in a strong position to transition to a new Genebanks Accelerator as part of the 2025–2030 CGIAR Portfolio. There is enormous potential to enable smarter, more widespread use of crop diversity, underpinned by sustainable conservation, a supportive policy environment, and exceptional phytosanitary controls.

The new structure will enable deeper collaboration both across CGIAR and with external partners, strengthening the global system while fostering more dynamic two-way exchanges between in situ and ex situ conservation efforts.

	2022	2023	**2024**
PROPOSAL BUDGET	$25.72M	$25.78M	**$26.49M**
APPROVED BUDGET [1]	$22.41M	$24.37M [2]	**$27.17M [2]**

[1] The approved budget amounts correspond to the figures available for public access through the Financing Plan dashboard.
[2] These amounts include carry-over and commitments.



Farmers harvesting potatoes in a CIP repatriation field in San José de Aymará, Peru.

Section 2: **Progress towards End of Initiative outcomes**

Initiative-level theory of change diagram

This is a simple, linear, and static representation of a complex, non-linear, and dynamic reality. Feedback loops and connections between this Initiative and other Initiatives' theories of change are excluded for clarity.

CHALLENGE STATEMENT

The unprecedented rate of biodiversity loss is one of the defining global challenges of our time. It undermines the resilience of agricultural systems, threatens nutritional security, and endangers the foundations of crop improvement. Homogeneous farming systems are at risk of failure because of extremes of abiotic stresses and severe occurrences of pests and diseases, exacerbated by climate change. The simplification of diets contributes to the additional burden of malnutrition.

International disagreement concerning the governance of genetic resources and genomic information is creating tensions among countries and challenges for multilateral cooperation and mechanisms. Sustainable Development Goal 2.5 highlights the importance of maintaining the genetic diversity of crops and their wild relatives through soundly managed genebanks and ensuring access to diversity and equitable benefit sharing, in accordance with international law. Better coordination is needed between organizations that are engaged in conserving plant genetic resources for food and agriculture worldwide. There are new opportunities to manage and use genetic resources more effectively and speed up plant breeding processes.

The Genebanks Initiative will (1) conserve and make available more than 20 staple crops in 10 locations across five continents to thousands of users worldwide every year under the International Treaty on Plant Genetic Resources for Food and Agriculture; (2) improve efficiencies by supporting long-term conservation activities at international standards, and by improving protocols and practices in genebanks and germplasm health units; (3) determine the value of genebank material for the benefit of a wide range of users; and (4) strengthen the global system by working together with strategic partners such as the Global Crop Diversity Trust, Plant Treaty Secretariat, and international and national genebanks.

SPHERE OF **CONTROL**

Work Packages

Work Package 1

Diversity in Perpetuity (Essential operations).

Work Package 2

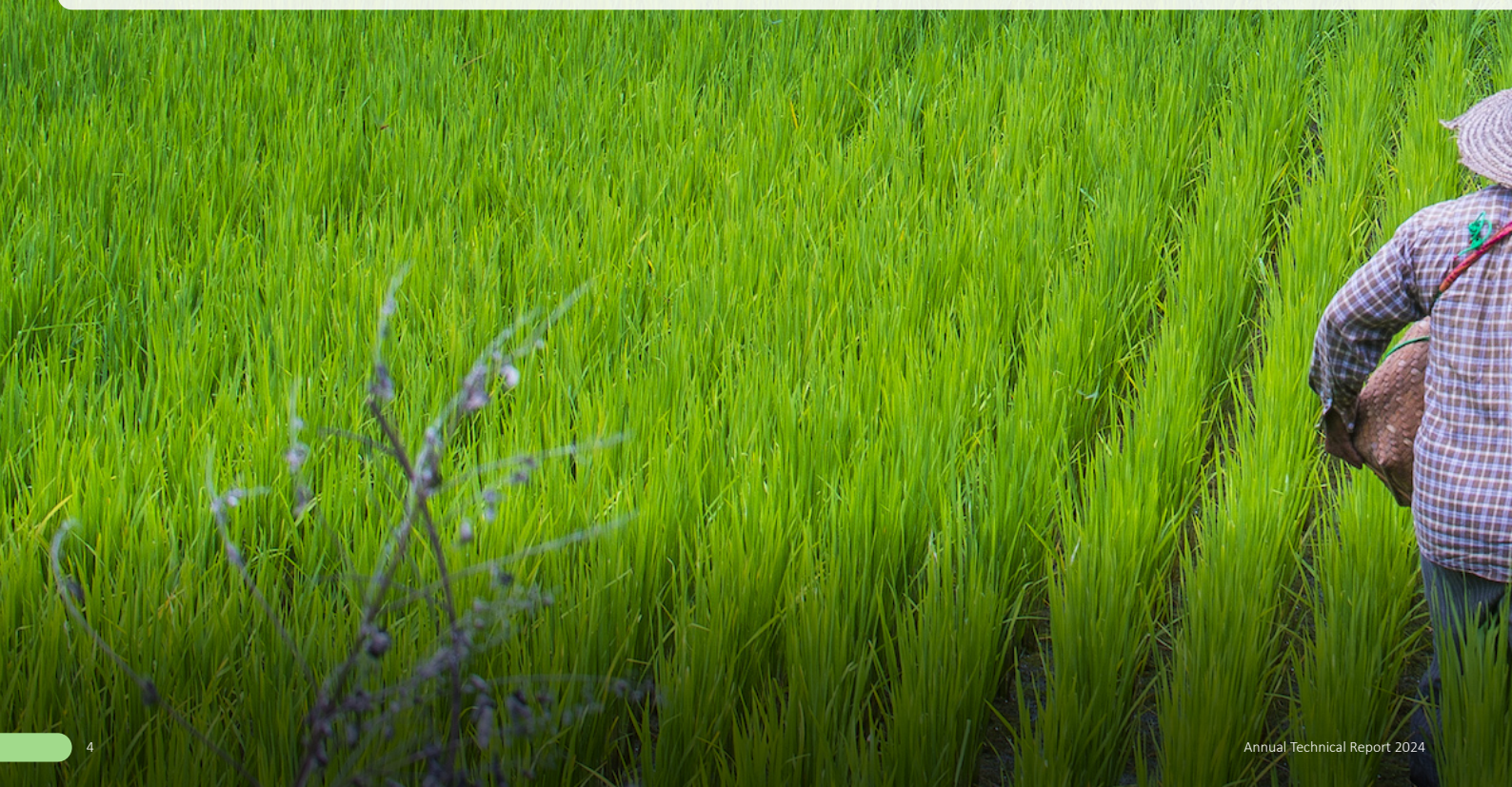
Futureproofing collections and exchange (Futureproofing).

Work Package 3

Supporting breeding programs through increasing value and use of collections (Use).

Work Package 4

Strengthening the Global System (Global system).



SPHERE OF **INFLUENCE**

End-of-Initiative Outcomes

End-of-Initiative Outcome 1

1 ▶ 2 ▶ External diverse users increasingly access and use crop diversity, in perpetuity, benefitting from added value information and long term conservation, of in-trust collections.

End-of-Initiative Outcome 2

3 ▶ Genebanks monitor the use of genebank data and materials by breeding programs.

End-of-Initiative Outcome 3

2 ▶ 3 ▶ 4 ▶ National and international genebanks conserve and distribute Plant Genetic Resources for Food and Agriculture more efficiently and reliably; in a strengthened global system, though capacity development and implementing enabling policies.

Action Area Outcomes

Systems Transformation

1 ▶ 2 ▶ 3 ▶ **1** · Research institutions, government analytical units, and scaling partners in the Global South have improved knowledge, skills, access to data, capacity to develop tools, innovations, and undertake research to support transformation of food, land and water systems contributing to livelihood, inclusion, nutrition, environmental and climate objectives.

1 ▶ 2 ▶ 3 ▶ **2** · National and sub-national government agencies use CGIAR research results to design or implement strategies, policies and programs which have the potential to transform food, land and water systems contributing to livelihood, inclusion, nutrition, environmental and climate resilience objectives.

Genetic Innovation

1 ▶ 2 ▶ 3 ▶ 2 ▶ **3** · National and private seed company breeding programs accelerate the development of varieties that provide larger scale benefits across the 5 Impact Areas.

SPHERE OF **INTEREST**

Impact Areas

Nutrition, Health & Food Security

1 ▶ 2 ▶ 3 ▶ · End hunger for all and enable affordable health diets for the 3 billion people who do not currently have access to safe and nutritious food.

Poverty Reduction, Livelihoods & Jobs

1 ▶ 2 ▶ 3 ▶ · Lift at least 500 million people living in rural areas above the extreme poverty line of US $1.90 per day (2011 PPP).

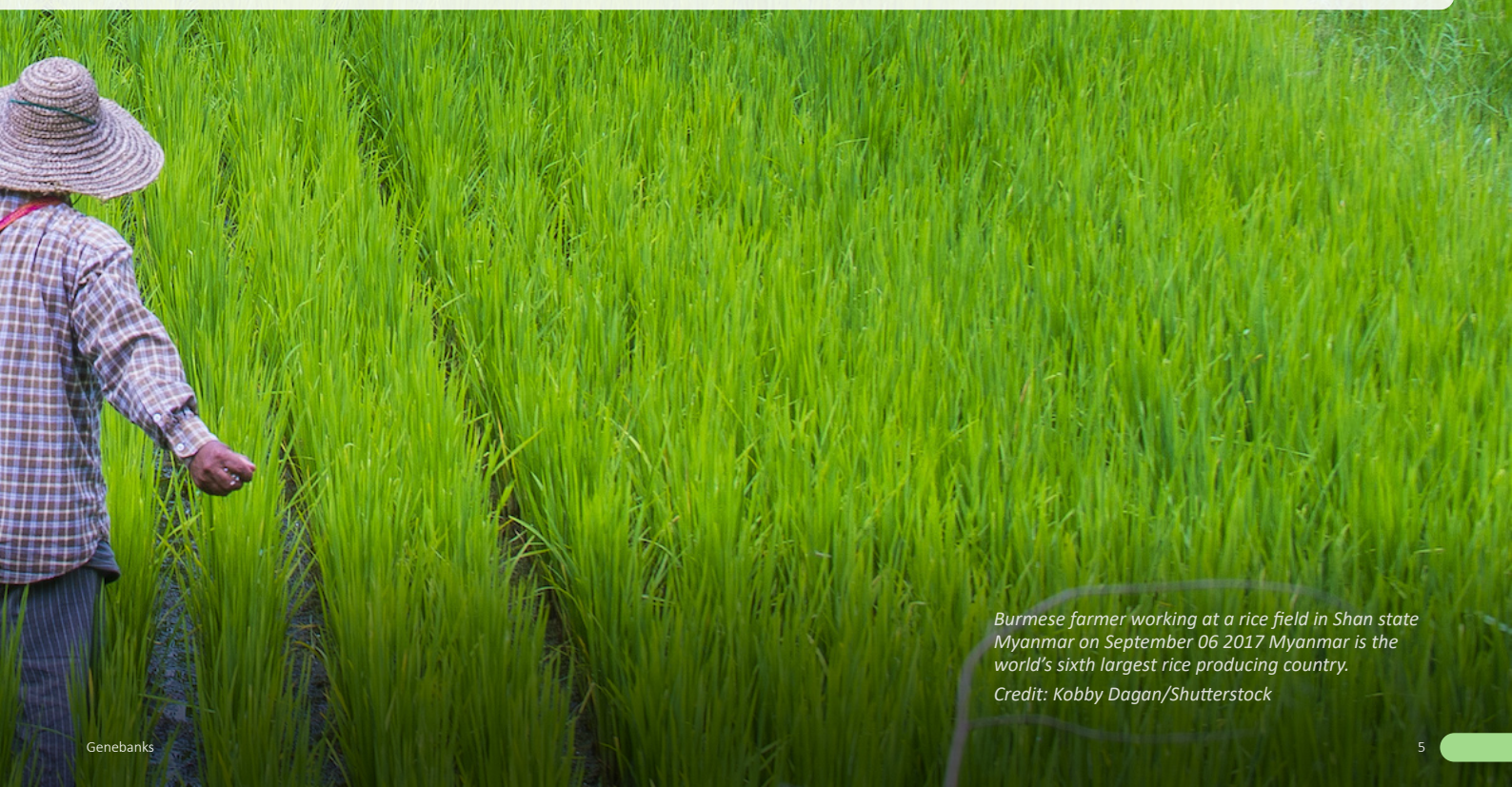
Climate Adaptation & Mitigation

1 ▶ 2 ▶ 3 ▶ · Equip 500 million small-scale producers to be more resilient to climate shocks, with climate adaptation solutions available through national innovation systems.

· Turn agriculture and forest systems into a net sink for carbon by 2050, with emissions from agriculture decreasing by 1 Gt per year by 2030 and reaching a floor of 5 Gt per year by 2050.

Environmental Health & Biodiversity

1 ▶ 3 ▶ · Maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed genebanks at the national, regional, and international levels.



Burmese farmer working at a rice field in Shan state Myanmar on September 06 2017 Myanmar is the world's sixth largest rice producing country.

Credit: Kobby Dagan/Shutterstock

Éliane Ubalijoro, CEO of CIFOR-ICRAF delivers seeds to the Svalbard Global Seed Vault. Credit Michael Major

Summary of progress against the theory of change

In 2024, CGIAR Genebanks provided more than 70,089 germplasm samples to 945 requestors in 83 countries (not including distributions from CIFOR-ICRAF). The largest proportion of external distributions were to universities and advanced research institutes for research purposes. India, Indonesia, Nigeria, China, and Peru were the top five recipients in 2024, receiving 68 percent of samples distributed externally. More than 3,400 samples of potato, maize, cassava, rice, forages, chickpea, miscellaneous legumes, wheat, Andean roots and tubers, barley, lentil, sweet potato, and yam were disseminated to farmers, NGOs, and farmer organizations in Peru, Mexico, Colombia, Philippines, Morocco, Nigeria, Italy, Djibouti, Ethiopia, Côte d'Ivoire, Guatemala, Bolivia, and Sierra Leone. A total of 3,043 samples were sent to commercial sector users in 26 countries. CGIAR breeders and researchers received 23 percent of the disseminated germplasm for research and breeding. Every germplasm import and export, including from breeding programs, passed through CGIAR GHUs, which carried out more than 1.27 million diagnostic assays and eliminated 29,911 pest/disease-contaminated samples, ensuring compliance with national phytosanitary regulations. With the support of the Genebanks Initiative Policy Team, all CGIAR acquisitions and distributions were compliant with national and international policies and laws.

In total, the 10 reporting CGIAR genebanks (not including CIFOR-ICRAF) conserved 721,041 accessions in the form of seeds, tissue culture, tubers, cryopreserved samples, trees, and plants in the field and screenhouse. Four Centers (AfricaRice, the Alliance, IITA, and IRRI) managed seed collections that reached and sustained performance targets for availability, safety duplication, documentation, and quality management. ICRISAT and CIMMYT wheat collections reached the target for availability and were both at 89 percent safety duplication. They will fully meet the target of 90 percent in 2026. CIMMYT maize and ICARDA, which reestablished collections from safety deposits held at the Svalbard Global Seed Vault after leaving Syria in 2014, managed seed collections of domesticated crops that will reach performance targets within the next two to three years. Seed collections remained at CIP, ICARDA, and ILRI of wild species that take more time and resources to reach performance targets, as well as clonal crop collections at the Alliance, CIP, and IITA.

Targets were agreed upon in 2014 after a quantitative assessment of the collections' status and recommendations from external reviewers. By the end of the Initiative cycle, the aggregate collection stood at 87 percent availability, compared to 66 percent when data were first collected. More than 150,000 accessions that were not accessible 13 years ago became available. Overall, the state of the collections' health and security was considerably improved. The genebanks were more resilient, with fewer materials requiring urgent attention. The six-person panel of the Independent Advisory and Evaluation Service published its report in 2024 and concluded that significant steps had been taken to address SDG 2.5. and ensure cost savings.

In 2024, CIMMYT completed the systematic re-inventorying of its maize and wheat collections, which involved the re-cleaning, viability testing, and packing of the 50-year-old collection. This once-in-a-generation exercise, undertaken in response to a technical review, enabled thousands of seed lots to be safely discarded or archived.

Nearly 30,000 accessions that were either excessively duplicated or no longer required were archived, helping to improve operational efficiency. In a normal year, the genebank may test the viability of around 10 percent of the collection (that is, approximately 15,000 accessions). Over the past two years, the CIMMYT genebank team verified the viability status of more than 175,000 accessions, requiring a large-scale mobilization of staff for this one exercise. The CIMMYT wheat collection essentially reached performance targets, with only 1,000 accessions remaining to be safety duplicated in a second location, and it will be eligible for in-perpetuity funding from the Crop Trust.

A new cryobank, the first regional cryohub for Latin America, was built and inaugurated at CIP with support from the German government. Agreements were set up with two countries to support the cryopreservation of national collections. In addition, as part of CGIAR's effort to develop diverse approaches to share benefits while cryobanking unique diversity, a project funded by the UK government and led by the Crop Trust supported communities in Madagascar and Zambia to send unique sweet potato landraces for disease-cleaning at the regional hub at KEPHIS in Kenya and long-term conservation at CIP's cryobank in Lima. The farmers will receive their returned landraces as cleaned, multiplied vine cuttings ready for planting on a large scale.

The Genebank QMS adopted some of the approaches of the Breeding Process Model developed under the CGIAR Research Initiative on Breeding Resources. While standard operating procedures (SOPs) were documented in detail by each genebank, and audited and validated using shared templates and formats, there was no attempt to develop a single Genebank Process Model that could accommodate the operational steps in all seed, tissue culture, and field collections. After the seed collection teams convened late in 2023, the clonal collection teams gathered in 2024 to review and revise the Genebank Process Model and develop a common strategy for improvement. Investment becomes more focused when Centers are aligned on improvement strategies and standards. Seed Collection Process Teams met monthly to continue building the details of the Genebank Process Model and to find opportunities for harmonizing processes across Centers. These efforts made progress on enabling much more powerful common data management approaches and tools and actively contributed to the development of a shared version of the accession data management tool, GRIN-Global Community Edition. The Seed Collection Teams conducted their first peer-to-peer audit before the end of 2024, with regeneration and seed process leaders from ICRISAT and CIMMYT traveling to audit seed processes at ICARDA in Morocco.

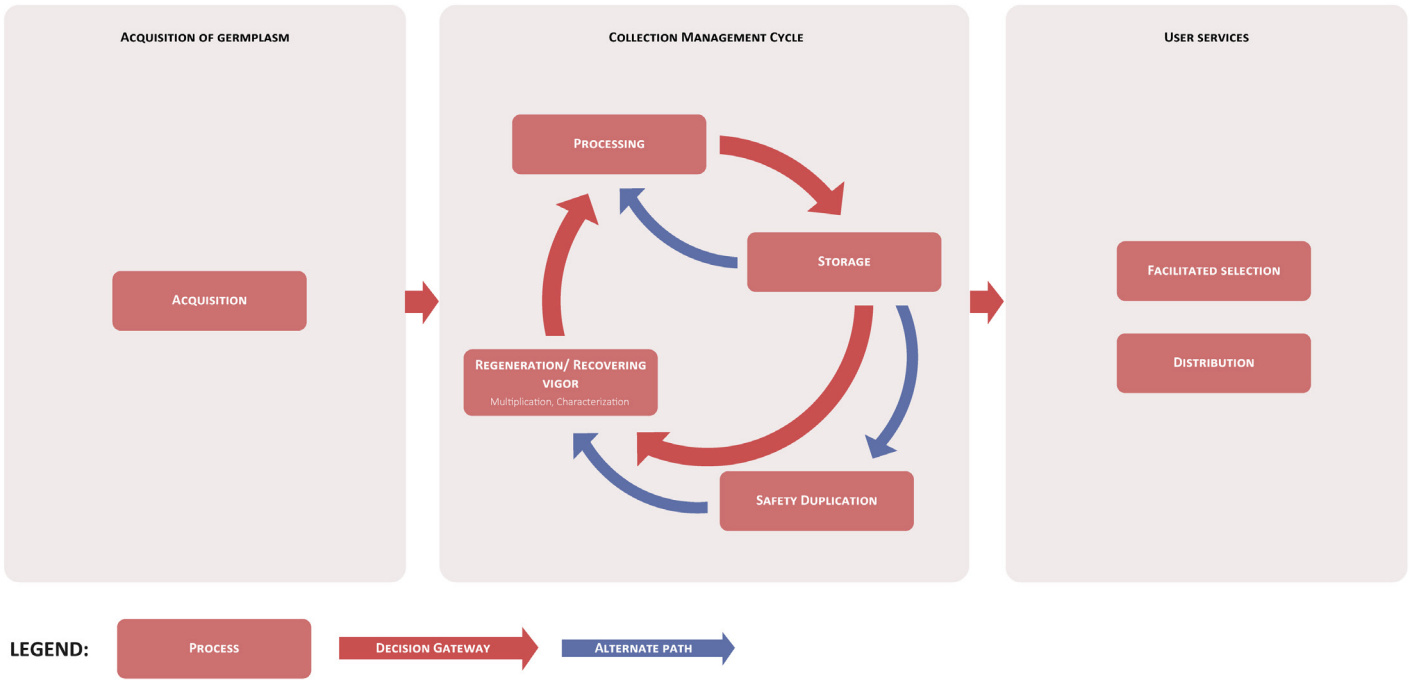


FIGURE. CGIAR Genebanks Process Model illustrating the general cycle of materials for seed and clonal crop collections.

To strengthen the global system of genebanks, thus directly addressing UN Sustainable Development Goal 2.5, more than 50 national agricultural research system (NARS) partners were engaged in capacity building and collaboration under Work Package (WP) 4. This work covered a range of genebank operations and activities, from cryopreservation to the use of genomic tools for collection management and use. Fifteen partners from national agricultural research and extension systems (NARES) benefited from project funding to develop capacity in genebank operations and international policy implementation. Regional workshops took place in Kenya, India, Morocco, Colombia, and Peru. These workshops helped to extend the reach of communities of practice on using genotypic data to manage collections and cryobanking, as well as general genebank operation. Thirteen institutes in Central and South America pooled resources to genotype and map genetic diversity of their respective collections of beans, maize, cassava, potato, and wheat. Several partners entered into collaborations with CIP to cryopreserve their clonal crop collections.

COP16, which took place in Colombia, adopted a decision to operationalize a multilateral mechanism for benefit sharing from the use of DSI. The decision included elements that the Genebanks Policy Team, on behalf of CGIAR, had advocated for, based on scientific evidence, over the last three years of negotiations. Some elements previously included in the draft law were removed from the final decisions, which was also aligned with positions advocated by CGIAR. These developments were significant to CGIAR research as a whole, thus laying a foundation for countries to collaborate and benefit from the generation and use of a range of data associated with genetic resources, with particular implications for the sharing and use of genetic sequence information. It also helped to ensure that the Convention on Biological Diversity's (CBD) policy and policies developed under the framework of the Plant Treaty remain aligned.

Progress against End of Initiative Outcomes

This infographic provides a concise summary of the Initiative's progress toward achieving its Theory of Change End-of-Initiative outcomes for the 2022-2024 period. By drawing on reported results, it offers a comprehensive synthesis of progress made against the established outcome targets, highlighting the Initiative's overall impact and key achievements at the conclusion of this three-year cycle.

EOIO 1

External diverse users increasingly access and use crop diversity, in perpetuity, benefitting from added value information and long term conservation, of in-trust collections.

EOIO 2

Genebanks monitor the use of genebank data and materials by breeding programs.

EOIO 3

National and international genebanks conserve and distribute plant genetic resources for food and agriculture more efficiently and reliably in a strengthened global system, through capacity development and implementing enabling policies.

Good progress was made against the goal to secure collections under CGIAR management in long-term conservation for availability to diverse users in perpetuity. Four genebanks had collections at performance targets, and two were expected to reach targets in one to two years. Three have in-perpetuity funding from the Crop Trust, IRRI, the Alliance (seeds), and AfricaRice. Genebanks were also harmonizing workflows as the basis for a more effective, unified data management system and service offering to users. In the last three years, Genebanks distributed 337,330 germplasm samples to 123 countries, 46 percent of which were requests from users outside CGIAR.

Genebanks worked continually to enrich accession-level information and develop more powerful accession selection methods. A subsetting tool to identify germplasm based on environmental variables was made available online. Genebanks responded to breeders' information needs. Georeferenced, phenotypic, and genotypic data were improved and collated to enhance environmental genome-wide association studies and other research.

More than 60 NARS partners were engaged for diverse capacity-building activities to strengthen the global system for plant genetic resources conservation and use and to address SDG 2.5. CGIAR has been recognized as a critical partner for capacity building in DSI by the Plant Treaty. Informed by CGIAR science and advocacy, COP16 adopted new rules for benefit sharing from the use of DSI. The Plant Treaty working group agreed to include options advocated by CGIAR as part of a package of measures being negotiated to enhance the functioning of the multilateral system.

WP1: Diversity in Perpetuity (Essential operations)

RESEARCH QUESTIONS

WP 1 does not address research questions but ensures that more than 700,000 accessions in genebanks are healthy, viable, and available for distribution and that users' requests are managed professionally. More than 400 CGIAR staff undertake these routine operations, which are documented and comply with specific international standards. This involves a high level of skill and professionalism but is not research, strictly speaking.

WORK PACKAGE 1

OUTPUTS

1 • Performance targets newly reached by 5 genebanks.

2 • 75 Standard Operating Procedures (SOPs) updated and audited.

3 • More than 90% legitimate requests responded to within accepted time-limits (incoming requests - outgoing germplasm).

OUTCOMES

1 2 3 ▶ **1** • Diverse users accessing satisfactorily disease-free, viable, documented germplasm.

1 ▶ **END-OF-INITIATIVE OUTCOME 1**

External diverse users increasingly access and use crop diversity, in perpetuity, benefitting from added value information and long term conservation, of in-trust collections.

Work Package 1 progress against the theory of change

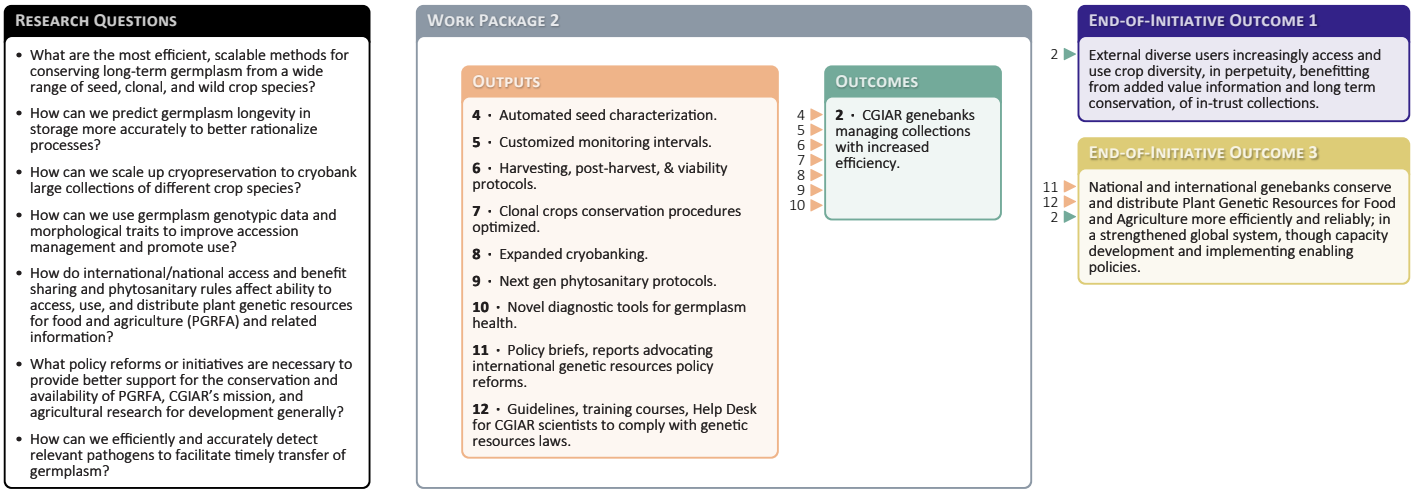
CGIAR genebanks carried out routine operations to ensure that crop collections were conserved and made available upon request. Seed lots and tissue culture samples were regenerated and multiplied in the field, screenhouse, and laboratory (130,000 samples in 2024); viability tested (154,000); health tested (52,000); and disease cleaned (8,500). New materials were received or accessioned (4,010 accessions) from Côte D'Ivoire, Madagascar, Niger, Peru, Sierra Leone, the United Kingdom, and Zambia, as well as from CGIAR breeders.

In 2024, 70,089 germplasm samples were distributed to 83 countries in response to 945 requests, mostly for research (more than 60 percent). Of those samples sent externally, 55 percent went to advanced research institutes and universities, 32 percent went to NARES, 6 percent went to farmers, nongovernmental organizations (NGOs), and farmer organizations, and 6 percent went to the commercial sector (see Section 4).

Four genebanks sustained performance targets for their seed collections. The Crop Trust provided US$5.3 million bilaterally to CGIAR genebanks (including ICRISAT) in 2024 in long-term funding, including three long-term partnership agreements (LPA). In 2024, a new LPA was approved by the Crop Trust's Executive Board to provide long-term funding for the first time to AfricaRice and will come into action in 2025. Overall, 87 percent of the collections were physically and legally available, a 5 percent increase from 2023 thanks to the work of CIMMYT, and 82 percent were safety duplicated (target of 90 percent). In 2024, 90 newly drafted or improved operating procedures were mainstreamed because of research and optimization undertaken in WP 2.

GHUs in 10 CGIAR Centers processed 245,193 accessions and 369,878 samples to facilitate 1,741 import/export events with 125 countries, of which 55 percent were for CGIAR breeders and 10 percent for non-plant taxa.

WP2: Futureproofing collections and exchange (Futureproofing)



Work Package 2 progress against the theory of change

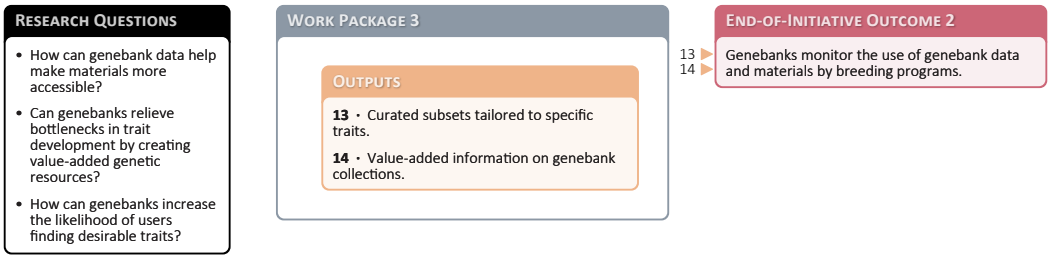
The seed quality management Community of Practice supported piloting of improved technologies and protocols for maximizing seed quality and longevity in all genebanks. AfricaRice, acting as a frontrunner, established a protocol for the automated characterization of rice grains using a multispectral videometer. The classifiers developed for rice at AfricaRice have 98 percent accuracy. Several PhD and MSc degrees dedicated to research questions relating to seed quality management were completed or near completion. In addition, results of research into the dormancy of African rice and forage species were being published by AfricaRice, the Alliance, and ILRI.

In 2024, 244 accessions of banana, potato, sweet potato, and yam were cryobanked. Conservation protocols were being optimized for taro, cassava, coconut, sweet potato, yam, ulluco, oca, and mashua, as well as for seed conservation of wild species of banana and potato.

The GHUs working on clonal crops adopted high-throughput sequencing (HTS) of small sRNA for virus diagnostics, and protocols were mainstreamed, enabling substantial gains in time for virus testing. There was an increase in the number of cryptic viruses detected using HTS. Any virus is a quarantine concern and a bottleneck to germplasm exchange unless evidence is generated to show that the virus detected is cryptic in a host. The GHU team therefore devised a decision tree to guide the deduction process and research to classify viruses as cryptic or not. End-point nucleic acid amplification-based diagnostics methods for the detection of cassava, banana, and legume viruses were established. A mancozeb-based seed treatment was standardized as an effective approach to eliminate seedborne bacteria in legume and cereal germplasm. The QMS procedures were updated, including the renewal of ISO accreditation at the Alliance, CIMMYT, CIP, and IRRI.

In 2024, CGIAR submitted reports to the UN FAO's Commission on Genetic Resources for Food and Agriculture (CGRFA), the Plant Treaty, and the Plant Treaty's Ad Hoc Open-ended Working Group to Enhance the Functioning of the Multilateral System of Access (OWG-EFMLS). CGIAR delegations were invited to make presentations to plenary sessions at the 11th and 12th sessions of the OWG-EFMLS and at the Fifth Meeting of the Plant Treaty's Ad Hoc Technical Expert Group on Farmers' Rights. CGIAR convened side events and expert panels for negotiators during COP16 and during the second meeting of the CBD's Ad Hoc Open-ended WG on Benefit-sharing from the Use of DSI on Genetic Resources. COP16 adopted Decision 16/2 "Digital Sequence Information on Genetic Resources" which incorporates many elements that CGIAR, together with other likeminded research and development organizations, had been advocating for years. The Plant Treaty's OWG-EFMLS will continue negotiations until November 2025; in the meantime, the negotiators have accepted several suggestions from CGIAR about elements to be included in the package of measures under consideration.

WP3: Supporting breeding programs through increasing value and use of collections (Use)



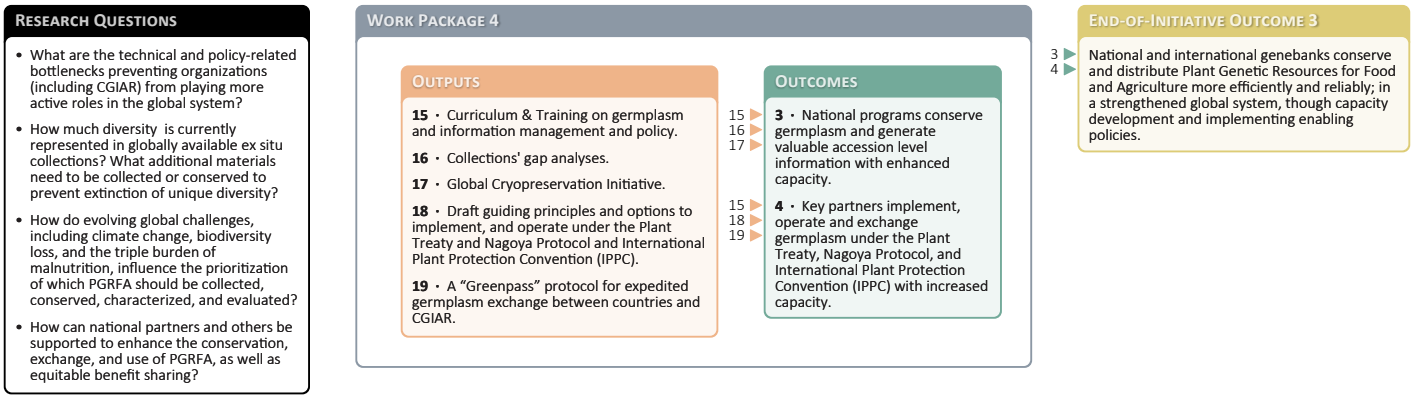
Work Package 3 progress against the theory of change

CGIAR genebanks continued to accumulate and enhance data resources critical for diversity analyses, germplasm selection, and collection management. With more than 30 crops and over 3,000 species conserved, their contributions to research and breeding were both extensive and impactful. Each genebank tailored its data enrichment approaches to the specific characteristics and uses of the crops it conserved. In 2024, key activities included:

- **Data curation and digitization:** Approximately 30,000 accessions underwent curation of georeferencing data, digitization of seed and plant images, or curation of other passport data. Updated records were made publicly accessible online and via Genesys. A dashboard connected to Genesys was completed to provide insights into the quality and completeness of passport data.
- **Genotypic data generation:** Genotypic data were produced for more than 30,000 accessions of wheat, bean, oca, ulluco, forages, banana, cassava, and wild relatives of potato and rice. These data support diversity and genetic integrity analyses, molecular-atlas development, chromosome painting, taxonomic classification, and the identification of potential duplicates.
- **Trait-focused subsets development:** Seventy-five subsets spanning Andean roots and tubers, beans, cassava, maize, Napier grass, potato, rice, sweet potato, forages, Urochloa, and other crops were developed and/or evaluated. These subsets were screened—often in collaboration with NARS or CGIAR scientists—for key abiotic, biotic, and nutritional traits, including drought, heat, and flood tolerance, disease resistance, enhanced nutritional quality, and near-infrared reflectance spectroscopy profiling. A beta version of trait subsetting tool and climate analogue was made available for users in Genesys.
- **Allele mining for climate resilience:** Several genebanks contributed to BMGF and FFAR-funded allele-mining projects. These efforts identified heat- and drought-tolerant accessions of cassava, rice, maize, wheat, groundnut, and beans using environmental genome-wide association studies. Candidate accessions carrying rare alleles associated with hot and/or dry environments were shared with breeding programs for introgression into elite genepools.
- The effort to establish a unified platform for genebank genotyping data progressed, incorporating data from five genebanks and public datasets from national partners. A capacity-building event on the Gigwa tool, featuring its latest version, gathered all CGIAR genebanks, emphasizing data filtering as a key step before genome-wide association studies (GWAS). Additionally, ICARDA implemented a diversity analysis and environmental GWAS workflow linked to this platform for direct dataset extraction and analysis.
- **Leveraging artificial intelligence:** IRRI developed an AI-based model for high-throughput screening of more than 60,000 rice accessions, successfully identifying those most tolerant to salinity, submergence, and drought. CIP is employing AI tools to monitor the viability of in vitro potato cultures and to build a chatbot for streamlined germplasm querying and requests.

Additionally, the Genebanks Initiative started work toward developing a unified online portal to provide seamless access to information across all CGIAR genebanks. This platform aims to enhance the exploration of collections, streamline germplasm requests, and support strategic planning informed by user trends. As part of the initial efforts, two key activities were launched: (1) identifying bottlenecks in the Acquisition, Distribution, and Use pipelines to improve user engagement, and (2) developing a user typology framework to standardize the classification of genebank users and their germplasm utilization purposes.

WP4: Strengthening the Global System (Global system)



Work Package 4 progress against the theory of change

WP4 enabled CGIAR genebanks to respond to needs expressed by NARS. Agreements were put in place between individual Centers' genebanks and 15 NARS partners to strengthen genebank operations, improve collection composition and implement international policy. Six countries were being supported to strengthen implementation of the Plant Treaty's Multilateral System of Access and Benefit Sharing. National consultations were held with all the participating countries to explore how to develop policies to adhere to and benefit from this system. By the end of 2024, all six had drafted laws to implement the Multilateral System of Access and Benefit Sharing, and in two of those countries, the drafts was presented to the Ministers of Agriculture for adoption. Lead partners in the remaining four countries will submit their draft bill for adoption in 2025. Letters of Agreement with nine countries were signed in 2023 to support genebank operations including germplasm collection, conservation, regeneration, and characterization.

In 2024, 10,294 people visited CGIAR genebanks. A total of 76 PhD, MSc, and BSc students were hosted by genebanks and around 140 training events took place with more than 1,800 participants from 55 countries, including:

- Asia and Pacific Regional Training/Workshop titled "Improving Genebank Operations and Data Curation" in Hyderabad, India, for NARS partners (organized by ICRISAT, IRRI, World Vegetable Center, and the Alliance)
- The second African Regional Workshop titled "Optimizing Genebank Operations: Advanced Seed Processing and Data Curation" in Nairobi, Kenya, for NARS partners (organized by ILRI, CIFOR-ICRAF [host in 2024], IITA, AfricaRice, and the Alliance).
- Genetic Resources Conservation and Use Training, Tashkent (organized by ICARDA, with participants from 14 Gulf, Caucasus, and Central Asia countries)
- CGIAR Cryo Workshop, Lima (organized by CIP with the Alliance, IITA, ICRAF, ICRISAT, and World Vegetable Center)
- Training workshops on germplasm health and seed phytosanitation were organized by the GHUs for national plant protection organizations in Africa, Asia, and Latin America, resulting in the training of more than 100 quarantine officials.
- The GreenPass consultation workshop was organized by IITA jointly with the African Union Inter-African Phytosanitary Council and nine plant protection organizations from sub-Saharan Africa (Benin, Côte d'Ivoire, Cameroon, Ethiopia, Ghana, Kenya, Nigeria, Uganda, and Zimbabwe) reached a consensus on developing harmonized (common) protocols for germplasm exchange of important food crops in sub-Saharan Africa.
- A new course on Seed Quality Management (SQM) was developed with the UK Open University and is expected to be launched online in 2025 for CGIAR and NARS staff.

Work Package progress rating summary

WORK PACKAGE	PROGRESS RATING & RATIONALE
1	On track Several milestones were reached in ensuring availability and security of collections. ICARDA-Morocco and ICRISAT collections approached performance targets and two clonal collections were close. 92 percent of potato clonal accessions were cryobanked.
2	On track Continuous improvement and updating of SOPs was demonstrated. Landmark workshop was held in QMS harmonization and genebank data management system. Multispectral imaging of seeds were in the process of being mainstreamed. GHUs developed improved diagnostics for clonal and sexual seed germplasm, phytosanitary protocols for eliminating bacteria and viruses, and updated QMS and SOPs, including capacity development for internal and external partners.
3	On track Increasing coherence was achieved in approaches to improving accuracy and relevance of accession data, including geographical origin, images, and environmental and genotypic data. Progress was made toward developing one portal for selecting and ordering germplasm.
4	On track Engagement with NARS partners occurred through multiple approaches: training in regional workshops, on-request technical backstopping, hosting of students and national genebank staff, online courses on Policy Genetic Resources (new version launched to include NARS) and preparation of a new course on SQM to be launched in 2025, and technical support to Crop Trust projects and other targeted project work. The GHUs made progress toward establishing harmonized protocols for staple crop germplasm exchange in sub-Saharan Africa through the GreenPass concept.

Definitions

On track

- Progress largely aligns with Plan of Results and Budget and Work Package theory of change.
- Can include small deviations/issues/delays/risks that do not jeopardize success of Work Package.

Delayed

- Progress slightly falls behind Plan of Results and Budget and Work Package theory of change in key areas.
- Deviations/issues/delays/risks could jeopardize success of Work Package if not managed appropriately.

Off track

- Progress clearly falls behind Plan of Results and Budget and Work Package theory of change in most/all areas.
- Deviations/issues/delays/risks do jeopardize success of Work Package.

Section 4: **Quantitative overview of key results**

This section provides an overview of results reported and contributed to, by the CGIAR Initiative on Genebanks from 2022 to 2024. These results align with the CGIAR Results Framework and Genebanks's theory of change. Further information on these results is available through the CGIAR Results Dashboard.

The data used to create the graphics in this section were sourced from the CGIAR Results Dashboard on 04 April 2025. These results are accurate as of this date and may differ from information in previous Technical Reports. Such differences may be due to data updates throughout the reporting year, revisions to previously reported results, or updates to the theory of change.

Overview of results by category

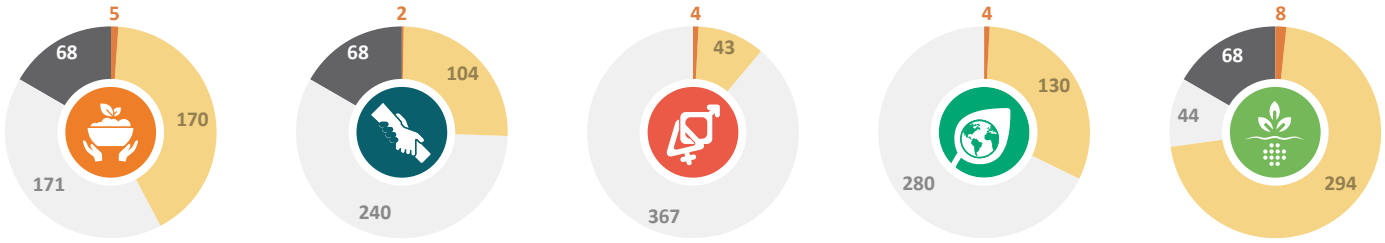
Outputs

- Knowledge products 218
- Other outputs 89
- Capacity sharing for development 53
- Innovation development 39

Outcomes

- Policy change 9
- Other outcomes 5
- Innovation use 1

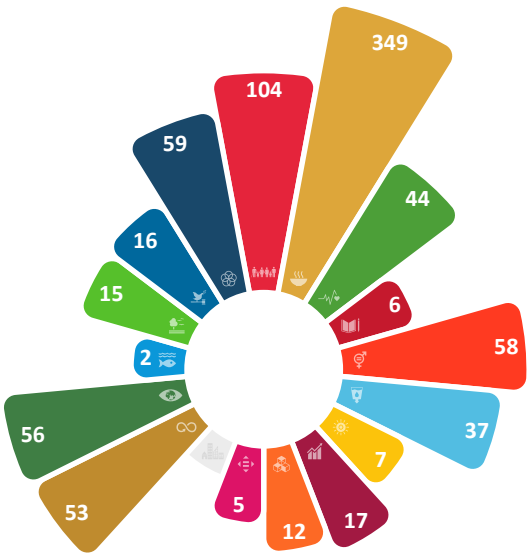
Number of results by Impact Area contribution



Nutrition, health and food security	Poverty reduction, livelihoods and Jobs	Gender equality, youth and social inclusion	Climate adaptation and mitigation	Environmental health and biodiversity
414	414	414	414	414

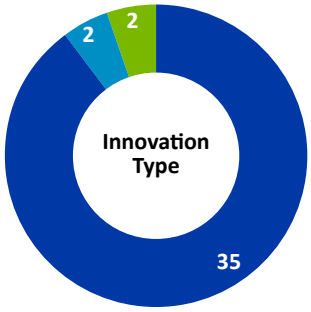
- **2 = Principal:** Contributing to one or more aspects of the Impact Area is the principal objective of the result. The Impact Area is fundamental to the design of the activity leading to the result; the activity would not have been undertaken without this objective.
- **1 = Significant:** The result directly contributes to one or more aspects of the Impact Area. However, contributing to the Impact Area is not the principal objective of the result.
- **0 = Not targeted:** The result has been screened against the Impact Area, but it has not been found to directly contribute to any aspect of the Impact Area as it is outlined in the CGIAR 2030 Research and Innovation strategy.
- **Not applicable:** Pertains to 2022 reported results when only information on Gender and Climate impact area tagging was available.

Contributions to the UN Sustainable Development Goals 2022–2024

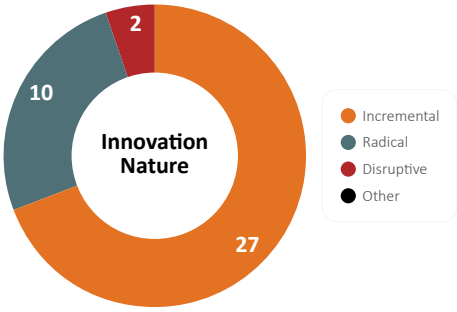


1	No Poverty	104
2	Zero Hunger	349
3	Good Health and Well-Being	44
4	Quality Education	6
5	Gender Equality	58
6	Clean Water and Sanitation	37
7	Affordable and Clean Energy	7
8	Decent Work and Economic Growth	17
9	Industry, Innovation and Infrastructure	12
10	Reduced Inequalities	5
11	Sustainable Cities and Communities	-
12	Responsible Consumption and Production	53
13	Climate Action	56
14	Life Below Water	2
15	Life on Land	15
16	Peace, Justice and Strong Institutions	16
17	Partnership for the Goals	59

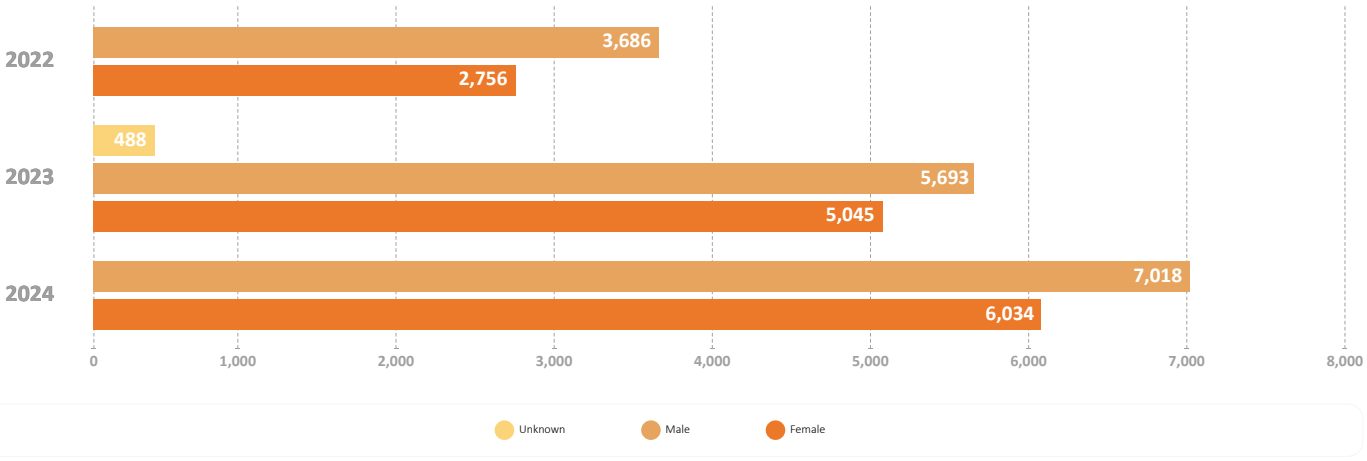
Innovations by typology



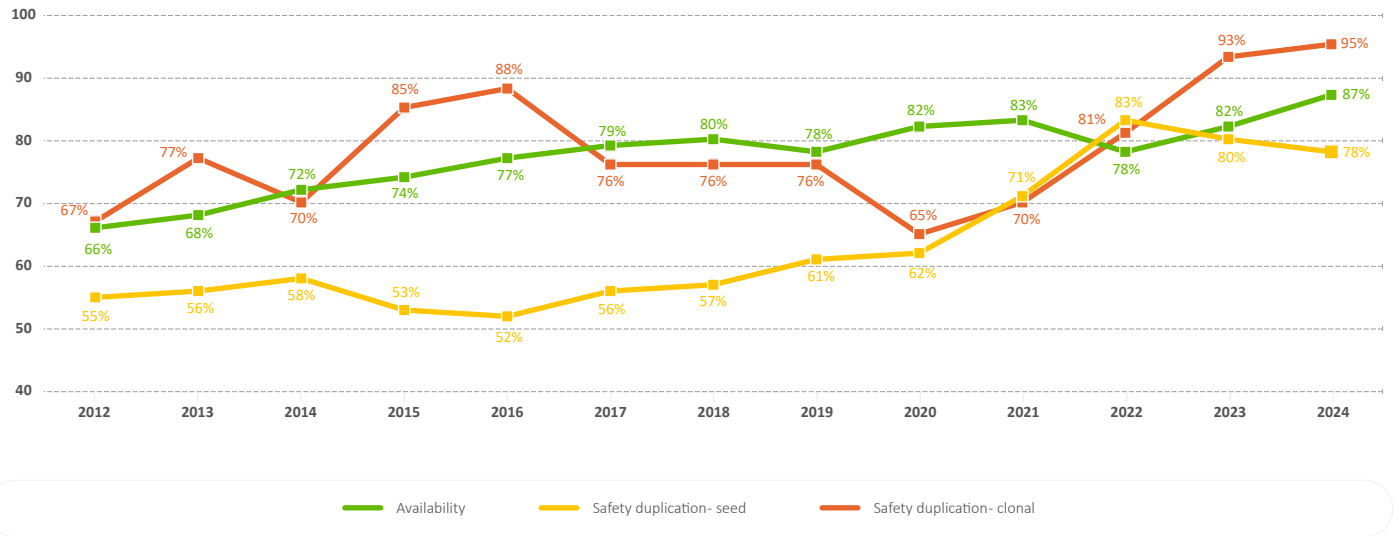
- **TECHNOLOGICAL INNOVATION**
  Innovations of technical/material nature, including varieties/breeds, crop and livestock management practices, machines, processing technologies, big data, and information systems.
- **POLICY/ORGANIZATIONAL/INSTITUTIONAL INNOVATION**
  Innovations that create enabling conditions, including policy, legal and regulatory frameworks; business models; finance mechanisms; partnership models; public/private delivery strategies.
- **CAPACITY DEVELOPMENT INNOVATION**
  Innovations that strengthen capacity, including farmer, extension or investor decision-support services; accelerator/ incubator programs; manuals, training programs and curricula; online courses.
- **OTHER INNOVATION**
  Unknown or the type does not work for the innovation.



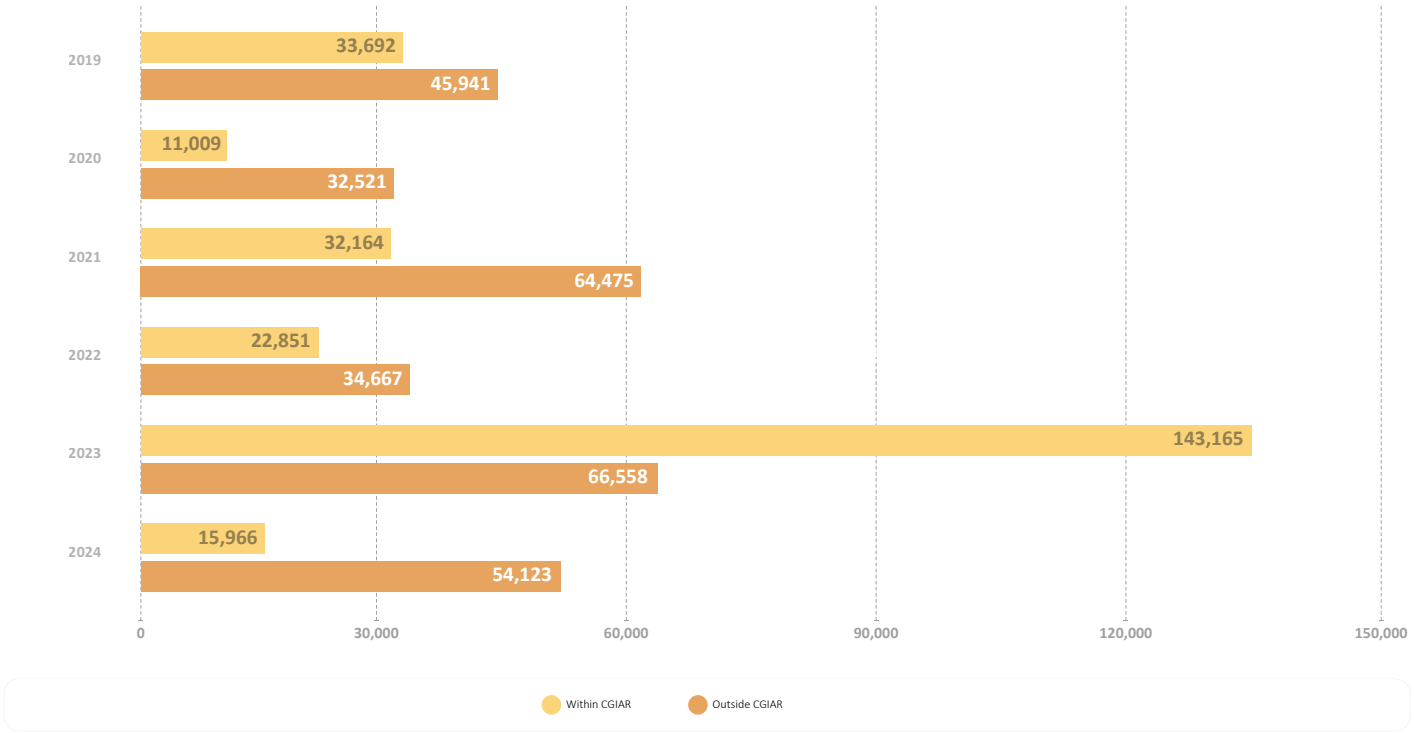
Number of people involved in capacity development events and genebank tours in 2022–2024



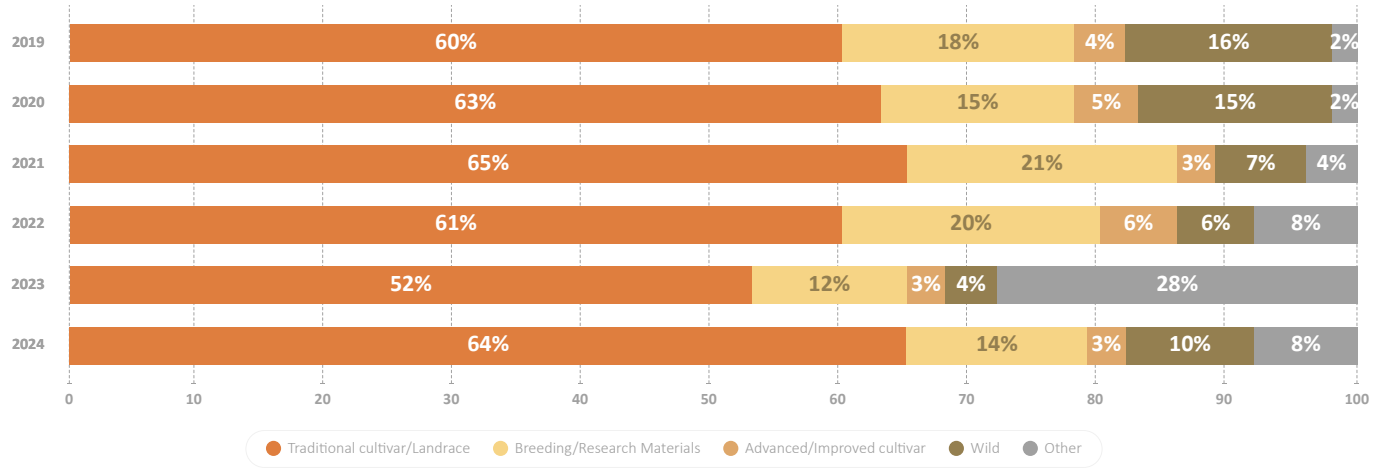
Status (percent) of availability and safety duplication of CGIAR genebanks from 2012 to 2024 (Target 90 percent)



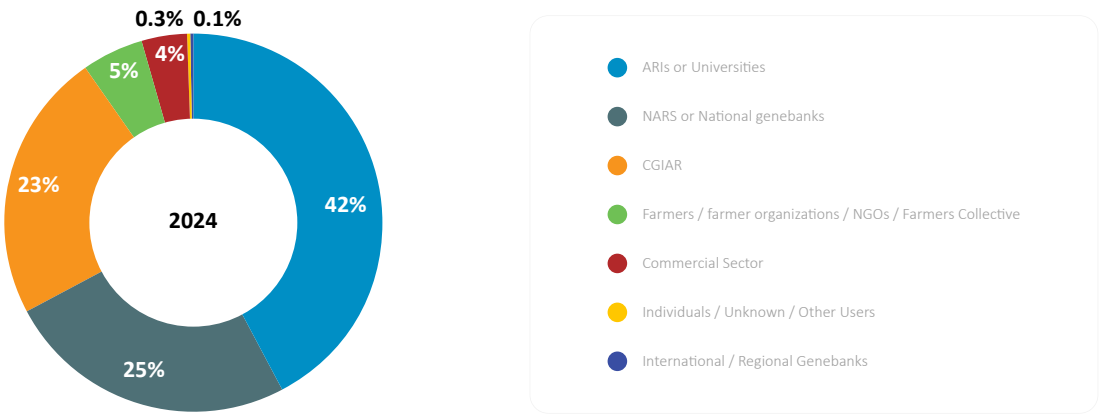
Samples distributed annually by CGIAR genebanks from 2019 to 2024



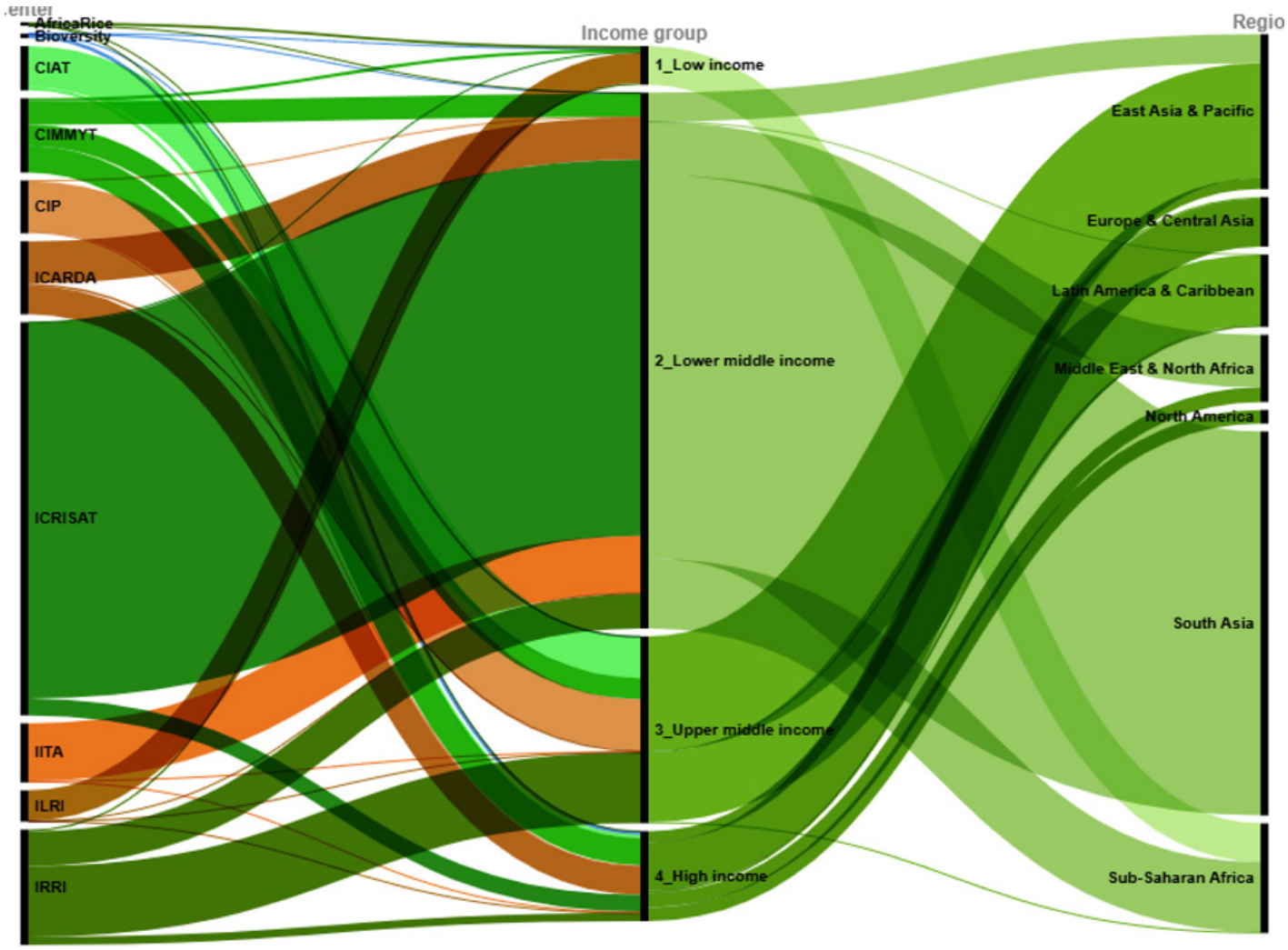
Types of materials requested from 2019 to 2023



Recipients of germplasm distributed by CGIAR genebanks in 2024

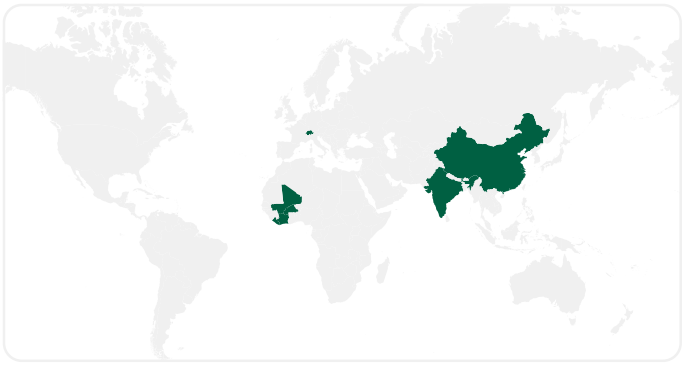


Distribution of germplasm samples from CGIAR genebanks in 2024 (excluding distributions to CGIAR Initiatives)

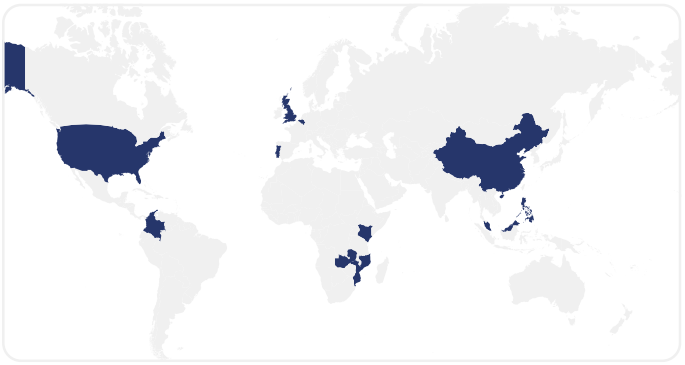


Germplasm external distributions by CGIAR Center in 2024

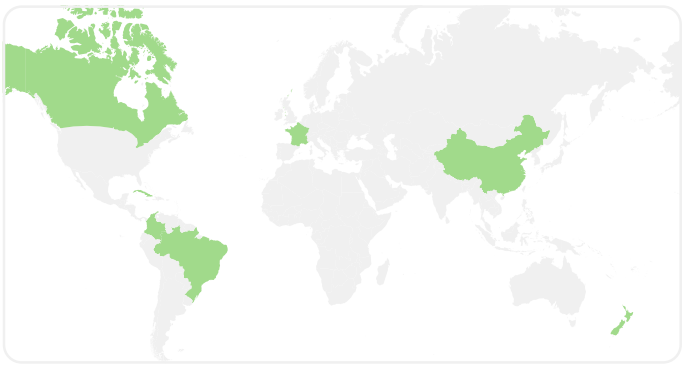
AfricaRice



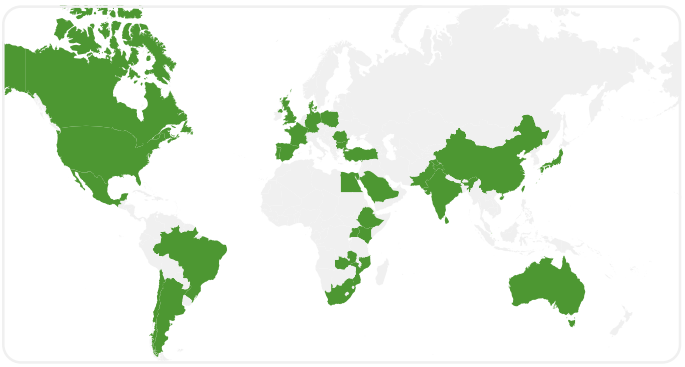
Alliance-Bioversity



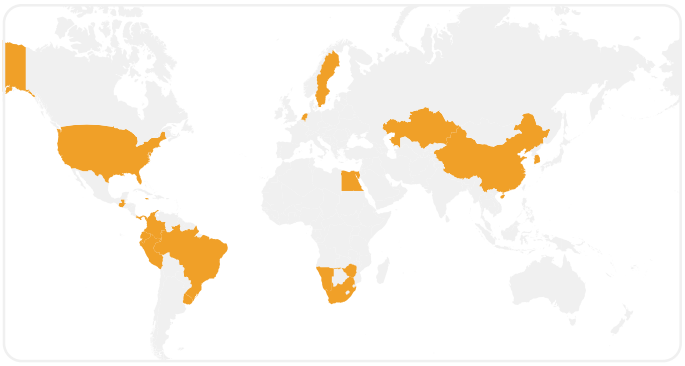
Alliance-CIAT



CIMMYT

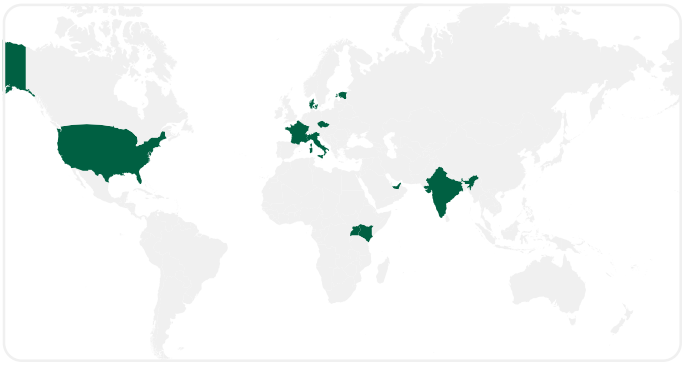


CIP

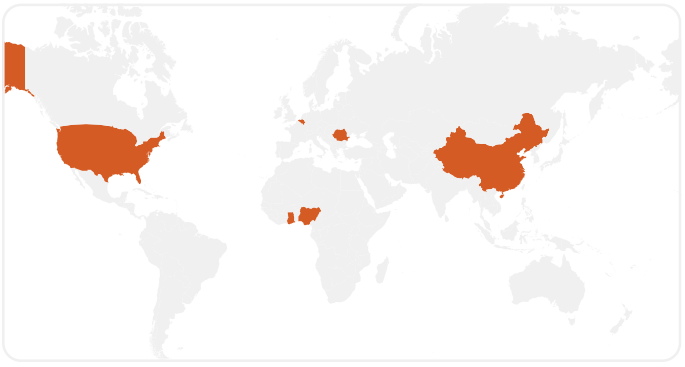


ICARDA

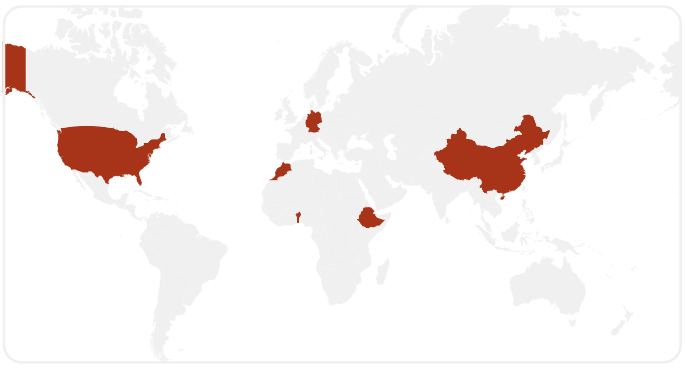
ICRISAT



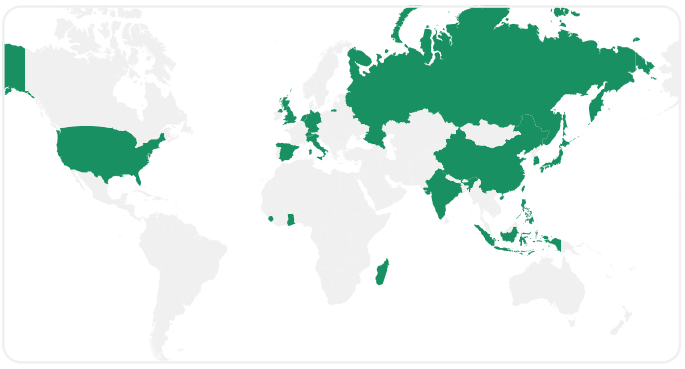
IITA



ILRI



IRRI



GENEBANKS'S EXTERNAL PARTNERS

This network diagram highlights Genebanks' broad and diverse partnerships that span more than 200 collaborators. Research organizations, NGOs and Organization (other than financial or research) formed the largest clusters, underscoring strong cross-sector engagement across the Initiative's three-year implementation. To allow for a clearer view, a maximum threshold of three partners was applied for each typology in the network diagram.
The list of partner acronyms is available here.

Partnerships and Genebanks's impact pathways

Partners can mainly be categorized as follows:

- Genebank users and beneficiaries
- Partners in generating data and evaluating germplasm
- Peers in the genebank community who benefit from sharing capacity or learning from each other's experience
- Plant protection organizations enabling international exchange of germplasm

The graph above mainly depicts peers in the genebank community who participated in workshops and exchanges or collaborated in writing scientific papers in 2022–2024. Moreover, in 2024, the genebanks responded to 945 users requesting germplasm from a range of public and private institutions in 83 countries, which are not shown on the graph. Services were also provided to NARS and CGIAR colleagues to support accession selection, provide technical backstopping, host safety duplicates, and multiply and clean germplasm.

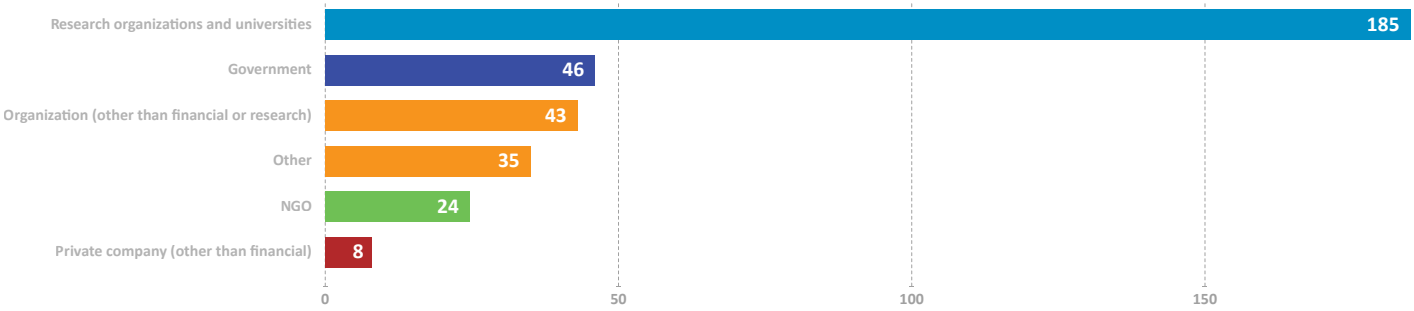
There were also important international partners. IRRI, ICARDA, ICRISAT, and ILRI all made deposits to the Svalbard Global Seed Vault in 2024, providing a safety back-up of their collections. At the end of the year, two-thirds of the deposited accessions were from CGIAR Genebanks. The Plant Treaty Secretariat and CGRFA provided policy guidance and set genebank standards and guidelines, respectively.

The Initiative's partnerships with the DSI Scientific Network (hosted by the Leibniz Institute) intensified over the course of 2024 during the final nine months of negotiations leading up to COP16. The Initiative also continued to work with the Periodic Table of Food Initiative on analyzing options and best practices for access and benefit sharing for DSI. Both participated in joint events with CGIAR and contributed to a range of publications on both technical and policy aspects.

The Global Crop Diversity Trust provided long-term funding to all 10 reporting genebanks. National partners from Uruguay (Instituto Nacional de Investigación Agropecuaria), Guyana (Guyana Rice Development Board), Togo (L'Institut Togolais de Recherche Agronomique), Nigeria (National Centre for Genetic Resources and Biotechnology), Mauritius (Ministry of Agro Industry and Food Security), and Zimbabwe (Genetic Resources and Biotechnology Institute)—all of which are national agricultural research organizations that also host the National Focal Points for the Plant Treaty–played a leading role in developing policies and practices to implement and operate as part of the Plant Treaty's Multilateral System of Access and Benefit Sharing. As such, they paved the way for their countries to participate proactively in a globally coordinated system to conserve and make available PGRFA diversity, and to share benefits derived from commercial uses of those resources.

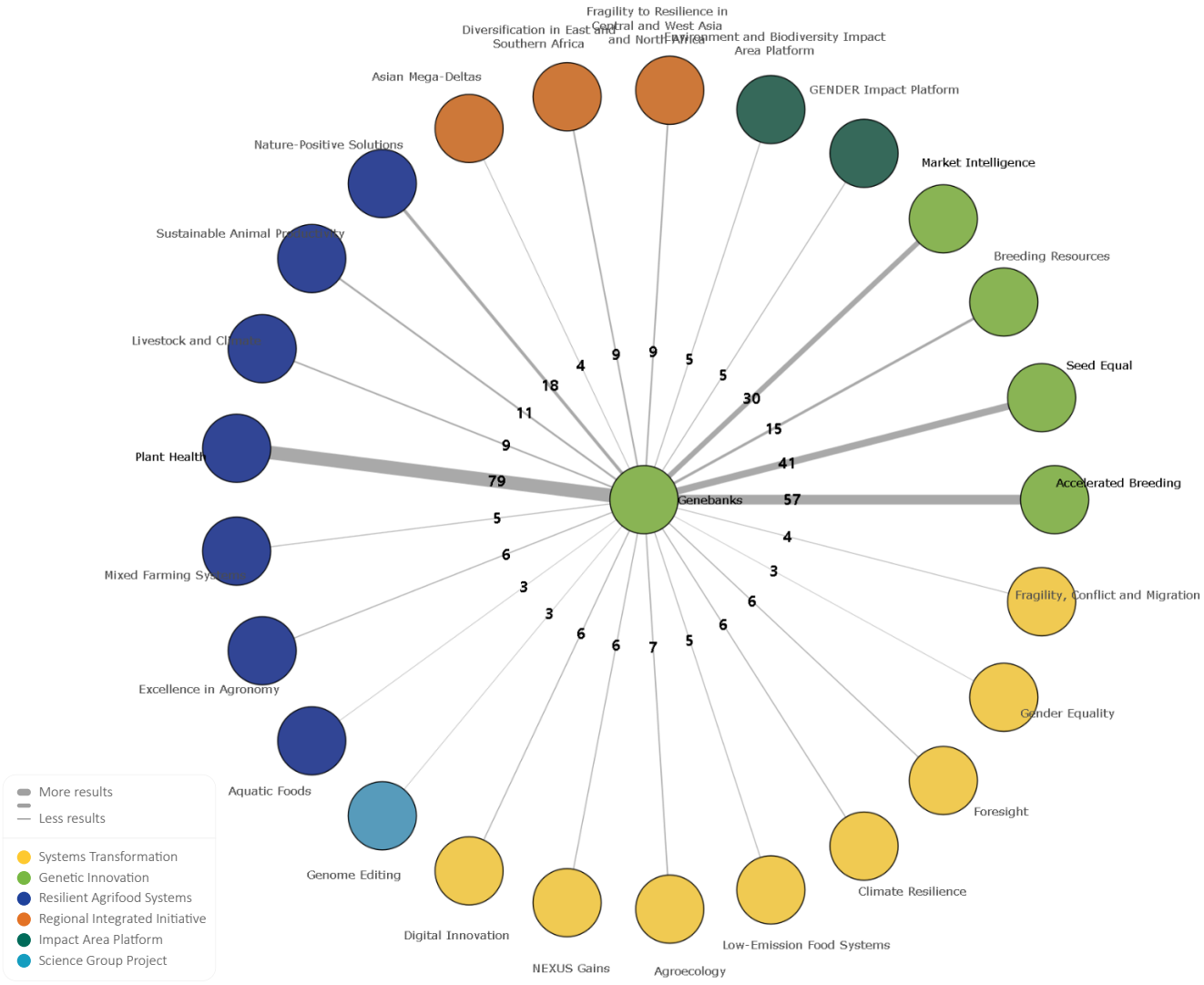
GHUs collaborated with the African Union Inter-African Phytosanitary Council (the Regional Plant Protection Organization for Africa) to establish harmonized procedures for staple crop germplasm exchange in Africa, essential for the GreenPass protocol.

Partner typologies that contributed to delivering 2022–2024 results



Multispectral Videometer at the AfricaRice genebank

Genebanks's internal network of collaborations



Connections are sized according to the number of shared reported results, highlighting the depth of collaboration across the CGIAR Portfolio.

A results threshold filter is applied (set to a minimum of three results) to focus the view on the most significant collaborations. Thicker lines represent stronger collaborative links based on a higher number of shared results.

Portfolio linkages and Genebanks's impact pathways

CGIAR genebanks provided germplasm and collaboration on request to many CGIAR scientists for a range of Initiatives and projects. There was also a specific connection with CGIAR breeders and researchers who generate data on genebank accessions. However, the traceability of these accessions and the associated data remain weak. Although genebanks adopted accession digital object identifiers minted by the Plant Treaty, they were not used by breeders and, too frequently, opportunities were lost to associate genebank accessions with valuable new data. Both groups sought approaches to improve this situation.

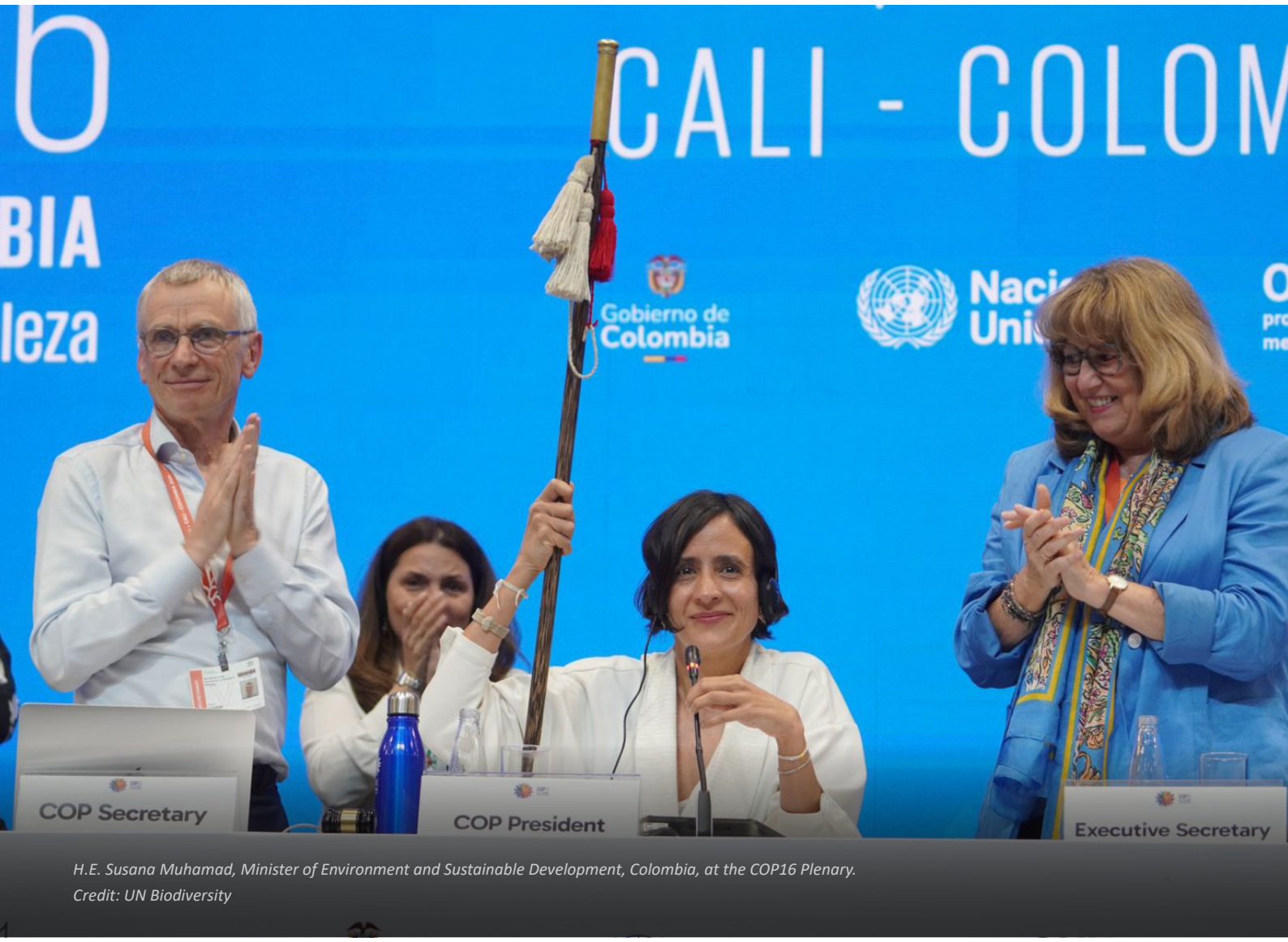
The Genebanks Initiative collaborated with the Breeding Resources Initiative on adopting similar approaches, models, templates, and tools for QMS harmonization and costing. In addition, the ICARDA genebank made use of the shared services portal, launched by Breeding Resources in 2023, to pilot a germplasm ordering portal using the same software platform. In 2024, the Initiative interacted with B4T, Multifunctional Landscapes, Sustainable Farming Science Programs, and CapSha and Digital Transformation Accelerators to develop the 2025–2030 proposal.


Alianza
Bioversity & CIAT

Section 7: **Key result story**

Global agreement on genetic data governance.

CGIAR's technical support helped negotiators at COP16 agree on a mechanism for sharing benefits derived from digital sequence information.



H.E. Susana Muhamad, Minister of Environment and Sustainable Development, Colombia, at the COP16 Plenary.
Credit: UN Biodiversity

Primary Impact Area

Other relevant Impact Areas targeted

Contributing Initiative

Genebanks

Geographic scope

Regions: Global

Advocacy by CGIAR helped shape a landmark decision at the UN Biodiversity Conference (COP16) to operationalize a multilateral mechanism to share benefits from digital sequence information (DSI). It recognizes the importance of non-monetary benefits and allows for continued open access to data. Payment obligations are based on companies' sales in relevant sectors, without tracking and tracing DSI use in specific commercial products. While this is a major step forward, further action is needed to develop a truly robust, efficient, fair, and equitable system.

Digital sequence information (DSI) broadly refers to detailed genetic data obtained by sequencing plant, animal, fungi, and microbial genomes – the complete set of DNA instructions unique to each species – although there is no internationally agreed-upon definition for DSI.

The international community has developed rules to ensure that some of the commercial benefits from using genetic resources flow back to those who developed or conserved such resources in natural or agricultural ecosystems.

But existing benefit-sharing systems were designed for physical materials and cannot easily be applied to digital information shared online. COP16 in Cali, Colombia, offered an opportunity to address this gap. A key challenge was how to share benefits from DSI fairly and equitably without hindering agricultural or other scientific research.

CGIAR was uniquely positioned to support negotiators, given its extensive experience in using DSI for crop and livestock improvement, agrobiodiversity conservation and restoration. During the two years before the conference, CGIAR scientists and policy experts:

- submitted policy briefs explaining how DSI is used in practice
- published articles in peer-reviewed scientific journals
- participated actively in an Informal Advisory Group
- engaged in formal and informal negotiations
- organized events facilitating dialogue between scientists and policymakers

This work built on more than a decade of advocacy alongside partners such as the DSI Scientific Network and the Plant Treaty Secretariat. Relevant resources were also made available in a DSI library on CGIAR's website.

These efforts helped negotiators reach agreement on operationalizing a global pooled fund—the Cali Fund—to facilitate benefit sharing from commercial uses of DSI without negatively affecting agricultural research and development. According to the decision, governments should encourage companies using DSI to pay to support biodiversity conservation and sustainable use in developing countries, as well as Indigenous peoples and local communities. Payment obligations are based on companies' sales in sectors that generally rely on DSI.

The agreement also acknowledged the importance of non-monetary benefit sharing, including capacity-building, knowledge exchange, and technical cooperation, core parts of CGIAR's work which enhance national partners' ability to benefit from and use DSI directly. The conference outcome recognized mechanisms being developed under other international conventions, including the Plant Treaty. Without this, scientists could have faced conflicting obligations under separate agreements.

Although the decision included many important components, other critical elements were omitted, such as tracking and tracing uses of DSI in the development of individual commercial products, and cumbersome monitoring and reporting obligations for database providers.

Overall, the outcome marks a major step forward in developing a robust and efficient system for sharing benefits from the use of DSI while allowing continued use of this tool to support farmers around the world. But significant work remains. Contracting parties agreed to incentivize, rather than require, financial contributions by companies in their jurisdictions. Questions remain as to what incentives they will create, and how effective they will be, or if companies will voluntarily make payments.

A critical next step will be the Plant Treaty's Governing Body meeting in November 2025. This meeting provides an opportunity to develop complementary arrangements to further strengthen multilateral benefit-sharing mechanisms. The basis for requiring payments will almost certainly be different from what was created in Cali, but there are opportunities ensure that they work in mutually supportive ways, without requiring double payments or creating impediments to the management and use of open-access DSI.

CGIAR will continue to offer technical assistance and advice to help develop an equitable, practical system that benefits farmers and consumers in developing countries.

> The negotiations that led to the operationalization of the Multilateral Mechanism on DSI, including the Cali Fund, by COP16 were supported by a broad base of multistakeholder engagement. CGIAR has conveyed the plural perspectives of agricultural research eloquently and made a remarkable contribution to forging consensus in Cali at the most vibrant and inclusive COP in the history of the Convention.
>
> Astrid Schomaker, Executive Secretary of the Convention on Biological Diversity

2022 key result story

Artificial intelligence helps unearth genebanks' hidden gems

2023 key result story

CGIAR genebanks modernize their approach to conservation through a shared policy framework that enables more dynamic curation of materials

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CIP genebank staff at the opening of the new Cryobank. Credit CIP.JPG