GLOBAL CROP CONSERVATION AND USE METRICS

CASSAVA
(*Manihot* Mill.)

CROP TRUST

Cover photo: Michael Major for Crop Trust

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Global crop conservation and use metrics

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With support from

CROP TRUST

International Treaty on Plant Genetic Resources for Food and Agriculture

Federal Ministry of Agriculture, Food and Regional Identity

Description

This report provides an up-to-date overview of the global status of *ex situ* conservation of genetic resources of cassava and its wild relatives, including key metrics on:

- the identity and composition of genebank collections;
- the Multilateral System (MLS) status of accessions in these collections;
- storage, regeneration, and safety duplication status;
- documentation, information systems, and research resources;
- germplasm distribution; and
- varietal registrations and releases.

The report also includes global statistics on crop production, trade, and availability in food supplies, as well as information about crop networks and partnerships. It is meant to provide an update to some of the information presented in the Global Conservation Strategy for cassava (Crop Trust, 2010), but is primarily based on publicly available datasets, rather than a new survey of genetic resource collections and expert consultations.

Introduction and background on cassava

Cassava (*Manihot esculenta* Crantz) is a woody shrub native to South America, where it was domesticated at least 7500 years ago, likely in the southwestern Amazon basin (Xia *et al.*, 2025). The plant produces starchy tuberous roots that serve as a critical source of carbohydrates for over 800 million people worldwide, making it the third most important source of calories in the tropics after rice and maize. Cassava is remarkably resilient, thriving in poor soils and drought conditions where other staple crops fail, which makes it particularly vital for food security in sub-Saharan Africa, where it was introduced by Portuguese traders in the 16th century and has since become a dietary staple (Jarvis *et al.*, 2012; Chiwona-Karltun *et al.*, 2022). The roots can be processed into various products, including flour, tapioca, and starch used in food and industrial applications (Lebot, 2019). The crop requires careful processing because it contains cyanogenic glucosides that release toxic cyanide when the roots are damaged, necessitating traditional preparation methods like soaking, fermenting, and cooking to make it safe to eat (Chiwona-Karltun *et al.*, 2022).

Beyond human consumption, cassava is used for animal feed and industrial applications such as production of biofuel and biodegradable plastics.

Based on the most recently available production statistics from FAOSTAT, reporting for the year 2023, cassava is cultivated in at least 99 countries on 32.2 million hectares worldwide, producing more than 333 million tonnes of fresh cassava at a value of USD 51.6 billion (FAO, 2025a). The largest producers include Nigeria, Democratic Republic of the Congo, Thailand, Ghana, Brazil, Indonesia, Cambodia, Angola, and Vietnam, each producing over 10 million tonnes per annum. Recent production statistics for cassava have risen considerably compared to equivalent data for the years 2015 to 2018 (Table 1) and are more than double those reported in the 2010 Strategy (Crop Trust, 2010)

There is considerable international trade in the crop (around 9.6 million tonnes of fresh and dry cassava and products exported per annum), with Thailand, Cambodia, Vietnam,

Costa Rica, Netherlands, Tanzania, and Uganda reporting exporting over 20,000 tonnes each year (FAO, 2025a). Among the 122 countries reporting importing cassava, the top recipients include China, Thailand, Vietnam, USA, Netherlands, Uganda, Rwanda, and Spain, all importing over 10,000 tonnes each year.

Cassava is a major contributor to calories in the food supplies of 68 countries and to food weight in 75 countries (Table 1), and is second only to potatoes among root and tuber crops in terms of contribution to global food supplies (Khoury *et al.*, 2023). Production, trade, and food supply metrics all indicate that cassava is widely utilized outside of its regions of origin, implying significant international interdependence with regard to its genetic resources.

Table 1. Global status of cassava production, trade, availability in food supplies, and public interest. Production, trade, and food supply statistics from FAOSTAT (2015 to 2018 average). Number of countries refers to the count of countries where the crop is reported as within the top 95 percent of crops in terms of contribution to production, trade, or food supply. The evenness metric quantifies evenness of production, trade, or availability in food supplies across world regions, where 0 equals highly uneven and 1 equals completely even. The international interdependence metric quantifies degree of production, trade, or availability in food supplies outside of the primary region of diversity of the crop, where 0 equals low estimated international interdependence and 1 equals high estimated international interdependence. Wikipedia metric is public pageviews over one year (2019) of the taxon name of the crop. All values from Khoury *et al.* (2023).

Metric	Global value	Number of countries where significant contributor	Evenness of contribution across world regions	Estimated international interdependence
Harvested area (ha)	26,503,754	63.00	0.21	0.92
Total production (tonnes)	293,239,613	72.00	0.21	0.90
Gross production value (current thousand USD)	36,024,095	52.75	0.21	0.93
Export quantity (tonnes)	13,108,680	7.75	0.05	0.99
Export value (current thousand USD)	3,881,629	7.25	0.06	0.97
Import quantity (tonnes)	13,873,308	23.00	0.07	1.00
Import value (current thousand USD)	3,809,692	17.00	0.08	1.00
Contribution to calories in food supplies (kcal/capita/day)	39.75	68.75	0.30	0.96
Contribution to protein in food supplies (g/capita/day)	0.28	39.25	0.28	0.97
Contribution to fat in food supplies (g/capita/day)	0.07	28.00	0.32	0.93
Contribution to food weight in food supplies (g/capita/day)	15.46	75.50	0.29	0.96
Number of public pageviews on Wikipedia over one year	9,580			

Table 2. Major *ex situ* collections of cassava genetic resources. Top 20 institutions listed in descending order by total number of accessions. Number of accessions and storage condition information from Genesys and FAO WIEWS (2024), with supplementary information as noted. Multilateral System (MLS) status from Plant Treaty GLIS (2025) and from Genesys and FAO WIEWS (2024).

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions conserved *in vitro* or in cryo storage	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
COL003	International Center for Tropical Agriculture / Centro Internacional de Agricultura Tropical (CIAT)	5,957	31.04	31.0%	5,957	5,951	5,957
NGA039	International Institute of Tropical Agriculture (IITA)	4,409	23.0%	54.0%	2,714	3,234	4,409
BRA004	Embrapa Mandioca e Fruticultura Tropical	2,386	12.4%	66.4%	0	0	2,328
PER034	Estación Experimental Agraria Donoso	740	3.9%	70.3%	0	0	740
CUB006	Instituto Nacional de Investigaciones en Viandas Tropicales	630	3.3%	73.6%	14	0	0
BRA027	Embrapa Amazônia Ocidental	446	2.3%	75.9%	0	0	437
GHA091	Plant Genetic Resources Research Institute	419	2.2%	78.1%	372	424	419
TGO031	Centre de Recherche Agronomique du Littoral	383	2.0%	80.1%	0	0	383
BRA017	Embrapa Semi-Árido	365	1.9%	82.0%	0	0	321
PHL129	Institute of Plant Breeding-National Plant Genetic Resources Laboratory	365	1.9%	83.9%	0	0	0
MWI041	Malawi Plant Genetic Resources Centre	330	1.7%	85.6%	0	0	330
ECU023	Departamento Nacional de Recursos Fitogenéticos	326	1.7%	87.3%	0	0	326
BRA018	Embrapa Amazônia Oriental	319	1.7%	89.0%	0	0	316
VNM049	Plant Resources Center	277	1.4%	90.4%	0	0	277
GUY021	National Agricultural Research and Extension Institute	274	1.4%	91.8%	1	0	0
CRI001	Centro Agronómico Tropical de Investigación y Enseñanza	131	0.7%	92.5%	0	0	0
PNG004	Southern Regional Centre Laloki (NARI)	125	0.7%	93.2%	0	0	125
BEN095	Laboratoire de Biotechnologie, Ressources Génétiques et Amélioration des Espèces Animales et Végétales,	116	0.6%	93.8%	0	0	0
ZMB048	National Plant Genetic Resources Centre	113	0.6%	94.4%	0	215	113
BRA003	Embrapa Recursos Genéticos e Biotecnologia	111	0.6%	94.9%	103	0	0
	Other institutions (n = 39)	972	5.1%	100%	260	16	335

Identity and composition of *ex situ* collections

Based on the latest data in global genetic resource databases, germplasm collections of cassava and its wild relatives (i.e., genus *Manihot* Mill.) are present in at least 59 institutions worldwide, collectively maintaining 19,194 accessions (Table 2, Table 3; Supplementary Table 1). This is somewhat more than the number of accessions reported for the crop (17,682) listed as major germplasm collections in *The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 2025b). The institutions are well distributed globally in regions of production, including large collections in the Americas, Asia, and Africa. The International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA) maintain international collections for the crop, while the largest national collections are in Brazil, Peru, Cuba, Ghana, and Togo; these international and national collections collectively maintain over 80% of documented accessions worldwide. Reported information on the status of accessions under the Multilateral System of Access and Benefit Sharing (MLS) of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty), as recorded in the Global Information System (GLIS) and in pertinent fields in Genesys and FAO WIEWS (Table 2; Table 4), likely underestimate the full degree to which accessions are currently included in the MLS, as several of the cassava collections without information on MLS status are in countries that are contracting parties to the Plant Treaty (such as Cuba, Philippines, and Guyana) and distribute samples using the Standard Material Transfer Agreement (SMTA).

Based on a genebank stakeholder survey and inventorying process, the 2010 Strategy identified around 7,685 cassava landrace and wild relative accessions (over 7,000 of which held in international centers), including 5,940 maintained in Latin America, 1,272 in Africa, and 473 in Asia (Crop Trust, 2010). The

Table 3. Composition of *ex situ* collections of cassava genetic resources. Main *ex situ* collections data from Genesys and FAO WIEWS (2024). Primary and secondary regions information from Khoury *et al.* (2023) and subsequent research for this summary. Botanic gardens data from BGCI PlantSearch (2024).

Metric	Number	Percentage
Total number of accessions in genebank collections	19,194	
Number of institutions holding genebank collections	59	
Number of distinct taxonomic names in genebank collections	42	
Number of accessions of crop wild relatives (CWR) in genebank collections	613	3.2%
Number of accessions of weedy materials in genebank collections	0	0%
Number of accessions of landraces in genebank collections	10,153	52.9%
Number of accessions of breeding materials in genebank collections	3,216	16.8%
Number of accessions of improved varieties in genebank collections	224	1.2%
Number of accessions of other materials in genebank collections	637	3.3%
Number of accessions not marked with an improvement type in genebank collections	4,351	22.7%
Number of countries where germplasm has been collected for genebank collections	62	
Number of accessions in genebank collections from the primary region(s) of diversity	2,899	15.1%
Number of accessions in genebank collections from the primary and secondary region(s) of diversity	6,280	32.7%
Number of taxa in botanic garden collections	16	
Number of botanic gardens holding collections of crop or its wild relatives	152	

Strategy proposed that a total of about 15,000 landrace varieties be conserved *ex situ* in order to represent the complete genetic diversity of the crop and its wild relatives.

The numbers of accessions maintained per institute as listed in the 2010 Strategy, compared to current global genetic resources databases, appears to have changed considerably for essentially all collections, indicating both growth in collections over the past 15 years as well as the dynamic nature of collections for a crop which is mainly conserved in the field (Table 5). The Strategy identified three main collections of wild *Manihot* germplasm: CIAT, EMBRAPA, and University of Brasilia in Brazil. This last institution is not currently reported in the global genetic resources databases.

Manihot Mill. (Euphorbiaceae) contains around 100 to 150 species, native to the American tropics and subtropics (USDA, 2025). The putative wild progenitor, *Manihot esculenta* Crantz subsp. *flabellifolia* (Pohl) Cif., is native to the upper Amazon, including parts of French Guiana, Guyana, Suriname, Venezuela, Brazil, Bolivia, and Peru. A published genepool concept for the crop includes the progenitor as well as *Manihot esculenta* Crantz subsp. *peruviana* (Müll. Arg.) Allem and *Manihot pruinosa* Pohl in the primary genepool, 97 taxa in the secondary genepool, and a further 46 taxa in the tertiary genepool (USDA, 2025).

Data compilation for this report on cassava genetic resources included all taxa in *Manihot*. Along with the crop, 40 taxa as well as accessions only identified to the genus level are present in germplasm collections (Supplementary Table 2). The only large collections are of the crop taxon, as well as accessions only identified at the genus level. Landraces make up the largest proportion of accessions (52.9%), followed by breeding materials (16.8%) while wild relatives make up only 3.2% of accessions (Table 3); these percentages are rough estimates based on available data, noting that 22.7% of accessions do not have biological status data. *Manihot* germplasm has been collected from at least 62 countries, with approximately 15.1% of accessions originating from the primary region of diversity and 32.7% from primary and secondary regions; these statistics are also estimates, as 10.9% of cassava wild relative accessions, for example, do not contain information even of the country where the accession was collected. Information on botanic garden collections from BGCI PlantSearch indicate that 152 botanic gardens collectively conserve 16 *Manihot* taxa.

Table 4. Representation of cassava accessions in international and national institutions, number of accessions with DOIs, and representation of accessions in the Multilateral System of Access and Benefit Sharing of the International Treaty on Plant Genetic Resources for Food and Agriculture. Main *ex situ* collections data from Genesys and FAO WIEWS (2024). DOI and MLS data from Plant Treaty GLIS (2025).

Metric	Number	Percentage
Number of accessions in genebank collections in international institutions	10,556	55.0%
Number of accessions in genebank collections in national or other institutions	8,638	45.0%
Number of accessions in genebank collections in Annex I	18,896	98.5%
Number of accessions with DOI (Plant Treaty GLIS 2025)	9,981	
Number of accessions included in the Multilateral System (MLS) (Plant Treaty GLIS 2025)	9,840	
Number of accessions included in the Multilateral System (MLS) (genebank collections databases)	16,816	87.6%
Number of accessions included in the Multilateral System (MLS) that are in international collections (genebank collections databases)	10,366	54.0%
Number of accessions not included in the Multilateral System (MLS) (genebank collections databases)	907	4.7%
Number of accessions without information regarding inclusion in the Multilateral System (MLS) (genebank collections databases)	1,471	7.7%

Aside from the taxa that appear to be entirely missing from, or with very small representation in, germplasm collections, the global genetic resources databases do not offer insights on diversity gaps, but published research has indicated specific priority species and geographic regions for further collecting for conservation. The 2010 Strategy listed estimated numbers of "*in situ* accessions" per country that were not yet represented in *ex situ* collections. It also identified a relatively new challenge for the crop: that of landraces being replaced by improved varieties, particular in Asia and Africa. The Strategy also remarked on increasing threats to cassava wild relatives due to habitat loss or modification (Crop Trust, 2010).

In a global *ex situ* conservation gap analysis of the wild relatives of major crops, Castañeda-Álvarez *et al.* (2016), assessing 135 cassava wild relatives, listed 122 (90.4%) as of high priority for further collecting, and six further taxa as of medium priority. Ramirez-Villegas *et al.* (2022) identified geographic gaps for cassava landrace groups in specific localities in Mesoamerica, tropical South America, and West and Central Africa.

Multilateral System status of accessions in *ex situ* collections

M. esculenta (only; the wild relatives are excluded) is listed in Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty) and is thus included in its Multilateral System of Access and Benefit Sharing (MLS). Of the 19,194 accessions conserved globally, approximately 55% are held in international institutions (i.e., CIAT, IITA and SPC's CePaCT), and are included in the MLS under Article 15 of the Plant Treaty, with the remainder maintained in national and other collections (Table 4).

As of 2025, 9,840 accessions are formally included in the MLS according to the Plant Treaty's GLIS database, and 9,981 accessions have been assigned Digital Object Identifiers (DOIs). Per the relevant fields in the global genetic resources databases, 16,816 accessions (87.6% of world total) are listed as included in the MLS; this likely an underestimate, noting that 7.7% of accessions do not have MLS status data. The discrepancies between the GLIS data and the global genetic resources data indicates that several institutions have not registered or recently updated their registrations in the GLIS portal.

Storage conditions, regeneration status, and safety duplication

Cassava germplasm collections are mainly maintained in the field (50.5% of accessions), with a very high degree of storage *in vitro* as well (49.1%) (Table 5). Only 0.4% of accessions are recorded as conserved in seed collections and 0.3% in cryopreservation. Information on storage type is not available for 15.5% of accessions.

Current regeneration status and needs cannot be directly derived from the global germplasm databases. FAO WIEWS reporting for the *Third State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 2025b) for the years 2014 to 2019, documented 4,595 cassava accessions regenerated during this time by reporting institutions, with 1,515 accessions identified as needing regeneration and 662 of these lacking funds to conduct the regeneration.

Analysis of the location of safety duplication sites of cassava germplasm, as listed in Genesys, indicates that at least 19.1% of accessions listed are safety duplicated in an active collection (i.e., apart from potentially being duplicated at the Svalbard Global Seed Vault [SGSV]) outside of the country of the main collection (Table 5). Information from the SGSV database from 2024 indicated that zero *Manihot* accessions were duplicated in Svalbard. It is not straightforward to assess from available online data how many of the total accessions conserved globally are *unique*, but given the considerable degree of duplication of accessions between some national collections and the international genebanks (Crop Trust, 2010), it is likely that the proportion of unique accessions safety duplicated in other institutions is considerably higher.

Table 5. Storage conditions of cassava *ex situ* collections, regeneration status, and safety duplication status. Main *ex situ* collections data from Genesys and FAO WIEWS (2024). Regeneration status information from FAO WIEWS (2024); data from 2014 to 2019. Safety duplication out of the country data based only on Genesys (2024) data. Svalbard Global Seed Vault data from SGSV portal (2024).

Metric	Number	Percentage
Number of accessions held in seed storage in genebank collections	74	0.4%
Number of accessions held in short-term seed storage in genebank collections	0	0%
Number of accessions held in medium-term seed storage in genebank collections	16	21.6%
Number of accessions held in long-term seed storage in genebank collections	57	77.0%
Number of accessions held in seed storage of undefined type in genebank collections	1	1.4%
Number of accessions held in field storage in genebank collections	9,740	50.6%
Number of accessions held in *in vitro* storage in genebank collections	9,416	49.1%
Number of accessions held in cryo storage in genebank collections	49	0.3%
Number of accessions held as DNA in genebank collections	0	0%
Number of accessions held in other storage in genebank collections	41	0.2%
Number of accessions not marked with a storage type in genebank collections	2,976	15.5%
Number of accessions in genebank collections regenerated 2014–2019	4,595	86,8%
Number of accessions in genebank collections in need of regeneration 2014–2019	1,515	28.6%
Number of accessions in genebank collections in need of regeneration without budget for regeneration 2014–2019	662	12.5%
Number of accessions safety duplicated out of the country in genebank collections	2,679	19.1%
Number of accessions in genebank collections safety duplicated in Svalbard	0	0%

In assessing the challenges and costs of securely maintaining *Manihot* germplasm, the 2010 Strategy mainly emphasized the value of implementing a more centralized approach, based around the international centers (Crop Trust, 2010). In such an approach, CIAT and IITA would take responsibility for:

- Duplicating all the landraces of national program collections, in their respective regions of responsibility.
- Maintaining at least two forms of each accession. At the time, this was mainly an active *in vitro* accession at the institute with a black box duplicate kept in another center. In the future, the proposal was for the addition of cryopreserved accessions. The 2010 Strategy mentioned that further research was needed for successful cryopreservation of recalcitrant types, which represented an estimated one-third of accessions. It also noted that seed from selfed accessions could be a less expensive and efficient conservation method, and would be equally or more effective in breeding programs, but that induction of flowering research was needed for accessions that do not readily flower.
- Making the material available to national genebanks.
- Meeting the demands and phytosanitary requirements for international exchange under terms of the Plant Treaty.

Documentation, information systems, and research resources

Available descriptor lists for cassava include versions published in 1998 (Fukuda and Guevara, 1998) and republished in 2010 (Fukuda *et al.*, 2010), as well as a prioritized list of characterization and evaluation descriptors published in 2009 (Bioversity International and CIAT, 2009).

The estimated completeness of passport information for cassava accessions listed in Genesys was 6.5 on a scale of 0 (no data) to 10 (complete data), which indicates that much data is available, but also that there are gaps regmaining that it would be valuable to fill. At least five cassava characterization

Table 6. Documentation, information systems, and research resources for cassava. Passport data completeness index (PDCI) from Genesys (2024), based on the methods outlined in van Hintum *et al.* (2011). Global Biodiversity Information Facility data from GBIF (2025). All other metrics data from Khoury *et al.* (2023).

Metric	Number
Passport data completeness index (range 0-10) as a median value across accessions in genebank collections	6.50
Number of genes as recorded in NCBI's Entrez database as of 2022	36,165
Number of genomes as recorded in NCBI's Entrez database as of 2022	1
Number of nucleotides as recorded in NCBI's Entrez database as of 2022	358,415
Number of proteins as recorded in NCBI's Entrez database as of 2022	231,496
Number of publications listed in Google Scholar with taxon name in title published between 2009 and 2019	3,120
Number of publications listed in PubMed Central with taxon name in text as of 2022	4,560
Number of research materials as recorded in GBIF (2025)	118,153

and evaluation datasets are available via Genesys, covering a total of 5,840 accessions. Four metrics of the current degree of digital sequence information (DSI) for cassava (from the National Center for Biotechnology Information USA database), two metrics of published literature on the crop (Google Scholar and PubMed Central), and one metric of the degree of research resources such as herbarium specimens (from the Global Biodiversity Information Facility - GBIF), are listed in Table 6. Cassava, along with potatoes and sweetpotatoes, stands out compared to many other root and tuber crops in terms of the degree of DSI resources, published literature, and research resources in GBIF (Khoury *et al.*, 2023).

The 2010 Strategy identified the need to compile accession level data across institutions to identify unique diversity as well as duplicates, based on passport, phenotypic, and genetic data, with the eventual goal of creating a global "common cassava registry" (Crop Trust, 2010). Information management for crop genetic resources has evolved substantially since the 2010 Strategy. The current Genesys and FAO WIEWS databases likely fulfill some needs in terms of essential taxonomic, institutional, and passport data, and Genesys now holds some characterization data for the crop. This said, a dedicated online information system including complete accession-level characterization and evaluation data for cassava germplasm collections remains a gap.

Germplasm distributions and varietal registrations and releases

Germplasm distribution and varietal development statistics for cassava are listed in Table 7. Germplasm distribution data from FAO WIEWS and the Plant Treaty Data Store reflect different reporting scopes: FAO WIEWS primarily reports distributions from national genebanks, while the Plant Treaty Data Store includes all transfers made under the SMTA, encompassing distributions made by genebanks as well as by breeding programs and other organizational types (Khoury *et al.*, 2025). Cassava is the most distributed root and tuber crop in the FAO WIEWS database and is, along with potatoes and sweetpotatoes, among the most distributed in the Plant Treaty dataset, as well as among the most active in terms of varieties registered or released (Khoury *et al*., 2023) (Table 7).

Table 7. Cassava germplasm distributions and varietal registrations and releases. FAO WIEWS distributions data is annual average over years 2014 to 2019. Plant Treaty Data Store distributions data is annual average over years 2015 to 2021. Evenness metric quantifies evenness of germplasm distributions across world regions, where 0 equals highly uneven and 1 equals completely even. International Union for the Protection of New Varieties of Plants (UPOV) PLUTO data is annual average over years 2014 to 2018. FAO WIEWS varietal releases data is annual average over years 2015 to 2019. All metrics data from Khoury *et al.* (2023), with Plant Treaty Data Store additions for more recent years (2019 to 2021).

Metric	Number
Average annual number of accessions distributed worldwide as recorded in FAO WIEWS	1,985.0
Average annual number of samples distributed worldwide as recorded in FAO WIEWS	52,168.0
Average annual number of samples distributed worldwide as recorded in the Plant Treaty Data Store	930.1
Number of countries receiving germplasm as recorded in the Plant Treaty Data Store	11.9
Evenness of distributions across world regions as recorded in the Plant Treaty Data Store	0.7
Average annual number of varietal registrations worldwide as recorded in UPOV's PLUTO	1.5
Average annual number of varietal releases worldwide as recorded in FAO WIEWS	10.4

Networks and partnerships

- CIAT and IITA continue to play critical roles in cassava germplasm conservation and varietal development, maintaining active partnerships with national agricultural research organizations, other international centers, and several academic and industry institutions.
- The 2010 Strategy listed a large number of networks that had previously existed for the crop at the global or regional levels. These included the Panamerican Cassava Breeders' Network, the Asian Cassava Research Network, the International Network for Cassava Genetic Resources, Cassava Biotechnology Network, Cassava R&D workers, Cassava Biotechnology Network, Cassava Genetic Resources Network, International Society for Tropical Root Crops (ISTRC), Global Cassava Partnership, Regional Asian Cassava Research Network, Panamerican Cassava Breeders' Network, Latin American Integrated Projects Network, Collaborators in Root and Tuber Improvement and Systems (CORTIS), African Francophone Cassava Network (CORAF), African Branch of the ISTRC, CLAYUCA, Subregional Eastern and Southern African Root Crop Research Network, Southern Cone Cassava Development Network. The majority of these were no longer active by the time of the Strategy, which saw value in future cassava networks being centered around "user-focused groups" (Crop Trust, 2010). Very little information is available online that confirms the level of activity of cassava networks at this time.

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Conclusions

Cassava continues to be an extremely important food crop in the tropics, has grown considerably and it is likely that it will continue to grow in importance in future food systems. Cassava genetic resources are bolstered by the activities taking place in CIAT and IITA, and in several national programs, in particular in Brazil. Available data indicates that collections have grown considerably since the 2010 Strategy, as has the degree of conservation *in vitro*, as well as the proportion of accessions included under the MLS of the Plant Treaty. There are also considerable amounts of associated research resources, and there is significant activity in germplasm distributions and varietal development for the crop.

It is likely that further efforts are needed to fill gaps in existing collections through collecting of unique and un-represented wild relatives and landraces, to comprehensively include all unique cultivated cassava germplasm collections under the MLS of the Plant Treaty, to continue to make the information accompanying accessions more complete and/or more accessible in online databases, and to address safety duplication, including through cryopreservation.

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Methods and materials

Primary data sources for the metrics reported in this summary include: Genesys; World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture of the Food and Agriculture Organization of the United Nations (FAO WIEWS); Botanic Gardens Conservation International PlantSearch database (BGCI PlantSearch); Global Information System of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty GLIS); Data Store of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty Data Store); Svalbard Global Seed Vault portal (SGSV portal); International Union for the Protection of New Varieties of Plants (UPOV) PLUTO database; FAOSTAT; National Center for Biotechnology Information's Entrez database (NCBI Entrez); Google Scholar; PubMed Central; Wikipedia; and the Global Biodiversity Information Facility (GBIF). Some of these data were acquired from literature/databases including Khoury *et al*. (2023) and Khoury *et al*. (2025). Data processing, metric calculation, and table generation were conducted in R, with code available on this GitLab repository. Extended methods are available here.

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Supplementary information

Supplementary Table 1: Full list of *ex situ* collections of cassava genetic resources, in descending order by total number of accessions. Number of accessions and storage condition information from Genesys and FAO WIEWS (2024), with supplementary information as noted. Multilateral System (MLS) status from Plant Treaty GLIS (2025) and from Genesys and FAO WIEWS (2024).

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions conserved *in vitro* or in cryo storage	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
COL003	Centro Internacional de Agricultura Tropical	5,957	31.0%	31.0%	5,957	5,951	5,957
NGA039	International Institute of Tropical Agriculture	4,409	23.0%	54.0%	2,714	3,234	4,409
BRA004	Embrapa Mandioca e Fruticultura Tropical	2,386	12.4%	66.4%	0	0	2,328
PER034	Estación Experimental Agraria Donoso	740	3.9%	70.3%	0	0	740
CUB006	Instituto Nacional de Investigaciones en Viandas Tropicales	630	3.3%	73.6%	14	0	0
BRA027	Embrapa Amazônia Ocidental	446	2.3%	75.9%	0	0	437
GHA091	Plant Genetic Resources Research Institute	419	2.2%	78.1%	372	424	419
TGO031	Centre de Recherche Agronomique du Littoral	383	2.0%	80.1%	0	0	383
BRA017	Embrapa Semi-Árido	365	1.9%	82.0%	0	0	321
PHL129	Institute of Plant Breeding-National Plant Genetic Resources Laboratory	365	1.9%	83.9%	0	0	0
MWI041	Malawi Plant Genetic Resources Centre	330	1.7%	85.6%	0	0	330
ECU023	Departamento Nacional de Recursos Fitogenéticos	326	1.7%	87.3%	0	0	326
BRA018	Embrapa Amazônia Oriental	319	1.7%	89.0%	0	0	316
VNM049	Plant Resources Center	277	1.4%	90.4%	0	0	277
GUY021	National Agricultural Research and Extension Institute	274	1.4%	91.8%	1	0	0
CRI001	Centro Agronómico Tropical de Investigación y Enseñanza	131	0.7%	92.5%	0	0	0
PNG004	Southern Regional Centre Laloki (NARI)	125	0.6%	93.2%	0	0	125
BEN095	Laboratoire de Biotechnologie, Ressources Génétiques et Amélioration des Espèces Animales et Végétales,	116	0.6%	93.8%	0	0	0
ZMB048	National Plant Genetic Resources Centre	113	0.6%	94.4%	0	215	113
BRA003	Embrapa Recursos Genéticos e Biotecnologia	111	0.6%	94.9%	103	0	0
MDG016	Centre de Recherche Régional du Moyen Est, FOFIFA	99	0.5%	95.5%	0	0	99
SUR005	Centre for Agricultural Research in Suriname	83	0.4%	95.9%	0	0	0

ARG1342	Banco de Germoplasma, Centro Nacional de Investigaciones Agropecuarias, Instituto Nacional de Tecnología Agropecuaria	80	0.4%	96.3%	80	0	0
ETH085	Ethiopian Biodiversity Institute	79	0.4%	96.7%	0	0	79
PAN147	Centro de Investigación Agropecuaria Central	78	0.4%	97.1%	78	0	78
TTO010	Central Experiment Station, Research Division, Ministry of Agriculture, Land and Fisheries	64	0.3%	97.5%	15	0	0
MEX013	INIFAP, Campo Experimental Cotaxtla (CECOT)	63	0.3%	97.8%	0	0	0
FJI049	Centre for Pacific Crops and Trees	59	0.3%	98.1%	59	16	0
CUB005	Instituto Nacional de Ciencias Agrícolas	44	0.2%	98.3%	3	0	0
BRA020	Embrapa Clima Temperado	35	0.2%	98.5%	0	0	0
PNG039	Highlands Regional Centre - Aiyura	32	0.2%	98.7%	0	0	32
ZAF062	RSA National Plant Genetic Resources Centre	29	0.1%	98.8%	0	0	0
PHL558	Department of Agriculture-Regional Field Unit 4A	27	0.1%	99.0%	0	0	0
CRI077	Instituto Nacional de Innovación y Transferencia de Tecnología Agropecuaria	24	0.1%	99.1%	0	0	0
FRA098	Station de la Réunion, CIRAD-FLHOR	20	0.1%	99.2%	0	0	0
NER001	Institut national de la recherche agronomique du Niger	17	0.1%	99.3%	0	0	17
NIC096	Centro de Desarrollo Tecnologico Nueva Guinea	17	0.1%	99.4%	0	0	0
PHL303	Northern Philippines Root Crops Research and Training Center	17	0.1%	99.5%	0	0	0
PAN172	Subcentro de Investigación Agropecuaria de San Félix	14	0.1%	99.5%	14	0	0
NIC052	Centro de Desarrollo Tecnologico Fidel Castro Ruz	10	0.0%	99.6%	0	0	0
CRI009	Centro de Investigación en Granos y Semillas, Universidad de Costa Rica	9	0.0%	99.6%	9	0	9
CUB251	Instituto de Investigaciones Agropecuarias Jorge Dimitrov	9	0.0%	99.7%	0	0	0
GIN009	Centre de Recherche Agronomique de Foulaya	8	0.0%	99.7%	0	0	8
PNG001	Islands Regional Centre Keravat	7	0.0%	99.7%	0	0	7
GBR004	Millennium Seed Bank - Royal Botanic Gardens Kew	6	0.0%	99.8%	0	0	0
LKA155	Agricultural Research Station, Girandurukotte	6	0.0%	99.8%	0	0	0
NIC014	Centro Nacional de Investigación Agropecuaria (INTA-CNIA)	6	0.0%	99.8%	0	0	0

PNG041	Momase Regional Centre, Bubia	5	0.0%	99.9%	0	0	5
SWZ015	National Plant Genetic Resources Centre	5	0.0%	99.9%	0	0	0
JPN183	NARO Genebank	4	0.0%	99.9%	0	0	0
SLV050	CENTA - Banco de Germoplasma	4	0.0%	99.9%	0	0	0
TZA016	National Plant Genetic Resources Centre	3	0.0%	100.0%	0	0	0
USA047	Subtropical Horticultural Research Unit, National Germplasm Repository - Miami, USDA	2	0.0%	100.0%	0	0	0
USA151	National Arboretum-Germplasm Unit, USDA/ARS	2	0.0%	100.0%	0	0	0
ARG1343	Banco Activo Regional del Nordeste	1	0.0%	100.0%	1	0	0
BRA034	Embrapa Cerrados	1	0.0%	100.0%	1	0	0
ECU308	Estación Experimental Central de la Amazonia	1	0.0%	100.0%	0	0	1
KEN212	Genetic Resources Research Institute	1	0.0%	100.0%	0	0	0
MDG017	Station de Recherche Ivoloina-Toamasina, FOFIFA	1	0.0%	100.0%	0	0	0

Supplementary Table 2: Full list of taxonomic names in *ex situ* genetic resource collections, in descending order by number of accessions conserved. Germplasm data from Genesys and FAO WIEWS (2024).

Taxon	Number of accessions (from genebank collections databases)
Manihot esculenta Crantz subsp. *esculenta*	18,806
Manihot Mill.	108
Manihot esculenta Crantz. subsp. *peruviana* (Müll. Arg.) Allem	88
Manihot carthaginensis (Jacq.) Müll. Arg.	27
Manihot caerulescens Pohl	26
Manihot tristis Müll. Arg.	16
Manihot grahamii Hook.	10
Manihot triphylla Pohl	10
Manihot aesculifolia Pohl	8
Manihot jacobinensis Müll. Arg.	8
Manihot orbicularis Pohl	8
Manihot carthaginensis subsp. *glaziovii* (Müll. Arg.) Allem	6
Manihot cecropiifolia Pohl	6
Manihot longipetiolata Pohl	6
Manihot acuminatissima Müll. Arg.	4
Manihot alutacea D. J. Rogers & Appan	4
Manihot brachyandra Pax & K. Hoffm.	4
Manihot janiphoides Müll. Arg.	4
Manihot maracasensis Ule	4
Manihot tripartita Müll. Arg.	4
Manihot dichotoma Ule	3
Manihot epruinosa Pax & K. Hoffm.	3
Manihot filamentosa Pittier	3
Manihot pilosa Pohl	3
Manihot pohlii Wawra	3
Manihot chlorosticta Standl. & Goldman	2
Manihot esculenta subsp. *flabellifolia* (Pohl) Cif.	2
Manihot irwinii D. J. Rogers & Appan	2
Manihot pauciflora Brandegee	2
Manihot sparsifolia Pohl	2
Manihot allemii M. J. Silva	1
Manihot anomala Pohl	1
Manihot compositifolia Allem	1
Manihot fruticulosa (Pax) D. J. Rogers & Appan	1
Manihot inflata Müll. Arg.	1
Manihot longiracemosa P. Carvalho & M. Martins	1
Manihot pentaphylla Pohl	1
Manihot pseudoglaziovii Pax & K. Hoffm.	1
Manihot quinquepartita Huber ex D. J. Rogers & Appan	1
Manihot rhomboidea subsp. *microcarpa* (Müll. Arg.) D. J. Rogers & Appan	1
Manihot triloba (Sessé ex Cerv.) Miranda	1
Manihot violacea Pohl	1

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