

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

This document is a concise summary of the [Global Strategy for the Conservation and use of Yam Genetic Resources](#) (Lebot and Dulloo 2021). This summary supports decision making by the stakeholders of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) by providing evidence-based information in an accessible format.

**Annex I crops:** *Dioscorea alata* L. (Southeast Asia, Melanesia), *Dioscorea bulbifera* L. (Latin America, Africa, Asia, Melanesia), *Dioscorea cayenensis* Lam. (West Africa), *Dioscorea esculenta* (Lour.) (Southeast Asia, Melanesia), *Dioscorea japonica* Thunb. (Japan), *D. nummularia* Lam. (Melanesia), *Dioscorea oppositifolia* L. (China), *Dioscorea pentaphylla* L., *D. rotundata* Poir. (West Africa), *Dioscorea trifida* L. (Southeast Asia, Melanesia).

**International collections:** IITA (Nigeria) and SPC (Fiji).

## Composition and gaps in *ex situ* collections

There are at least 13,706 accessions of *Dioscorea* species conserved globally *ex situ*. The International Institute of Tropical Agriculture (IITA) conserves 43% of these. *D. alata*, *D. rotundata* and *D. esculenta* are well represented, while other minor *Dioscorea* cultivated species and wild species are not well represented in *ex situ* collections. Several countries in Africa have already been

identified for further collecting of *D. cayenensis* and *D. rotundata* (Cameroon, Ethiopia). Countries such as the Central African Republic and South Sudan should also be included in future collecting missions. It is recommended that IITA enrich its collection with accessions of *D. alata* from East Africa, Madagascar and Southeast Asia. *D. trifida* needs further collecting in northern Brazil and in the Guianas. *D. nummularia* needs to be collected in Indonesia, Papua New Guinea, Solomon Islands and Vanuatu. *D. oppositifolia* and *D. japonica* cultivars need to be collected in China, Japan and Taiwan.

## Crop wild relatives (CWRs)

The strategy recommends collecting, exchanging and preserving seeds of yams CWRs as a cost-efficient way to bypass germplasm health constraints. Other recommendations are developing long-term storage techniques for wild relatives, producing better documentation of CWRs, developing a global inventory of *in situ* CWRs, creating an early warning monitoring system for the *in situ* loss of wild yams, and conducting a global *in situ* conservation planning exercise.

Key metrics	Data source	Value	%
Estimated number of accessions conserved <i>ex situ</i>	Survey (2020)	13,706	
Accessions in Genesys and WIEWS	Genesys and FAO-WIEWS (2020)	7,949	
Accessions with DOI	<a href="#">GLIS portal</a>	6,563	48%
Estimated number of accessions notified as available in the MLS	<a href="#">GLIS portal</a>	6,495	47%
Estimated number of accessions in the MLS	Plant that feed the world study <sup>1</sup>	7,085	52%
Distributions per year at national level	Survey (2020)	357	
Distributions per year at international level	Survey (2020)	85	
<a href="#">Passport data completeness index</a> : median value in Genesys (Range 0–10)	Genesys (2023)	6.15	

<sup>1</sup>Estimate based on ITPGRFA Contracting Party status of countries holding germplasm. Source: The Plants that Feed the World (Khoury et al., 2023).

With support from



Federal Ministry of Food and Agriculture

## Routine operations, regeneration and quality management system

Very few collections can conduct routine activities at international standards and very few curators have attempted to establish a quality management system. Only IITA has externally reviewed standard operating procedures. Several collections do not have optimal facilities for the storage of vegetative material and all curators report they need assistance to improve the health status of the collection.

## Safety duplication and unintended duplication

There is a need to duplicate all unique accessions in genebanks with high-standard *in vitro* conservation to prevent irreversible loss. Before collections are duplicated they must first be reviewed to identify duplicates in primary collections. This review will reduce the number of accessions and make duplication more manageable. As of 2021, there were only two international hubs (the IITA and SPC genebanks) for *in vitro* safe duplication and the sanitation of yam germplasm at the regional level.

## Documentation and information systems

Most collections have good passport data, but poor characterization and evaluation data. The information is rarely available online. There is a need to support the use of a user-friendly genebank documentation system in collections. Several collections are seeking new data management systems (e.g. GRIN).

## Human and financial resources

Yams are low priority in national programs and many collections are dependent on project funding for most research activities, which directly impact their oper-

ational efficiency. More staff need to be assigned to the management of collection and existing staff need training to upgrade their skills. Furthermore, there are very few yam breeders.

## Distribution and obstacles to use

Sixty-four percent of the 2020 survey respondents confirmed material is available for international distribution. However, in many countries collections are not used regularly and distribution is mostly at the national level. Only IITA and SPC distribute internationally albeit in small amounts.

The most important constraint on the use of yam germplasm is the difficulty that curators and scientists face in obtaining materials from collections from other countries. This is primarily due to the viruses and quarantine issues but also to very strict national policies. There is a need to evaluate all present accessions for traits of immediate interest to farmers (e.g. resistance to diseases and tuber quality) and to breeders (e.g. ploidy levels and sex).

## Crop descriptors

Experts developed a comprehensive list of descriptors in 1980 and revised it in 1997<sup>1</sup>. This list includes a basic list of descriptors for major edible yam species. Most countries apply the 1997 IPGRI descriptors for yams when scoring their *ex situ* field collections for pests and diseases. Various attempts to determine the intraspecific classification of *D. alata* using a morphological description of aerial and underground organs have failed to produce a clear structure.

<sup>1</sup>International Plant Genetic Resources Institute and International Institute of Tropical Agriculture (IPGRI/IITA). 1997. Descriptors for yam (*Dioscorea* spp.). Ibadan, Nigeria and Rome, Italy: IPGRI and IITA.



## Partnerships and networks

There is a single international network, a regional network and a set of institutional partnerships coordinated by IITA. These networks are not formalized and meet on an ad hoc basis. Curators expressed interest in extending and broadening the networks in a new setting with more partners.

## In situ conservation

Major constraints for implementing *in situ* conservation of CWR are: insufficient inventory and assessment of diversity, extent of protected areas, lack of information on indigenous knowledge, poor management of protected areas, lack of technical know/how and of financial resources, poor database and documentation, lack of supportive policies, and low local awareness of the value of CWR. A better understanding of the distribution and patterns of CWR diversity is needed to develop a rational *in situ* conservation strategy that will allow the effective implementation of reintroduction methodologies and management of wild populations.

## On-farm conservation

It is not known how many cultivars of yam are still extant in farmer's fields. It is plausible that the majority of the genetic diversity of yams is still managed by farmers on-farm or occurs in the wild in their natural habitats. Key constraints and obstacles to on-farm conservation are: lack of policies to promote the local diversity of yam genetic resources, insufficient seed and planting material, insufficient and unskilled staff and insufficient finances.

## Recommendations and priorities

The implementation of a global strategy will be facilitated by forming an international network for yam conservation and use. An international network would help facilitate the exchange of well-characterized accessions and improved evaluation in a range of environments. IITA could lead the coordination of yam in Africa. India, Philippines and Vietnam could lead in Asia. Papua New Guinea, Vanuatu and New Caledonia, with technical support from SPC, can assemble a large proportion of the diversity in the Pacific. Yam collections in Cuba, Haiti, Guadeloupe and Brazil are also of importance.

The incentive for national collections to join an international network is the assurance that their collection will be safely backed up when they share material with IITA, regional hubs or other partners.

- Stratify *D. alata*, *D. rotundata* and *D. cayenensis* germplasm based on ploidy and sex and detect duplicates using molecular markers if needed. The aim of this process is to use a rational subdivision of accessions held *ex situ*, to ease the detection of duplicates, reduce the number of accessions and improve their conservation.
- Assemble elite subsets for each of the 11 cultivated *Dioscorea* species from elite cultivars (approximately 10% of the total number of accessions) selected according to their tuber shape, tuber quality and tolerance to major diseases. These elite subsets should be transferred to regional or international genebanks and validated using standardized molecular markers to identify duplicates.
- Collect, produce, exchange and preserve true seeds from wild relatives and selected cultivars to broaden the genetic base of collections for future use in breeding programs. Research on the conservation of *Dioscorea* true botanical seeds should be conducted and long-term storage techniques developed. The international exchange of true seeds among regional breeding programs should be promoted.

## Bibliography

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## Acknowledgements

The development of this document was funded by the German Federal Ministry of Food and Agriculture (BMEL) as part of the project "Mainstreaming the Global Crop Conservation Strategies in Plant Treaty Processes".