# Global strategy for the conservation and use of sorghum genetic resources: summary for ITPGRFA stakeholders

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**This document is a concise summary of the *Global Strategy for the Conservation and Use of Sorghum* (Bramel et al., 2022) with some key metrics updated in 2025. Its aim is to support decision making by the stakeholders of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) by providing evidence-based information on this genepool in an accessible format.**

**Annex I crop covered by the strategy:** *Sorghum bicolor* (L.) Moench
**International collections:** International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Center for Biosaline Agriculture (ICBA), International Livestock Research Institute (ILRI), Alliance of Bioversity International and CIAT.
**Regional collections:** South African Development Community Plant Genetic Resources Centre (SPGRC)

## Global system for the conservation and use of sorghum genetic resources

The current global system for the conservation and use of sorghum genetic resources includes:

- Natural areas, where most of the diversity of the wild relatives are still conserved.
- Local farmers and households, who play a key role in conserving and managing most of the cultivated diversity.
- National collections in the centers of diversity, which conserve a high proportion of local diversity and offer significant opportunities for local engagement in both conservation and use.
- National collections outside the centers of diversity, which often conserve accessions that are likely duplicates of those held elsewhere, or local materials with unique traits. These collections may face an uncertain future as national priorities shift.
- Four international, one regional and 11 national genebanks that conserve mainly accessions from other geographical origins.

## Composition and gaps in *ex situ* collections

A survey[1] gathered information on approximately 220,00 accessions of *Sorghum* and its crop wild relatives conserved *ex situ*. When also considering collections that

**Table 1.** Summary of key metrics for sorghum.

| Key metrics | Data source | Value |
|---|---|---|
| Estimated global number of accessions *ex situ* | Survey (2021) | 217,679 |
| Number of accessions with DOI | GLIS portal (2025) | 77,877 |
| Number of accessions notified as available in the MLS | GLIS portal (2025) | 71,271 |
| Number of accessions notified as available in the MLS conserved in Article 15 genebanks | GLIS portal (2025) | 50,329 |
| Number of accessions safety duplicated at Svalbard Global Seed Vault | SGSV web portal (2025) | 70,984 |
| Estimated number of accessions needing regeneration without a budget for regeneration | WIEWS (2014-2019) | 20,349 |
| Number of seed samples distributed per year | Data store of the ITPGRFA[2] | 3,462 |
| Passport data completeness index: median value in Genesys (Range 0-10) | Genesys (2025) | 6 |

[1]Thirty-eight genebanks from 37 institutions responded to the survey conducted in 2021.
[2]Annual average of germplasm distributions between 2019 and 2021. Source: Data Store of the ITPGRFA

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did not respond to the survey, it is estimated that about 260,000 accessions of sorghum and its crop wild relatives are conserved *ex situ* worldwide.

The largest sorghum collections are held by:

- USDA Agricultural Research Service Plant Genetic Resources Conservation Unit (USDA-ARS) – 47,412 accessions.
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) – 45,397 accessions.
- National Bureau of Plant Genetic Resources (NBPGR) in India – 25,507 accessions.
- Chinese Academy of Agricultural Sciences (CAAS) – 18,250 accessions.

Other large collections include:

- Ethiopian Biodiversity Institute (EBI) – 11,063 accessions.
- Genetic Resources Research Institute of the Kenya Agricultural and Livestock Research Organization (GeRRI) – 6,287 accessions.
- Australian Grains Genebank (AGG) – 7,107 accessions.
- Sudan Agricultural Plant Genetic Resources Conservation and Research Centre – 7,212 accessions.
- Southern African Development Communities Plant Genetic Resources Centre (SPGRC) – 4,658 accessions
- Vavilov Research Institute of Plant Industry in Russia (VIR) – 7,335[3] accessions.
- Research Center of Genetic Resources at the National Agriculture and Food Organization of Japan (NARO) – 5,053 accessions.
- Genetic Resources and Biotechnology of the Empresa Brasileira de Pesquisa Agropecuária in Brazil (EMBRAPA-CENARGEN) – 4,726 accessions.

According to the survey results, 62% of accessions of *Sorghum* wild species conserved *ex situ* belong to the wild *Sorghum bicolor.*

ICRISAT, the Indian Institute of Millets Research, and the NBPGR in India, as well as genebanks in some African countries, have used Geographic Information Systems (GIS) to identify gaps and have begun addressing them. However, when the gaps identified in the 2021 survey were compared with those highlighted in 2007 (Global Crop Diversity Trust, 2007), many in West and Central Africa and South Sudan remain unfilled.

The 2021 assessment also revealed significant gaps in other regions, including Central America, Central Asia, and the Caucasus. In addition, species coverage remains inadequate, and ecological sampling at the national level is still limited.

[3]This estimate is from Global Crop Diversity Trust (2007)

## Routine operations, regeneration, quality management system, and safety duplication

About 30% of the genebanks that responded to the 2021 survey reported not having long-term seed storage. Seven institutions conserved sorghum material only in medium-term storage, while four had to store seed at ambient temperature due to lack of reliable cold storage. Most respondents used sealed aluminum packs, with or without vacuum packing, for long-term conservation. Around 20% of the genebanks employed automated systems to monitor security, temperature, and relative humidity. Given the importance of proper drying for long-term conservation of sorghum seeds, it is concerning that only half of the national institutions had access to a low-temperature seed dryer.

More than 70% of wild relative accessions were under long-term storage, and 43% had undergone baseline seed viability testing. Compared to cultivated sorghum, a smaller proportion of wild accessions had been regenerated or multiplied, due to the difficulties of growing these materials in the field or greenhouse.

The 2021 survey also revealed that many national genebanks lack the space, facilities, and equipment required to meet international standards for conserving orthodox seeds. A high proportion also reported inadequate access to sites for seed regeneration.

Regarding documentation and standards:

- 18% of institutes had no written procedures or protocols.
- 64% reported relying on published procedures and protocols.
- About 25% had their own genebank operational manuals and/or written standard operating procedures (SOPs) for key processes.
- 18% reported using a quality management system (QMS) or applying the FAO (2014) genebank standards for plant genetic resources for food and agriculture. However, these standards are recommendations rather than written procedures or protocols.

Safety duplication was also uneven. Four surveyed genebanks had no part of their collections duplicated elsewhere. Generally, smaller collections had a lower percentage of safety-duplicated accessions, while larger collections had a higher proportion. As of 2025, 70,984 sorghum accessions were safety duplicated at the Svalbard Global Seed Vault, but 42% of the 152,681 sorghum accessions in Genesys had no record of any form of safety duplication.

Overall, many collection holders are not meeting international conservation standards. The system remains insecure, characterized by inefficient and poorly resourced operations in many national institutions, limited seed availability, insufficient sharing of accession-level data,

and weak engagement with users at local, national, and global levels.

Some of the main challenges include:

- Lack of consistent, long-term financial support for sorghum conservation in many genebanks.
- Limited knowledge of the extent of sorghum diversity conserved globally.
- Low levels of research support for sorghum.

## Documentation and information systems

Across the surveyed institutions, 95% of accessions were documented with passport data, and 85% were entered into a searchable database. About 77% of accessions had been characterized for minimal traits, and 69% had characterization data stored in a searchable database. While documentation of passport and characterization data has improved, more than 60% of institutions reported that their data was not publicly available.

## Human and financial resources

For most of the surveyed institutions, the number of staff and their level of expertise were adequate to carry out routine operations and fulfill distribution requests. About half of the institutions relied primarily on annual budgets as their main source of funding for routine conservation activities, regeneration, multiplication, and characterization. However, sorghum generally receives lower priority from donors compared with other crops, both nationally and internationally. As a result, there are few opportunities to secure funding to address existing gaps or to upgrade routine operations, facilities, equipment, and procedures.

## Distribution and obstacles to use

All but two of the surveyed institutes distributed materials to users within their institute and nationally. About 60% also distributed internationally, under an SMTA or a government- or institution-mandated MTA. Several institutions reported no distribution in the past five years either to users outside the country or to the private sector within the country. The survey results suggest that significant obstacles remain in distributing accessions internationally. Limited private-sector breeding programs have reduced the commercial use of these collections, and the lack of accession-level information may also contribute to the low level of use by international users.

## Partnerships and networks

There are few international platforms for collaboration on sorghum genetic resources, aside from some specific sequencing and genotyping efforts involving global coalitions. Global collections, such as ICRISAT, USDA-ARS, NBPGR, AGG, EMBRAPA, and select key national collections, could serve as the foundation for a global network. ICRISAT, as a CGIAR center with an international collection, has taken the lead in actively engaging partners for the crops it conserves, while the Institut de Recherche pour le Développement (IRD, France) continues to work primarily with West African countries.

The SADC Plant Genetic Resources Center (SPGRC) involves all sorghum national collections within the Southern African Development Community (SADC) countries. For European collection holders, the European Cooperative Programme for Plant Genetic Resources (ECPGR) provides a collaborative platform.

Twenty-eight institutions reported on their partnerships with various users. The most common partnerships were with local users (82%) and national researchers and breeders (86%). Local users included farmers, farmers' organizations, NGOs, and extension services. Partnerships with the private sector were the least common.

Sorghum diversity in Botswana. Photo: Michael Major for ICBA

## Descriptors

Characterization and evaluation descriptors for sorghum have been revised and updated (Alercia, 2011), and a revision of the racial classification of sorghum has been published (Dahlberg, 2018). However, only 24% of the surveyed genebanks used these updated descriptors, and only 8% used the revised sorghum classification. In contrast, 81% of the surveyed genebanks still relied on the IBPGR and ICRISAT descriptors from 1993.

## Key actions required

Secure the long-term conservation of sorghum genetic resources by:

- Increasing the security of *ex situ* conservation through improved routine operations, facilities, and safety duplication in key national genebanks.
- Identifying duplicates across genebanks and gaps in the conservation of unique diversity, both in *ex situ* collections and in farmers' fields and natural areas.
- Conserving research materials.
- Enhancing global engagement among conservers and between conservers and users.
- Advocating for the importance of sorghum and its conservation to the public, local governments and communities, policymakers, and other research communities to raise awareness and secure financial support.

Increase the availability and exchange of sorghum germplasm by:

- Improving the quantity, quality, and viability of seeds available for distribution from genebanks.
- Identifying key administrative, technical, and policy bottlenecks to distribution in different genebanks and implementing solutions.

Increase the use of conserved genetic diversity by:

- Improving access to accession-level information that meets users' needs, preferably online.
- Expanding evaluation (via phenomics) and genotyping with input from users to facilitate utilization.
- Continuing to establish and make available core collections and other subsets to support the discovery and use of valuable traits.
- Strengthening engagement between genebanks and a wide range of users, including researchers and farmers.

### Priority Action 1:
### Global initiative to fill global gaps in conservation

- The first key activity of this initiative is to upgrade the information systems in national collections with key sorghum collections and ensure that complete passport data for sorghum accessions are added to Genesys.
- The second key activity in the global initiative is to convene a broad range of sorghum diversity conservers and users. This group will decide on the goals and approach for a comprehensive global gap analysis. The results of the gap analysis will guide investment in collecting for *ex situ* conservation and a global conservation planning exercise to determine key priority sites for on-farm and *in situ* conservation activities.
- The third key activity is to establish a working group to provide expert guidance for investments into a global sorghum genotyping (and eventually also phenotyping) initiative.

### Priority Action 2:
### Global initiative to secure the conservation and use of collections for future users

This first activity of this initiative will be the development of a competitive grants program for sorghum collection holders. Institutions will be able to apply for funding to support much-needed upgrades. A global working group of conservation and use experts—including representatives from the major collection holders—will play a key role in setting project priorities, ensuring global collaboration, recommending projects for funding, monitoring progress, and communicating results.

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