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Synthesis Learning from a Decade of CGIAR Research Programs –

Action Area 3: Genetic Innovations

CGIAR Advisory Services

July 2021

Brief 3

Background and Context

In 2020, in an ambitious One CGIAR reform, CGIAR commenced to streamline the governance, operational structures and processes guided by the 2030 Research and Innovation Strategy. In the Strategy, the Action Area 3 on Genetic Innovations aims to ensure the world's growing food and nutrition requirements are met in a time of unprecedented climate change, rapid population growth and urbanization, while simultaneously supporting the livelihoods of millions of farmers. This will be achieved by accelerating the supply of more productive, nutritious, and climate-resilient crop varieties. Without access to genetically diverse resources for breeding programs and the mobilization of genetic resources conserved in genebanks, agri-food systems will not be able to respond to emerging threats or meet the evolving needs of consumers including women and youth.

Evaluation Synthesis Methodology

In 2021, the Evaluation Function of the CGIAR Advisory Services (CAS) conducted an evaluative exercise to provide recommendations for and support the future One CGIAR. The 2021 Synthesis, serves the dual purpose of accountability to CGIAR funders and learning from 10 years of implementing CGIAR Research Programs (CRPs)—see Figure 1 (overleaf).

The approach of the 2021 synthesis was summative and formative. The predominately qualitative method used a narrative approach to synthesize findings. The synthesis of evaluative evidence relied on information from 43 purposefully selected CRP and thematic evaluations and reviews. Validation of results and quality assurance relied mainly on data triangulation, including related synthesis of evaluative evidence. The quantitative method used basic descriptive statistics, where quantitative data on the quality of scientific publications were available. The overarching analytical framework was based on five themes: quality of science; inputs and progress towards outputs; performance; management and governance; and future orientation/relevance. Key limitations included the reliance on secondary source data due to the synthesis nature and desk-based nature of 2020 CRP reviews without first-hand, face-to-face contact with key stakeholders, evidence gaps and limited comparability across themes and subthemes; and limitations related to discontinuation of several of the systems CRPs after one phase.

Key Findings and Lessons

CGIAR with partners has a long history of investing in plant genetic resources conservation and genetic gains in farmers' fields across the globe. Figure 2 (page 3) depicts the latest data for CGIAR expenditure on genebanks and plant breeding, which totalled over $200 million in 2019—almost 25 per cent of the total CGIAR expenditure for that year[1].

[1] In the CGIAR 2030 Research and Innovation Strategy, since Genetic Innovation under FISH and LIVESTOCK is to be implemented under Resilient Agrifood Systems, Action Area 2, these topics are not being treated in this brief. Refer to the Synthesis Annexes A5.1-A5.3 for more information.

The evaluative evidence analyzed for the Synthesis led to a number of key findings of relevance to the Genetic Innovations action area. This action area has been characterized by a high quality of physical outputs and publications. Other key findings are as follows:

Conservation

- Breeders' access to germplasm from genebanks depends on the quality and availability of characterization and evaluation data, and the extent of collections. The sample of genetic diversity conserved in genebanks does not fully reflect the range of diversity found in nature or on-farm. To meet breeders' current and longer-term needs for germplasm diversity, a more effective use of collections requires improved information systems and fewer gaps in diversity, and effective linking of conservation and use across genebanks and breeding programs. The availability of, and access to diverse and valuable germplasm, improved varieties and strains and crop wild relatives, requires an enabling policy environment.

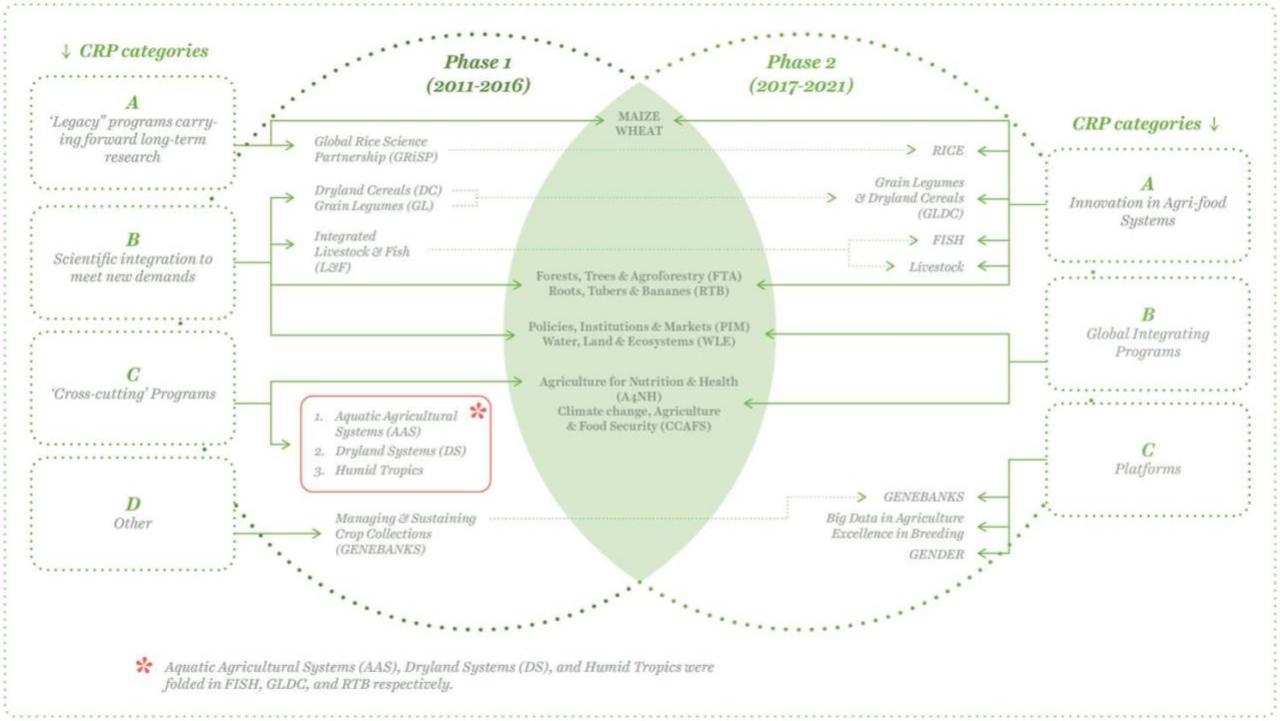

Figure 1. Evolution of the CRPs over two phases of implementation

Pre-breeding

- In the 2nd phase of CRPs, refinement in target market prioritization and target product profile definition to guide breeding and upstream research efforts improved but more needs to be done.

Breeding

- The modernization of the CGIAR breeding programs accelerated during the second phase of the CRP era with support from Platforms like the Excellence in Breeding Platform (EiB), cross-CRP collaboration and partnerships with Advanced Research Institutes (ARIs).

Seed Systems, Prioritization and Delivery

- The high rate of selection and release of germplasm improved for productivity, resilience and nutrition has the potential to address the grand global challenges. However, this potential is curtailed by ineffective delivery pathways for diverse farming systems.
- A more multidisciplinary approach to priority setting, needs assessment, adaptive research and delivery facilitated a greater emphasis on sustainable intensification, value chains, seed systems and postharvest processing which brought CGIAR breeding programs closer to downstream stakeholders.
- Meeting the needs of future generations in a fast-changing world requires that discovery science is backed by strategic investment in the delivery of science.

Synergies and Linkages

- The CRPs played a vital role as enablers of multi-institutional partnerships in genebanks and plant breeding to address challenging research questions and bring solutions to those with greater needs in a rapidly changing world.
- Synergies generated by combining the complementary strengths of a broad range of collaborating partners in genebanks and plant breeding have led to efficiency gains and enhanced effectiveness.
- Multidisciplinary research led to an increased understanding of global threats to agri-food systems, nutrition and water security which resulted in CGIAR breeding programs moving towards a more end-user and climate-change-ready focus. However, a greater emphasis on the diverse needs of the poorest, at-risk or marginalized groups is still required.
- On-line publication of genebank characterization and evaluation data needs to be extended, and the interface improved in Genesys, and included in Germplasm Resource Information Network (GRIN) GLOBAL, to promote greater collaboration between CGIAR genebanks and breeders and increase germplasm exploitation.

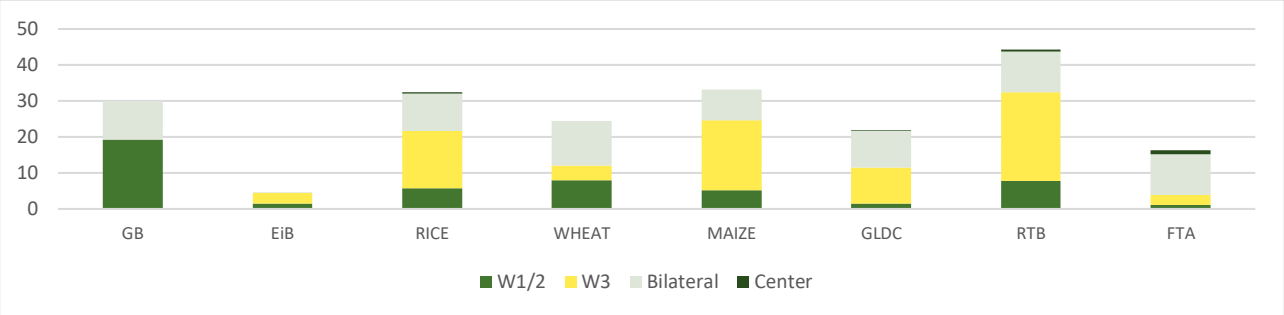

Figure 2: CGIAR 2019 Expenditure on Plant Breeding and Genebanks ($M)[2]

Selected Evidence Gaps

- The missing assessment of the support platforms in 2020 constrained the analysis of progress along and between the two phases (the Genebank platform), and made it impossible to assess the level of collaboration and interaction between the Platforms (Genebank, EiB, Gender and Big Data in Agriculture) and CRPs. The 2021 evaluation of the EiB and Big Data Platforms will provide an opportunity to assess the level of collaboration and synergies between these two Platforms and CGIAR breeding programs.
- Climate-change threats have highlighted the urgent need for conserving the wealth of the genetic diversity found in nature and on farms. The use of germplasm for research and crop improvement requires access to an increasingly diverse array of genetic material that has been characterized and evaluated for yield, nutrition and resistance to, and tolerance of, rapidly changing biotic and abiotic stresses. While it is well recognized that crop and tree diversity is essential to prepare agri-food systems for changing conditions, up-to-date information on the proportion of germplasm in genebanks that reflects the genetic diversity found in nature is lacking, as is information on how effective genebanks and national partners have been in identifying and filling gaps in their collections. It is also unclear how well genebanks are meeting the current and longer-term priorities of breeders.

[2] Data sourced from: www.cgiar.org/food-security-impact/finance-reports/dashboard/

Although genetic innovations were underpinned by two CGIAR Platforms, Genebanks and Excellence in Breeding (EiB), Agri-Food Systems Programs (RICE, WHEAT, MAIZE, GLDC, RTB and FTA) also invested in genetic innovations.

Conclusions and Recommendations

CGIAR and partners have long been the custodians of invaluable genetic resources and have played a vital role in developing and releasing high-yielding, nutritious and resilient germplasm. Building on this legacy, and in the face of unprecedented global challenges, moving forward One CGIAR should:

- Ensure that high priority is given to nutrition, health, resilience, and environmental sustainability objectives in research groups focused on genetics.
- Increase inclusiveness in defining product profiles, executing programs, and delivering outputs, to better contextualize variety development and tailor research to diverse agricultural communities and to the needs of children, youth, women, and other at-risk or marginalized groups.
- To facilitate impact at scale, prioritize seed sector development, including by expanding partnerships with the private sector and civil society and strengthening key policies and regulations.
- Catalyze partnerships with other research and innovation partners in defined systems to enable crop system diversification and improve access to affordable, healthy diets.
- Accelerate the modernization and technical capacity development of plant-breeding programs across Centers and in national program partners.
- Integrate research with wider development and investment commitments related to climate change adaptation and mitigation.
- Engage strategically with policies (e.g., International Treaty on Plant Genetic Resources for Food and Agriculture, Commission on Genetic Resources for Food and Agriculture) around the value of germplasm diversity, farmers' and breeders' rights to plant and animal genetic resources, and international transfer agreements to ensure access to and availability of diverse and valuable germplasm, improved varieties and strains, and crop wild relatives.

Read the report and download the annexes: cas.cgiar.org/evaluation/publications/2021-synthesis.

CGIAR Advisory Services
Via di San Domenico 1, 00153 Rome, Italy
CAS-Secretariat@cgiar.org
https://cas.cgiar.org/