GLOBAL CROP CONSERVATION AND USE METRICS

# MAIZE
## (*Zea* L.)

CROP TRUST

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# Global crop conservation and use metrics

# MAIZE
## (*Zea* L.)

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# Description

This report provides an up-to-date overview of the global status of *ex situ* conservation of genetic resources of maize 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 maize (Crop Trust, 2007), but is primarily based on publicly available datasets, rather than a new survey of genetic resource collections and expert consultations.

# Introduction and background on maize

Maize (*Zea mays* L.), also commonly known as corn, was domesticated approximately 9,000 years ago in southern Mexico (Piperno *et al*., 2009). Today, maize ranks as one of the world's three most important cereal crops alongside wheat and rice, serving diverse purposes including human consumption (as grain, flour, oil, and sweeteners), animal feed (comprising a major portion of livestock diets), and industrial applications (ranging from biofuel production to biodegradable plastics and pharmaceutical ingredients) (Ranum *et al*., 2014). The crop remains a dietary staple and of central cultural significance for millions, particularly in Latin America, sub-Saharan Africa, and parts of Asia.

Based on the most recently available production statistics from FAOSTAT, reporting for the year 2023, maize is cultivated in at least 165 countries on 209.3 million total hectares worldwide, producing nearly 1.25 billion tonnes of dry grain and green corn at a value of over USD 318 billion (FAO, 2025a). The largest producers include USA, China, Brazil, Argentina, India, Ukraine, Mexico, Indonesia, Russian Federation, South Africa, Canada, France, Nigeria, and Ethiopia, each producing over 10 million tonnes per annum. Global average yield (per hectare) of the crop is much higher than any other major grain (FAO, 2025a).

There is considerable international trade in maize (over 200 million tonnes per annum), with Brazil, USA, Ukraine, Argentina, Romania, Poland, South Africa, Paraguay, France, Russian Federation, Canada, India, Türkiye, Pakistan, Bulgaria, Hungary, Myanmar, Slovenia, and Serbia all reporting exporting over 1 million tonnes each year (FAO, 2025a). Among the 190 countries reporting importing maize, the top recipients include China, Mexico, Japan, Vietnam, Republic of Korea, Spain, Italy, Colombia, Egypt, and the Netherlands, all importing over 5 million tonnes each year.

The global per capita dietary contribution of maize reported for the year 2022 – as measured in terms of calories (148.4 kcal/capita/day), protein (2.9 g/capita/day), and fat (2.1 g/capita/day) – is among the most significant of all cereals (along with wheat and rice), and maize is a major contributor to calories and protein in the food supplies of 149 countries. Production, trade, and food supply metrics all indicate that maize is widely utilized outside of its regions of origin, implying significant international interdependence with regard to genetic resources (Table 1).

**Table 1.** Global status of maize 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) | 196,836,040 | 143.50 | 0.36 | 0.96 |
| Total production (tonnes) | 1,121,710,881 | 134.25 | 0.28 | 0.97 |
| Gross production value (current thousand USD) | 237,244,94 | 110.75 | 0.23 | 0.97 |
| Export quantity (tonnes) | 165,209,13 | 79.50 | 0.23 | 0.99 |
| Export value (current thousand USD) | 34,205,504 | 76.50 | 0.28 | 0.98 |
| Import quantity (tonnes) | 160,651,34 | 169.00 | 0.39 | 0.85 |
| Import value (current thousand USD) | 38,272,587 | 170.75 | 0.42 | 0.87 |
| Contribution to calories in food supplies (kcal/capita/day) | 154.50 | 149.50 | 0.50 | 0.88 |
| Contribution to protein in food supplies (g/capita/day) | 3.76 | 149.75 | 0.48 | 0.87 |
| Contribution to fat in food supplies (g/capita/day) | 1.38 | 121.00 | 0.39 | 0.84 |
| Contribution to food weight in food supplies (g/capita/day) | 18.62 | 143.00 | 0.51 | 0.89 |
| Number of public pageviews on Wikipedia over one year | 63,212 | | | |

# Identity and composition of *ex situ* collections

Based on the latest data in global genetic resource databases, germplasm collections of maize and its close wild relatives (i.e., genus *Zea* L.) are present in at least 184 institutions worldwide, collectively maintaining 233,575 accessions (Table 2, Table 3; Supplementary Table 1). This is slightly more than the number of accessions reported for the crop (231,918) in the major germplasm collections listed 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, including large collections in the Americas, Asia, Europe, and Africa. The International Maize and Wheat Improvement Center (CIMMYT) along with national and public university collections in the USA, Portugal, the Russian Federation, India, Mexico, and Ukraine collectively maintain over half of documented accessions. 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 maize collections without information on MLS status are in countries that are contracting parties to the Plant Treaty (such as USA, Serbia, and Bulgaria) and distribute samples using the Standard Material Transfer Agreement (SMTA).

Based on a genebank stakeholder survey process, the 2007 Strategy identified over 27,000 unique maize accessions from the Americas and the Caribbean and around 20,000-40,000 from elsewhere in germplasm collections, excluding breeding materials (Crop Trust, 2007). In addition to the major genetic resource collections, the Strategy also highlighted the importance of the Maize Genetic Cooperation Stock Center, located in the Department of Crop Sciences of the University of Illinois, which conserves and makes available maize mutant stocks. The 2007 Strategy identified CIMMYT, the USDA collections, and the Maize Genetic Cooperation Stock Center as the key collections, while recognizing the significance of other national collections for specific diversity (including, for example, those in Brazil, Colombia, Mexico, and Peru).

*Zea* L. (Poaceae) is a small genus with six species and four subspecies, native to Mesoamerica (USDA, 2025). The primary genepool of the crop, *Zea mays* L. subsp. *mays*, includes:
*Zea mays* L. subsp. *mexicana* (Schrad.) H. H. Iltis (probable progenitor)
*Zea mays* L. subsp. *parviglumis* H. H. Iltis & Doebley (probable progenitor)
*Zea mays* L. subsp. *huehuetenangensis* (H. H. Iltis & Doebley) Doebley.
The secondary genepool contains the remaining species in the genus:
*Zea diploperennis* H. H. Iltis et al.
*Zea luxurians* (Durieu & Asch.) R. M. Bird
*Zea nicaraguensis* H. H. Iltis & B. F. Benz
*Zea perennis* (Hitchc.) Reeves & Mangelsd., and
*Zea vespertilio* Gómez-Laur.

Members of the related genus *Tripsacum* L. are considered tertiary genepool relatives of maize.

Data compilation for this report on maize genetic resources included all species in *Zea*. All taxa aside from *Z. vespertilio* are present in germplasm collections (Supplementary Table 2). The wild relatives with the largest collections include the two progenitors. Across all institutions, landraces make up the largest proportion of collections (44.6%), followed by breeding materials (24.2%) and improved varieties (6.8%) (Table 3). Wild relatives comprise only 0.7% of collections. These percentages are estimates based on available data, noting that 23.6% of accessions do not have biological status data.

Maize germplasm has been collected from at least 156 countries, with approximately 11.1% of accessions originating from the primary region of diversity of the crop (i.e. Mesoamerica) and 17.4% from primary and secondary (i.e. Andean and tropical South America, East Africa, and South and Southeast Asia) regions; these statistics are also estimates, as 4.7% of maize landrace accessions and 47% of wild relative accessions do not contain information even of the country where the accession was collected. Information on botanic garden collections from BGCI PlantSearch indicate that 121 botanic gardens collectively conserve eight *Zea* taxa. All of these taxa are also conserved in genebank collections.

Aside from *Z. vespertilio* being entirely missing from germplasm collections, and very low numbers of accessions of *Z. nicaraguensis*, *Z. perennis*, and *Z. mays* subsp. *luxurians,* the genetic resources databases do not offer insights on diversity gaps, but published research has indicated specific priority species

**Table 2.** Major *ex situ* collections of maize 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 in long term storage (-18-20 C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| MEX002 | International Maize and Wheat Improvement Center/ Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT) | 30,962 (32,900)# | 13.3% | 13.3% | Not listed* | 30,977 | 0 (28,565)^ |
| USA020 | North Central Regional Plant Introduction Station, USDA-ARS, NCRPIS | 19,956 | 8.5% | 21.8% | 19,956 | 0 | 0 |
| RUS001 | N.I. Vavilov All-Russian Research Institute of Plant Industry (VIR) | 14,233 | 6.1% | 27.9% | 14,233 | 0 | 0 |
| PRT001 | Banco Português de Germoplasma Vegetal | 12,097 | 5.2% | 33.1% | 11,801 | 0 | 12,097 |
| IND001 | National Bureau of Plant Genetic Resources (NBPGR_ | 11,249 | 4.8% | 37.9% | 11,249 | 0 | 0 |
| MEX208 | INIFAP, Centro Nacional de Recursos Genéticos (CNRG) | 9,767 | 4.2% | 42.1% | 9,767 | 0 | 0 |
| USA174 | Maize Genetics Cooperation - Stock Center; Soybean/ Maize Germplasm, Pathology & Genetics Research Unit, USDA/ ARS/MWA/Urbana; Department of Crop Sciences, University of Illinois | 8,506 | 3.6% | 45.7% | 8,506 | 0 | 0 |
| UKR001 | Institute of Plant Production n.a. V.Y. Yurjev of UAAS | 6,613 | 2.8% | 48.5% | 6,613 | 0 | 0 |
| MEX131 | UDG, Centro Universitario de Ciencias Biológicas y Agropecuarias (UDG-CUCBA) | 6,110 | 2.6% | 51.2% | Not listed | 0 | 0 |
| JPN183 | NARO Genebank | 5,522 | 2.4% | 53.5% | 2,196 | 1,569 | 1,569 |
| SRB001 | Maize Research Institute 'Zemun Polje' | 5,475 | 2.3% | 55.8% | Not listed | 0 | 0 |
| ITA386 | CREA-Centro di Ricerca Cerealicoltura e Colture Industriali - Sede di Bergamo | 5,471 | 2.3% | 58.2% | Not listed | 599 | 682 |
| ROM007 | Suceava Genebank | 4,922 | 2.1% | 60.3% | 1,817 | 2,650 | 2,653 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20 C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| BGR001 | Institute for Plant Genetic Resources 'K.Malkov' | 4,828 | 2.1% | 62.4% | 4,252 | 0 | 0 |
| PER066 | Programa Cooperativo de Investigación en Maíz, Universidad Nacional Agraria La Molina | 4,266 | 1.8% | 64.2% | Not listed | 0 | 4,266 |
| COL017 | Corporación Colombiana de Investigación Agropecuaria, AGROSAVIA | 4,226 | 1.8% | 66.0% | 3,722 | 0 | 0 |
| BRA001 | Embrapa Milho e Sorgo | 4,080 | 1.8% | 67.8% | Not listed | 0 | 4,071 |
| MEX006 | UACh, Banco Nacional de Germoplasma Vegetal (BANGEV) | 3,405 | 1.5% | 69.2% | 1,845 | 0 | 0 |
| UKR005 | Institute of Grain Growing | 3,318 | 1.4% | 70.6% | 3,318 | 0 | 0 |
| UZB006 | Uzbek Research Institute of Plant Industry | 2,931 | 1.3% | 71.9% | Not listed | 0 | 0 |
|  | Other institutions (n = 164) | 65,638 | 28.1% | 100% | 35,750 | 10,122 | 24,034 |

*But documented in the 2007 Strategy as maintaining collections in long-term conditions (Crop Trust, 2007)
#From the time of data acquisition for this report to the current listing on Genesys (September 2025), the CIMMYT collection has increased, with 32,900 accessions currently listed as actively maintained.
^From the time of data acquisition for this report to the current listing on Genesys (September 2025), the CIMMYT collection has increased, with 28,565 accessions currently listed as included in the MLS.

and geographic regions for further collecting for conservation. In a global *ex situ* conservation gap analysis of the wild relatives of major crops, Castañeda-Álvarez *et al.* (2016), assessing ten maize wild relatives in both *Zea* and *Tripsacum*, listed five (*Tripsacum dactyloides* (L.) L., *Tripsacum dactyloides* (L.) L. var. *dactyloides*, *Tripsacum dactyloides* (L.) L. var. *meridonale* de Wet & Timothy, *Z. diploperennis*, and *Z. luxurians*) as of high priority for further collecting, and three other taxa (*Tripsacum dactyloides* (L.) L. var. *hispidum* (Hitchc.) de Wet & J. R. Harlan, *Tripsacum dactyloides* (L.) L. var. *mexicanum* de Wet & J. R. Harlan, and *Z. nicaraguensis*) as medium priority.

Regarding landraces, the 2007 Strategy generally stated that collections in the Americas and Caribbean were relatively complete, other than specific small gaps, although some of the germplasm in *ex situ* collections has likely been lost over time. Priority gaps at the time of the Strategy included waxy maize in Southeast Asia, and landraces in portions of the Amazon basin, parts of Central America, and the island of Dominica, among others (Crop Trust, 2007). Ramirez-Villegas *et al.* (2022) identified geographic gaps for maize landrace groups in Mesoamerica, South America, and in Africa.

**Table 3.** Composition of *ex situ* collections of maize 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 | 233,575 | |
| Number of institutions holding genebank collections | 184 | |
| Number of distinct taxonomic names in genebank collections | 12 | |
| Number of accessions of crop wild relatives (CWR) in genebank collections | 1,704 | 0.7% |
| Number of accessions of weedy materials in genebank collections | 333 | 0.1% |
| Number of accessions of landraces in genebank collections | 104,073 | 44.6% |
| Number of accessions of breeding materials in genebank collections | 56,491 | 24.2% |
| Number of accessions of improved varieties in genebank collections | 15,791 | 6.8% |
| Number of accessions of other materials in genebank collections | 7 | 0% |
| Number of accessions not marked with an improvement type in genebank collections | 55,176 | 23.6% |
| Number of countries where germplasm has been collected for genebank collections | 156 | |
| Number of accessions in genebank collections from the primary region(s) of diversity | 25,944 | 11.1% |
| Number of accessions in genebank collections from the primary and secondary region(s) of diversity | 40,515 | 17.4% |
| Number of taxa in botanic garden collections | 8 | |
| Number of botanic gardens holding collections of crop or its wild relatives | 121 | |

# Multilateral System status of accessions in *ex situ* collections

The genus *Zea,* excluding wild relative species *Z. perennis, Z. diploperennis,* and *Z. luxurians*, is listed in Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty) and is thus partially included in its Multilateral System of Access and Benefit Sharing (MLS). Of the 233,575 accessions conserved globally, approximately 15% are held in international institutions (i.e., CIMMYT and the International Institute of Tropical Agriculture - IITA), and 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, 46,649 accessions are formally included in the MLS according to the Plant Treaty's GLIS database, and 53,674 accessions have been assigned Digital Object Identifiers (DOIs). Per the relevant fields in the global genetic resources databases, 49,372 accessions (21.1% of world total) are listed as included in the MLS; this is an underestimate, noting that 53.1% of accessions do not have MLS status data and that CIMMYT information was incomplete in the dataset (Table 4). This said, there are several large collections that are in countries that are not currently Contracting Parties of the Plant Treaty, such as Mexico, the Russian Federation, and Ukraine.

**Table 4.** Representation of maize 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 | 35,107 (34,712) | 15.0% (14.9%) |
| Number of accessions in genebank collections in national or other institutions | 198,468 | 85.0% |
| Number of accessions in genebank collections in Annex I | 233,495 | 100.0% |
| Number of accessions with DOI (Plant Treaty GLIS 2025) | 53,674 | |
| Number of accessions included in the Multilateral System (MLS) (Plant Treaty GLIS 2025) | 46,649 | |
| Number of accessions included in the Multilateral System (MLS) (genebank collections databases) | 49,372* (77,937) | 21.1%* (33.4%) |
| Number of accessions included in the Multilateral System (MLS) that are in international collections (genebank collections databases) | 1,707* (29,468) | 0.7%* (12.6%) |
| Number of accessions not included in the Multilateral System (MLS) (genebank collections databases) | 60,137 | 25.7% |
| Number of accessions without information regarding inclusion in the Multilateral System (MLS) (genebank collections databases) | 124,066 | 53.1% |

*These numbers/percentages are undoubtedly underestimates. For example, from the time of data acquisition for this report to the current listing on Genesys (September 2025), the CIMMYT collection has increased from 0 accessions listed as within the MLS to 28,565 accessions currently listed as included in the MLS. Estimated updates of these statistics by including the CIMMYT numbers are provided in parentheses

# Storage conditions, regeneration status, and safety duplication

As expected for an orthodox seed crop, the great majority (at least 83.7%) of maize accessions are conserved as seed, with 69.1% of these accessions listed as conserved under long-term cold-storage conditions (Table 5). Information on storage in general is missing for 15.8% of all accessions, and information on seed storage type (i.e., long, medium, or short term) is missing for 0.4% of seed accessions.

Current regeneration status and needs cannot be directly derived from the global germplasm databases. The 2007 Strategy noted that most accessions in the Americas and Caribbean had been regenerated recently, but that regeneration status of other collections was less well known (Crop Trust, 2007). The Strategy further noted that regeneration at CIMMYT was on track; that regeneration of the USDA collections was challenged by infrastructure and funding; and that in several other collections there were more serious constraints.

Re-collection (rather than regeneration) was advised for many collections, when possible. 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 15,983 accessions regenerated during this time by reporting institutions, with 17,138 accessions identified as needing regeneration and 9,360 of these lacking funds to conduct the regeneration.

Analysis of the location of safety duplication sites of maize germplasm, as listed in Genesys, indicates that 59.8% 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). The actual extent of safety duplication of maize accessions worldwide, when also considering safety duplication within the same country, may be higher than

this estimate, given that a number of national genebanks (such as the USA and Russian Federation) typically provide safety backup their collections in a different location within the country. Information from the SGSV database from 2024 indicated that approximately 17.9% of total accessions worldwide were duplicated in Svalbard. Further, it is not straightforward to assess from available online data how many of the 233,575 accessions conserved globally are *unique*, but given the high degree of duplication of accessions among major collections (Crop Trust, 2007), it is likely that the proportion of unique accessions safety duplicated in other institutions, other locations, or at SGSV is considerably higher than these percentages.

The 2007 Strategy remarked that the major collections were fairly well safety duplicated, for example CIMMYT collections in national institutes, and USDA collections in its own backup repository. On the other hand, core collections and important breeding materials needed to be sent to CIMMYT or USDA (or IITA for African germplasm, as necessary). At that time, USDA was willing to accept maize germplasm from outside the Americas. The 2007 Strategy also noted the importance of further (secondary) duplication at the soon-to-open Svalbard Global Seed Vault.

**Table 5.** Storage conditions of maize *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 | 195,489 | 83.7% |
| 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 | 59,595 | 30.5% |
| Number of accessions held in long-term seed storage in genebank collections | 135,025 | 69.1% |
| Number of accessions held in seed storage of undefined type in genebank collections | 869 | 0.4% |
| Number of accessions held in field storage in genebank collections | 1,602 | 0.7% |
| Number of accessions held in *in vitro* storage in genebank collection | 0 | 0% |
| Number of accessions held in cryo storage in genebank collections | 1 | 0% |
| Number of accessions held as DNA in genebank collections | 4 | 0% |
| Number of accessions held in other storage in genebank collections | 0 | 0% |
| Number of accessions not marked with a storage type in genebank collections | 36,918 | 15.8% |
| Number of accessions in genebank collections regenerated 2014–2019 | 15,983 | 27.2% |
| Number of accessions in genebank collections in need of regeneration 2014–2019 | 17,138 | 29.1% |
| Number of accessions in genebank collections in need of regeneration without budget for regeneration 2014–2019 | 9,360 | 15.9% |
| Number of accessions safety duplicated out of the country in genebank collections | 24,725 | 59.8% |
| Number of accessions in genebank collections safety duplicated in Svalbard | 41,841 | 17.9% |

# Documentation, information systems, and research resources

A descriptor list for maize was published in 1991 and is available online (IBPGR and CIMMYT, 1991), and a prioritized list of characterization and evaluation descriptors was published in 2009 (Bioversity International and CIMMYT, 2009). The estimated completeness of passport information for maize accessions listed in Genesys was 6.6 on a scale of 0 (no data) to 10 (complete data), which indicates that much data is available, but also that there are gaps that it would be valuable to fill. Eight maize characterization and evaluation datasets are available via Genesys, covering a total of 29,631 accessions. Four metrics of the current degree of digital sequence information (DSI) for maize (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. Maize, along with wheat, rice, and barley, stands out compared to other cereals in terms of the degree of DSI resources, published literature, and research resources in GBIF (Khoury *et al.*, 2023).

At the time of the 2007 Strategy, many collections had simple information management systems, often offline and not well standardized (Crop Trust, 2007). Many of the recommendations of the Strategy required, as a foundation, the development of a more comprehensive, accessible information resource for maize germplasm (i.e., a "Global maize genetic resources registry"). Information management for crop genetic resources has evolved substantially since the 2007 Strategy. The current Genesys and FAO WIEWS databases offer some essential taxonomic, institutional, and passport data, and Genesys now holds some characterization data for the crop, but a dedicated online information system including complete accession-level characterization and evaluation data for maize germplasm collections remains a gap.

**Table 6.** Documentation, information systems, and research resources for maize. 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 | 6.6 |
| Number of genes as recorded in NCBI's Entrez database as of 2022 | 121,273 |
| 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 | 5,275,398 |
| Number of proteins as recorded in NCBI's Entrez database as of 2022 | 682,367 |
| Number of publications listed in Google Scholar with taxon name in title published between 2009 and 2019 | 16,300 |
| Number of publications listed in PubMed Central with taxon name in text as of 2022 | 49,105 |
| Number of research materials as recorded in GBIF (2025) | 390,136 |

# Germplasm distributions and varietal registrations and releases

Germplasm distribution and varietal development statistics for maize 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). Maize is among the most distributed cereal crops in both these datasets (Khoury *et al*., 2023) (Table 7). Further, information on varietal registrations and releases indicate that maize holds the primary position among cereals in terms of varietal development.

**Table 7.** Maize 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 | 4,773.3 |
| Average annual number of samples distributed worldwide as recorded in FAO WIEWS | 10,711.1 |
| Average annual number of samples distributed worldwide as recorded in the Plant Treaty Data Store | 71,846.3 |
| Number of countries receiving germplasm as recorded in the Plant Treaty Data Store | 60.1 |
| Evenness of distributions across world regions as recorded in the Plant Treaty Data Store | 0.8 |
| Average annual number of varietal registrations worldwide as recorded in UPOV's PLUTO | 3,335.5 |
| Average annual number of varietal releases worldwide as recorded in FAO WIEWS | 1,105.6 |

# Networks and partnerships

- CIMMYT continues to play a critical role in maize germplasm conservation and varietal development, maintaining active partnerships with national agricultural research organizations, other international centers, and several academic and industry institutions.
- Crop networks relevant to maize have changed substantially since the 2007 Strategy. Currently active networks include:
  - The European Cooperative Programme for Plant Genetic Resources (ECPGR) Maize Working Group and European Evaluation Network (EVA) for Maize
  - The USDA ARS Maize Crop Germplasm Committee (also here).

# Conclusions

Maize continues to be among the most important crops worldwide and it is likely that it will maintain this importance in future food systems. Maize genetic resources are bolstered by the activities taking place at CIMMYT and in several major collections in national agricultural research organizations and public universities. There appears to have been some significant progress made in safety duplication and in information systems over the past two decades, there are considerable associated research resources, and there has been significant activity in germplasm distributions and varietal development for the crop. These data also indicate that further efforts are needed to fill gaps in existing collections through collecting of wild relatives and landraces, to more fully include maize germplasm collections under the MLS of the Plant Treaty, to make the information accompanying accessions more complete and/or more accessible in online databases, and to address regeneration backlogs (or conducting re-collection, as possible) and safety duplication.


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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 maize 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 in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| MEX002 | Centro Internacional de Mejoramiento de Maíz y Trigo | 30,962 | 13.3% | 13.3% | Not listed* | 30,977 | 0 |
| USA020 | North Central Regional Plant Introduction Station, USDA-ARS, NCRPIS | 19,956 | 8.5% | 21.8% | 19,956 | 0 | 0 |
| RUS001 | N.I. Vavilov All-Russian Research Institute of Plant Industry | 14,233 | 6.1% | 27.9% | 14,233 | 0 | 0 |
| PRT001 | Banco Português de Germoplasma Vegetal | 12,097 | 5.2% | 33.1% | 11,801 | 0 | 12,097 |
| IND001 | National Bureau of Plant Genetic Resources | 11,249 | 4.8% | 37.9% | 11,249 | 0 | 0 |
| MEX208 | INIFAP, Centro Nacional de Recursos Genéticos (CNRG) | 9,767 | 4.2% | 42.1% | 9,767 | 0 | 0 |
| USA174 | Maize Genetics Cooperation - Stock Center; Soybean/Maize Germplasm, Pathology & Genetics Research Unit, USDA/ARS/MWA/ Urbana; Department of Crop Sciences, University of Illinois | 8,506 | 3.6% | 45.7% | 8,506 | 0 | 0 |
| UKR001 | Institute of Plant Production n.a. V.Y. Yurjev of UAAS | 6,613 | 2.8% | 48.5% | 6,613 | 0 | 0 |
| MEX131 | UDG, Centro Universitario de Ciencias Biológicas y Agropecuarias (UDG-CUCBA) | 6,110 | 2.6% | 51.2% | Not listed | 0 | 0 |
| JPN183 | NARO Genebank | 5,522 | 2.4% | 53.5% | 2,196 | 1,569 | 1,569 |
| SRB001 | Maize Research Institute 'Zemun Polje' | 5,475 | 2.3% | 55.9% | Not listed | 0 | 0 |
| ITA386 | CREA-Centro di Ricerca Cerealicoltura e Colture Industriali - Sede di Bergamo | 5,471 | 2.3% | 58.2% | | 599 | 682 |
| ROM007 | Suceava Genebank | 4,922 | 2.1% | 60.3% | 1,817 | 2,650 | 2,653 |
| BGR001 | Institute for Plant Genetic Resources 'K.Malkov' | 4,828 | 2.1% | 62.4% | 4,252 | 0 | 0 |
| PER066 | Programa Cooperativo de Investigación en Maíz, Universida Nacional Agraria La Molina | 4,266 | 1.8% | 64.2% | Not listed | 0 | 4,266 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| COL017 | Corporación Colombiana de Investigación Agropecuaria, AGROSAVIA | 4,226 | 1.8% | 66.0% | 3,722 | 0 | 0 |
| BRA001 | Embrapa Milho e Sorgo | 4,080 | 1.8% | 67.8% | Not listed | 0 | 4,071 |
| MEX006 | UACh, Banco Nacional de Germoplasma Vegetal (BANGEV) | 3,405 | 1.5% | 69.2% | 1,845 | 0 | 0 |
| UKR005 | Institute of Grain Growing | 3,318 | 1.4% | 70.6% | 3,318 | 0 | 0 |
| UZB006 | Uzbek Research Institute of Plant Industry | 2,931 | 1.2% | 71.9% | Not listed | 0 | 0 |
| HUN003 | Centre for Plant Diversity | 2,920 | 1.2% | 73.1% | 816 | 0 | 156 |
| MEX287 | Banco de Germoplasma de Especies Nativas de Oaxaca (BAGENO) | 2,405 | 1.0% | 74.2% | Not listed | 0 | 0 |
| ECU023 | Departamento Nacional de Recursos Fitogenéticos | 2,345 | 1.0% | 75.2% | 2,123 | 12 | 2,337 |
| ECU330 | Estación Experimental Tropical Pichilingue | 2,291 | 1.0% | 76.2% | Not listed | 0 | 2,291 |
| AUS165 | Australian Grains Genebank, Agriculture Victoria | 1,981 | 0.8% | 77.0% | 1,904 | 1,737 | 2 |
| TUR001 | Plant Genetic Resources Department | 1,826 | 0.8% | 77.8% | 1,826 | 0 | 0 |
| KEN212 | Genetic Resources Research Institute | 1,824 | 0.8% | 78.6% | 1,824 | 855 | 1,824 |
| ARG1346 | Banco Activo de Germoplasma de Pergamino | 1,775 | 0.8% | 79.3% | Not listed | 0 | 0 |
| ESP004 | Centro Nacional de Recursos Fitogenéticos | 1,763 | 0.8% | 80.1% | 1,319 | 0 | 1,520 |
| NGA039 | International Institute of Tropical Agriculture | 1,667 | 0.7% | 80.8% | 790 | 1,667 | 797 |
| BOL317 | Estación Experimental de Toralapa | 1,577 | 0.7% | 81.5% | Not listed | 0 | 0 |
| CHL028 | Banco Base de Semillas INIA Intihuasi | 1,552 | 0.7% | 82.1% | 1,552 | 0 | 0 |
| ZMB030 | SADC Plant Genetic Resources Centre | 1,551 | 0.7% | 82.8% | 1,551 | 0 | 0 |
| DEU146 | Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research | 1,502 | 0.6% | 83.4% | 1,478 | 1,500 | 1,500 |
| MEX201 | UACh, Centro Regional Universitario Sur (CRUS) | 1,330 | 0.6% | 84.0% | Not listed | 0 | 0 |
| IDN179 | Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development | 1,287 | 0.6% | 84.6% | 1,287 | 20 | 19 |
| BRA003 | Embrapa Recursos Genéticos e Biotecnologia | 1,275 | 0.6% | 85.1% | 1,275 | 0 | 0 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| ETH085 | Ethiopian Biodiversity Institute | 1,274 | 0.6% | 85.7% | 1,221 | 0 | 1,246 |
| CAN004 | Plant Gene Resources of Canada, Saskatoon Research and Development Centre | 1,272 | 0.5% | 86.2% | 1,272 | 0 | 1,272 |
| MAR088 | Centre Régional de la Recherche Agronomique de Settat | 1,248 | 0.5% | 86.7% | Not listed | 0 | 0 |
| POL003 | Plant Breeding and Acclimatization Institute | 1,103 | 0.5% | 87.2% | 1,103 | 0 | 268 |
| LSO015 | Lesotho National Plant Genetic Resources Centre | 1,063 | 0.5% | 87.7% | Not listed | 0 | 0 |
| PAK001 | Plant Genetic Resources Program | 990 | 0.4% | 88.1% | 584 | 0 | 587 |
| URY003 | INIA La Estanzuela | 945 | 0.4% | 88.5% | 945 | 939 | 0 |
| LKA036 | Plant Genetic Resources Centre | 916 | 0.4% | 88.9% | Not listed | 0 | 0 |
| ZAF062 | RSA National Plant Genetic Resources Centre | 908 | 0.4% | 89.3% | 901 | 0 | 0 |
| GHA091 | Plant Genetic Resources Research Institute | 895 | 0.4% | 89.7% | Not listed | 907 | 893 |
| GTM001 | Instituto de Ciencia y Tecnología Agrícolas | 849 | 0.4% | 90.0% | Not listed | 1 | 0 |
| USA974 | Seed Savers Exchange | 846 | 0.4% | 90.4% | Not listed | 0 | 0 |
| CZE122 | Gene bank | 791 | 0.3% | 90.7% | 791 | 3 | 791 |
| EGY087 | National Gene Bank | 748 | 0.3% | 91.0% | Not listed | 61 | 748 |
| SVK001 | National Agricultural and Food Centre (NPPC), Research Institute of Plant Production (RIPP) | 747 | 0.3% | 91.4% | Not listed | 0 | 747 |
| ROM008 | Agricultural Research and Development Station Simnic | 726 | 0.3% | 91.7% | Not listed | 0 | 0 |
| ALB026 | Plant Genetic Resources Center | 698 | 0.3% | 92.0% | 698 | 54 | 599 |
| ZMB048 | National Plant Genetic Resources Centre | 688 | 0.3% | 92.3% | 688 | 444 | 645 |
| UKR008 | Ustymivka Experimental Station of Plant Production | 638 | 0.3% | 92.5% | 638 | 0 | 0 |
| VNM039 | National Maize Research Institute | 614 | 0.3% | 92.8% | Not listed | 0 | 0 |
| BLR011 | Republican Unitary Enterprise 'Research and Practical Centre of the National Academy of Sciences of Belarus for Arable Farming' | 583 | 0.2% | 93.1% | 155 | 0 | 0 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| CHL171 | Banco de Semillas SAG Magallanes | 578 | 0.2% | 93.3% | 578 | 0 | 0 |
| TZA016 | National Plant Genetic Resources Centre | 569 | 0.2% | 93.5% | 569 | 0 | 0 |
| AZE015 | Genetic Resources Institute | 549 | 0.2% | 93.8% | Not listed | 0 | 549 |
| NLD037 | Centre for Genetic Resources, the Netherlands | 487 | 0.2% | 94.0% | 487 | 487 | 487 |
| FRA015 | Institut national de recherche pour l'agriculture, l'alimentation et l'environnement, Departement de biologie et amelioration des plantes | 455 | 0.2% | 94.2% | 453 | 0 | 346 |
| CHE001 | Agroscope Changins | 413 | 0.2% | 94.4% | 407 | 0 | 413 |
| MWI041 | Malawi Plant Genetic Resources Centre | 411 | 0.2% | 94.5% | 411 | 0 | 208 |
| GRC005 | Greek Genebank, Institute of Plant Breeding and Genetic Resources | 410 | 0.2% | 94.7% | Not listed | 0 | 0 |
| ESP007 | Consejo Superior de Investigaciones Científicas. Estación Experimental de Aula Dei | 404 | 0.2% | 94.9% | 402 | 0 | 404 |
| CRI001 | Centro Agronómico Tropical de Investigación y Enseñanza | 402 | 0.2% | 95.1% | 402 | 402 | 402 |
| CRI085 | CATIE - Banco de Germoplasma (Colecciones Semillas Ortodoxas) | 402 | 0.2% | 95.2% | 402 | 0 | 402 |
| MLI002 | Institut d'Economie Rurale | 396 | 0.2% | 95.4% | 147 | 381 | 147 |
| ESP119 | Xunta de Galicia. Consellería do Medio Rural. Centro de Investigaciónes Agrarias de Mabegondo | 392 | 0.2% | 95.6% | 386 | 0 | 389 |
| NPL069 | National Agriculture Genetic Resources Centre-Genebank | 379 | 0.2% | 95.7% | 379 | 0 | 0 |
| CUB014 | Instituto de Investigaciones Fundamentales en Agricultura Tropical | 374 | 0.2% | 95.9% | Not listed | 0 | 0 |
| MEX069 | UAAAN, Centro de Conservación de Semillas Ortodoxas, Región Norte (CC-SO) | 366 | 0.2% | 96.0% | Not listed | 0 | 0 |
| NGA010 | National Centre for Genetic Resources and Biotechnology | 345 | 0.1% | 96.2% | Not listed | 414 | 0 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| BTN026 | National Biodiversity Center | 336 | 0.1% | 96.3% | 336 | 0 | 0 |
| SLV050 | CENTA - Banco de Germoplasma | 333 | 0.1% | 96.5% | 333 | 0 | 0 |
| ESP009 | Consejo Superior de Investigaciones Científicas. Misión Biológica de Galicia | 327 | 0.1% | 96.6% | 322 | 0 | 140 |
| SDN002 | Agricultural Plant Genetic Resources Conservation and Research Centre | 310 | 0.1% | 96.8% | 310 | 0 | 297 |
| BLR026 | The Polessye Institute of Plant Growing | 296 | 0.1% | 96.9% | 85 | 0 | 0 |
| BEN098 | Groupe de Recherche, Innovation agricole, Gestion de la Biodiversité et Action pour un Développement durable et Équitable à la Base | 289 | 0.1% | 97.0% | Not listed | 0 | 0 |
| PRT102 | Banco de Germoplasma - Universidade da Madeira | 275 | 0.1% | 97.1% | 275 | 0 | 275 |
| PHL129 | Institute of Plant Breeding-National Plant Genetic Resources Laboratory | 273 | 0.1% | 97.2% | 73 | 0 | 0 |
| UGA132 | Plant Genetic Resource Centre | 243 | 0.1% | 97.3% | 243 | 0 | 1 |
| UGA528 | Uganda National Genebank | 243 | 0.1% | 97.4% | Not listed | 0 | 0 |
| USA995 | National Center for Genetic Resources Preservation | 234 | 0.1% | 97.5% | 234 | 0 | 0 |
| CRI077 | Instituto Nacional de Innovación y Transferencia de Tecnología Agropecuaria | 233 | 0.1% | 97.6% | 62 | 0 | 0 |
| HRV041 | Faculty of Agriculture, University of Zagreb | 228 | 0.1% | 97.7% | Not listed | 0 | 151 |
| ROM028 | Agricultural Research and Development Station Suceava | 227 | 0.1% | 97.8% | Not listed | 0 | 0 |
| CMR205 | Ecogerm Farmers | 209 | 0.1% | 97.9% | Not listed | 0 | 0 |
| MEX194 | Instituto de Investigación y Capacitación Agropecuaria, Acuícola y Forestal del Estado de México (ICAMEX) | 209 | 0.1% | 98.0% | Not listed | 0 | 0 |
| CRI007 | Escuela de Ciencias Agrarias, Universidad Nacional | 201 | 0.1% | 98.1% | Not listed | 0 | 0 |
| ERI003 | National Agricultural Research Institute | 199 | 0.1% | 98.2% | 199 | 0 | 87 |
| MDA010 | Laboratory for Plant Genetic Resources | 191 | 0.1% | 98.3% | Not listed | 0 | 0 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| PHL200 | Department of Agriculture - Region 2 | 180 | 0.1% | 98.3% | Not listed | 0 | 0 |
| SWZ015 | National Plant Genetic Resources Centre | 180 | 0.1% | 98.4% | 180 | 0 | 0 |
| MLI017 | Station de Recherche sur la Biologie des Essences Autochtones | 170 | 0.1% | 98.5% | 170 | 0 | 170 |
| ROM023 | University of Agricultural Sciences and Veterinary Medicine Timisoara | 165 | 0.1% | 98.6% | Not listed | 0 | 0 |
| NIC014 | Centro Nacional de Investigación Agropecuaria (INTA-CNIA) | 164 | 0.1% | 98.6% | Not listed | 0 | 0 |
| ZWE049 | Genetic Resources and Biotechnology Institute-Department of Research and Specialist Services | 155 | 0.1% | 98.7% | Not listed | 89 | 0 |
| MLI015 | Centre Régional de Recherche Agricole Mopti/Délégation Progamme Mil | 138 | 0.1% | 98.8% | 138 | 0 | 138 |
| MNG030 | Institute of Plant and Agricultural Science | 134 | 0.1% | 98.8% | Not listed | 0 | 4 |
| THA300 | Genebank | 119 | 0.0% | 98.9% | 107 | 0 | 0 |
| MEX263 | SNICS, Depositario Nacional de Referencia de Semillas (DNRS) | 112 | 0.0% | 98.9% | Not listed | 0 | 0 |
| CUB005 | Instituto Nacional de Ciencias Agrícolas | 110 | 0.0% | 99.0% | Not listed | 0 | 0 |
| ESP172 | Cabildo Insular de Tenerife. Centro de Conservación de la Biodiversidad Agrícola de Tenerife | 110 | 0.0% | 99.0% | Not listed | 0 | 110 |
| CUB030 | Instituto de Investigaciones de Granos | 87 | 0.0% | 99.1% | Not listed | 0 | 0 |
| MKD001 | Faculty of Agriculture, University Ss. Cyril and Methodius | 85 | 0.0% | 99.1% | 1 | 0 | 0 |
| BIH039 | Institute of Genetic Resources, University of Banja Luka | 82 | 0.0% | 99.1% | 71 | 0 | 0 |
| ITA034 | Institute of Plant Breeding and Agricultural Research 'Nazzareno Strampelli' | 82 | 0.0% | 99.2% | Not listed | 0 | 0 |
| BEN025 | Institut National des Recherches Agricoles du Bénin | 81 | 0.0% | 99.2% | Not listed | 0 | 0 |
| GEO001 | I.Lomouri Institute of Crop Science | 77 | 0.0% | 99.2% | Not listed | 0 | 0 |
| UKR027 | Zakarpats'kyi Institute of Agroindustrial Production | 77 | 0.0% | 99.3% | 77 | 0 | 0 |
| ROM012 | Agricultural Research and Development Station Lovrin | 75 | 0.0% | 99.3% | Not listed | 0 | 0 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| TUN029 | Banque Nationale de Gènes de Tunisie | 74 | 0.0% | 99.3% | 74 | 0 | 74 |
| TWN001 | World Vegetable Center | 72 | 0.0% | 99.4% | 72 | 72 | 72 |
| ITA368 | Banca del germoplasma autoctono vegetale regionale | 71 | 0.0% | 99.4% | 55 | 0 | 0 |
| MNE001 | Institute of Agriculture | 68 | 0.0% | 99.4% | 68 | 0 | 3 |
| ARG1408 | Instituto de Investigación y Desarrollo Hortícola Semillero | 63 | 0.0% | 99.4% | Not listed | 0 | 0 |
| CHE095 | Verein Rheintaler Ribelmais | 63 | 0.0% | 99.5% | Not listed | 0 | 38 |
| MMR015 | Myanmar SeedBank | 60 | 0.0% | 99.5% | Not listed | 0 | 0 |
| MYS125 | Universiti Putra Malaysia | 60 | 0.0% | 99.5% | 60 | 0 | 60 |
| NAM006 | National Plant Genetic Resources Centre | 60 | 0.0% | 99.5% | 58 | 0 | 0 |
| CUB284 | Centro de Investigaciones Agropecuarias | 57 | 0.0% | 99.6% | Not listed | 0 | 0 |
| AUT001 | Austrian Agency for Health and Food Safety | 55 | 0.0% | 99.6% | 55 | 0 | 55 |
| NER001 | Institut national de la recherche agronomique du Niger | 55 | 0.0% | 99.6% | 55 | 0 | 45 |
| MLI014 | Station d'Elevage et de Recherche Zootechnique de Toronke | 52 | 0.0% | 99.6% | 52 | 0 | 52 |
| IDN415 | Borneo Institute | 51 | 0.0% | 99.7% | Not listed | 0 | 0 |
| BGD003 | Bangladesh Agricultural Research Institute | 43 | 0.0% | 99.7% | 35 | 0 | 0 |
| MEX367 | Facultad de Ciencias Naturales, Universidad Autónoma de Querétaro | 43 | 0.0% | 99.7% | Not listed | 0 | 0 |
| SEN075 | Unité de Recherche en Culture In-vitro | 38 | 0.0% | 99.7% | Not listed | 0 | 38 |
| AUT005 | Genebank Tirol | 35 | 0.0% | 99.7% | Not listed | 0 | 35 |
| TJK027 | National Center for Genetic Resources | 34 | 0.0% | 99.7% | 26 | 0 | 34 |
| BEN097 | Unité de Génétique, Biotechnologie et Science des Semences | 32 | 0.0% | 99.8% | Not listed | 0 | 0 |
| BWA015 | National Plant Genetic Resources Centre | 32 | 0.0% | 99.8% | 32 | 0 | 0 |
| ITA363 | Dipartimento di Chimica, Biologia e Biotecnologie, Universitá degli Studi Perugia | 32 | 0.0% | 99.8% | 31 | 0 | 0 |
| CHE100 | Sortengarten Erschmatt | 31 | 0.0% | 99.8% | Not listed | 0 | 31 |
| NGA136 | Biodiversity Education and Resource Centre | 30 | 0.0% | 99.8% | Not listed | 0 | 0 |
| ARE003 | International Center for Biosaline Agriculture | 27 | 0.0% | 99.8% | Not listed | 20 | 27 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| SVN019 | Crops and Seed Production Department, Agricultural Institute of Slovenia | 26 | 0.0% | 99.8% | Not listed | 0 | 0 |
| ESP027 | Gobierno de Aragón. Centro de Investigación y Tecnología Agroalimentaria. Banco de Germoplasma de Hortícolas | 25 | 0.0% | 99.8% | Not listed | 0 | 25 |
| HRV021 | Agricultural Institute Osijek | 24 | 0.0% | 99.9% | Not listed | 0 | 0 |
| GBR016 | Genetic Resources Unit, Institute of Biological, Environmental & Rural Sciences, Aberystwyth University | 23 | 0.0% | 99.9% | Not listed | 0 | 0 |
| GRC100 | CIHEAM Mediterranean Agronomic Institute of Chania | 22 | 0.0% | 99.9% | 22 | 0 | 0 |
| PHL008 | Bureau of Plant Industry, Department of Agriculture | 22 | 0.0% | 99.9% | Not listed | 0 | 0 |
| TUR034 | Field Crop Central Research Institute | 20 | 0.0% | 99.9% | 20 | 0 | 0 |
| CHL071 | Banco de Germoplasma de Papa, Universidad Austral de Chile | 18 | 0.0% | 99.9% | 11 | 0 | 0 |
| LBN002 | International Centre for Agricultural Research in Dry Areas | 16 | 0.0% | 99.9% | Not listed | 0 | 0 |
| PAN075 | Centro de Investigacion Agropecuaria de Recursos Geneticos | 16 | 0.0% | 99.9% | Not listed | 0 | 0 |
| GEO013 | Niko Ketskhoveli Institute of Botany | 15 | 0.0% | 99.9% | Not listed | 0 | 0 |
| HND101 | Fundación para la Investigación Participativa con Agricultores de Honduras | 15 | 0.0% | 99.9% | Not listed | 0 | 15 |
| GIN009 | Centre de Recherche Agronomique de Foulaya | 14 | 0.0% | 99.9% | Not listed | 0 | 14 |
| TTO010 | Central Experiment Station, Research Division, Ministry of Agriculture, Land and Fisheries | 14 | 0.0% | 99.9% | Not listed | 0 | 0 |
| ARM005 | Institute of Botany | 13 | 0.0% | 99.9% | 6 | 0 | 6 |
| HND029 | Dirección de Ciencia y Tecnología Agropecuaria | 13 | 0.0% | 99.9% | Not listed | 0 | 13 |
| PAN172 | Subcentro de Investigación Agropecuaria de San Félix | 12 | 0.0% | 100.0% | Not listed | 0 | 0 |
| GBR004 | Millennium Seed Bank - Royal Botanic Gardens Kew | 10 | 0.0% | 100.0% | Not listed | 0 | 0 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| ITA435 | Banca del Germoplasma Vegetale | 10 | 0.0% | 100.0% | 10 | 0 | 0 |
| LBY006 | National Bank for Plant Genetic Resources | 10 | 0.0% | 100.0% | Not listed | 0 | 0 |
| GUY021 | National Agricultural Research and Extension Institute | 9 | 0.0% | 100.0% | Not listed | 0 | 0 |
| MKD007 | Fabia CSB Bogdanci | 9 | 0.0% | 100.0% | Not listed | 0 | 0 |
| ETH013 | International Livestock Research Institute | 8 | 0.0% | 100.0% | Not listed | 7 | 7 |
| SWE054 | Nordic Genetic Resource Center | 8 | 0.0% | 100.0% | 8 | 7 | 8 |
| MDG016 | Centre de Recherche Régional du Moyen Est, FOFIFA | 6 | 0.0% | 100.0% | Not listed | 0 | 5 |
| NZL001 | Margot Forde Genebank, AgResearch Ltd | 4 | 0.0% | 100.0% | Not listed | 0 | 0 |
| QAT004 | Biotechnology Center, Ministry of Environment | 4 | 0.0% | 100.0% | 4 | 41 | 4 |
| ARM059 | Agrobiotechnology Scientific Center | 3 | 0.0% | 100.0% | 3 | 0 | 2 |
| AUT025 | Referat Pflanzengesundheit und Spezialkulturen | 3 | 0.0% | 100.0% | 3 | 0 | 3 |
| GBR017 | Henry Doubleday Research Association | 3 | 0.0% | 100.0% | Not listed | 0 | 0 |
| MRT002 | Centre National de Recherche Agronomique et de Développement Agricole | 3 | 0.0% | 100.0% | Not listed | 0 | 0 |
| ECU167 | Banco de Germoplasma de la Universidad Técnica Particular de Loja | 2 | 0.0% | 100.0% | 2 | 0 | 0 |
| JOR105 | National Agricultural Research Center | 2 | 0.0% | 100.0% | Not listed | 2 | 2 |
| KGZ040 | Bank-Laboratory of Plant Genetic Resources of the KR | 2 | 0.0% | 100.0% | 2 | 0 | 2 |
| VNM049 | Plant Resources Center | 2 | 0.0% | 100.0% | Not listed | 0 | 0 |
| AZE004 | Institute of Botany | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |
| BEL002 | Gembloux agro-biotech, Université de Liège, département des Sciences agronomiques, Phytotechnie tropicale et Horticulture | 1 | 0.0% | 100.0% | Not listed | 0 | 1 |
| BGD195 | Sher-e-Bangla Agricultural University (SAU) | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |

| Institution Code | Institution name | Number of accessions | Percent of total | Cumulative percent | Number of accessions in long term storage (-18-20°C) | Number of accessions included in MLS (from Plant Treaty GLIS) | Number of accessions included in MLS (from genebank collections databases) |
|---|---|---|---|---|---|---|---|
| CUB251 | Instituto de Investigaciones Agropecuarias Jorge Dimitrov | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |
| ECU331 | Granja experimental Socavón | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |
| ESP026 | Generalidad Valenciana. Universidad Politécnica de Valencia. Escuela Técnica Superior de Ingenieros Agrónomos. Banco de Germoplasma | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |
| HRV053 | Center for Seed and Seedlings | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |
| LVA009 | Latvian State Forest Research Institute 'Silava' | 1 | 0.0% | 100.0% | 1 | 0 | 1 |
| ROM055 | Research and Development Station for Vegetables - Bacau | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |
| USA151 | National Arboretum-Germplasm Unit, USDA/ARS | 1 | 0.0% | 100.0% | Not listed | 0 | 0 |

*But documented in the 2008 Strategy as maintaining collections in long-term conditions (Crop Trust, 2008)

**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) |
|---|---|
| *Zea mays* subsp. *mays* | 232,196 |
| *Zea* mays subsp. *mexicana* (Schrad.) H. H. Iltis | 554 |
| *Zea* mays subsp. *parviglumis* Iltis & Doebley | 396 |
| *Zea* L. | 278 |
| *Zea diploperennis* H. H. Iltis et al. | 35 |
| *Zea luxurians* (Durieu & Asch.) R. M. Bird | 29 |
| *Zea mays* subsp. *huehuetenangensis* (H. H. Iltis & Doebley) Doebley | 25 |
| *Zea* sp. | 21 |
| *Zea nicaraguensis* H. H. Iltis & B. F. Benz | 16 |
| *Zea perennis* (Hitchc.) Reeves & Mangelsd. | 16 |
| *Zea* hybr. | 8 |
| *Zea mays* subsp. *luxurians* (Durieu & Asch.) H. H. Iltis | 1 |

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