CROP-SPECIFIC GENEBANK STANDARDS FOR ORTHODOX SEEDS

Agreed by the ECPGR Maize Working Group (2 October 2025)

FAO Genebank standards for orthodox seeds[1]		Crop-specific genebank standards for orthodox seeds Maize	Remarks (reasons for deviating from FAO standards)
4.1	**Standards for acquisition of germplasm**		
4.1.1	All seed samples added to the genebank collection have been acquired legally with relevant technical documentation.		
4.1.2	Seed collecting should be made as close as possible to the time of maturation and prior to natural seed dispersal, avoiding potential genetic contamination, to ensure maximum seed quality.	Seed from a representative number of plants should be required	
4.1.3	To maximize seed quality, the period between seed collecting and transfer to a controlled drying environment should be within 3 to 5 days or as short as possible, bearing in mind that seeds should not be exposed to high temperatures and intense light and that some species may have immature seeds that require time after harvest to achieve embryo maturation.	If necessary, the seed collected could be dried immediately at 35 ºC one week, stored in cold chamber at 4 ºC and processed in winter	
4.1.4	All seed samples should be accompanied by at least a minimum of associated data as detailed in the FAO/Bioversity multi-crop passport descriptors.		
4.1.5	The minimum number of plants from which seeds should be collected is between 30-60 plants, depending on the breeding system of the target species	When farmers bring maize from landraces (heterogenous material), a minimum of 10 ears from 10 different plants is required	Ten ears represent 10 females and a large number of males of a landrace.
4.2	**Standards for drying and storage**		
4.2.1	All seed samples should be dried to equilibrium in a controlled environment of 5-20°C and 10-25 percent of relative humidity, depending upon species.	Ears are dried immediately at 35 ºC one week to reach <14% relative humidity	At 5-20°C ears coming from humid environments take too long to dry down and can be badly damaged by fungi.
4.2.2	After drying, all seed samples need to be sealed in a suitable airtight container for long term storage; in some instances where collections that need frequent access to seeds or likely to be depleted well before the predicted time for loss in viability, it is then possible to store seeds in non–airtight containers.		

[1] See Chapter 4 in: FAO. 2014. Genebank Standards for Plant Genetic Resources for Food and Agriculture. Rev. ed. Rome. (www.fao.org/docrep/019/i3704e/i3704e.pdf)

4.2.3	Most-original-samples and safety duplicate samples should be stored under long-term conditions (base collections) at a temperature of -18 ± 3°C and relative humidity of 15%± 3percent.		
4.2.4	For medium-term conditions (active collection) samples should be stored under refrigeration at 5-10°C and relative humidity of 15%± 3 percent.		Medium-term conservation at 15 ± 3 percent RH is cost-demanding and technically difficult to attain in case of large cold rooms. Practice of WG members is to store samples at below 60% RH, depending on technical capacity.
4.3	**Standards for seed viability monitoring**		
4.3.1	The initial seed viability test should be conducted after cleaning and drying the accession or at the latest within 12 months after receipt of the sample at the genebank.	Accession masses are monitored regularly for germination in Petri dishes by placing 25 kernels in each of two Petri dishes with filter paper imbibed with distilled water in a dark room at 25 °C during one week and count the proportion of germinated kernels.	
4.3.2	The initial germination value should exceed 85 percent for most seeds of cultivated crop species. For some specific accessions and wild and forest species that do not normally reach high levels of germination, a lower percentage could be accepted.		
4.3.3	Viability monitoring test intervals should be set at one-third of the time predicted for viability to fall to 85 percent[2] of initial viability or lower depending on the species or specific accessions, but no longer than 40 years. If this deterioration period cannot be estimated and accessions are being held in long-term storage at -18°C in hermetically closed containers, the interval should be ten years for species expected to be long-lived and five years or less for species expected to be short-lived.		
4.3.4	The viability threshold for regeneration or other management decision such as recollection should be 85 percent or lower depending on the species or specific accessions of initial viability.	Accessions are multiplied when germination falls below 80 %	In humid environments, germination falls due to fungi and it is not reasonable to multiply too many accessions per year

[2] The time for seed viability to fall can be predicted for a range of crop species using an online application based on the Ellis/Roberts viability equations (see http://data.kew.org/sid/viability/).

4.4	Standards for regeneration		
4.4.1	Regeneration should be carried when the viability drops below 85 percent of the initial viability or when the remaining seed quantity is less than what is required for three sowings of a representative population of the accession. The most-original-sample should be used to regenerate those accessions.		
4.4.2	The regeneration should be carried out in such a manner that the genetic integrity of a given accession is maintained. Species-specific regeneration measures should be taken to prevent admixtures or genetic contamination arising from pollen geneflow that originated from other accessions of the same species or from other species around the regeneration fields.	For the regeneration/multiplication of maize germplasm under optimal conditions, appropriate pollination methods must be considered depending on the biological status of each accession. **Pollination methods:** ***Natural Pollination*** Utilization of isolated areas in order to avoid genetic contamination from other fields. The minimum distance from other maize fields should be 200-300 meters (local landraces, inbred lines). Hemp curtains can also be used. The distances between the other maize accessions must be of 20 m (local landraces). ***Artificial Pollination*** Performed manually under controlled conditions and can include the following types: • Self-pollination – pollen from a plant is used to fertilize its own flowers (usually for inbred lines). • SIB (Sibling Crossing) – crossing between brother and sister plants from the same population (local landraces). • Chain cross (monoecious mode) — uses each plant as a male and female • Free pollen circulation – allows open pollination within a restricted group of selected plants (compartmented green house or small solarium) (local landraces) • Landraces. For field multiplication, at least 150 kernels of the mass conserved for multiplication will be sown in several adjacent, properly labelled rows. As flowering approaches, inspect	

		the plants and cover the flower primordia of the ear with translucent paper bags before the silks emerge. This allows the silks to be observed without lifting the bag. When the tassels begin to produce pollen, cover the tassel that have produced anthers with craft paper bags secured with a clip to prevent pollen from entering or leaving the bag. The day after covering the tassel, collect the tassel bag, usually when it is sunny and warm and viable pollen is already produced by the plant. The pollen is poured on the silks of a primordia of a different plant of the same accession, quickly lifting the translucent bag avoiding exposing the silks to foreign pollen. The tassel bag is then closed, covering the pollinated flower primordium of the pollinated plant until the kernel matures. At least 50 crosses should be made between plants of each accession, using one plant only once as a male or a female. In this procedure, the tassel of each plant used as a male must be broken so that it cannot be reused in order to prevent using a plant twice. It is advisable to label each pollinized plant to avoid losses in case the bags are lost due to wind and rain.	
4.4.3	If possible at least 50 seeds of the original and the subsequent most-original-samples should be archived in long-term storage for reference purposes.	In the case of landraces, if possible, at least 1000 pooled kernels of the original and the subsequent most-original- samples should be archived in long-term storage for archive purposes.	
4.5	**Standards for characterization**		
4.5.1	Around 60 percent of accessions should be characterized within five to seven years of acquisition or during the first regeneration cycle.	Most of samples are characterized in the field after multiplication from the original sample. If results are promising, further evaluations are made in the field or under controlled conditions.	
4.5.2	Characterization should be based on standardized and calibrated measuring formats and characterization data follow internationally agreed descriptor lists and are made publicly available.		
4.6	**Standards for evaluation**		
4.6.1	Evaluation data on genebank accessions should be obtained for		

	traits that are included in internationally agreed crop descriptor lists. They should conform to standardized and calibrated measuring formats.		
4.6.2	Evaluation data should be obtained for as many accessions as practically possible, through laboratory, greenhouse and/or field analysis as may be applicable.	Evaluations are made primarily in the field and, when appropriate, in greenhouse or growth chamber under controlled stress conditions	
4.6.3	Evaluation trials should be carried out in at least three environmentally diverse locations and data collected over at least three years.		
4.7	**Standards for documentation**		
4.7.1	Passport data of 100 percent of the accessions should be documented using FAO/Bioversity multi-crop passport descriptors.		
4.7.2	All data and information generated in the genebank relating to all aspects of conservation and use of the material should be recorded in a suitably designed database.	Data are published in open access and further information is available upon request	
4.8	**Standards for distribution and exchange**		
4.8.1	Seeds should be distributed in compliance with national laws and relevant international treaties and conventions.		
4.8.2	Seed samples should be provided with all relevant documents required by recipient country.		
4.8.3	The time span between receipt of a request for seeds and the dispatch of the seeds should be kept to a minimum.		
4.8.4	For most species, a sample of a minimum of 30-50 viable seeds should be supplied for accessions with sufficient seeds in stock. For accessions with too little seed at the time of request and in the absence of a suitable alternative accession, samples should be supplied after regeneration/multiplication, based on a renewed request. For some species and some research uses, smaller numbers of seeds should be an acceptable distribution sample size.	For each requested maize accession, maximum 100 viable seeds are supplied.	
4.9	**Standards for safety duplication**		
4.9.1	A safety duplicate sample for every original accession should be stored in a geographically distant area, under the same or better conditions than those in the original genebank.	Samples maintained in the active collection are duplicated in a Germplasm Bank and additional copies are maintained in other collections	
4.9.2	Each safety duplicate sample should be accompanied by relevant associated information.		

4.10 Standards for security and personnel		
4.10.1 A genebank should have a risk management strategy in place that includes *inter alia* measures against power cut, fire, flooding and earthquakes.		
4.10.2 A genebank should follow the local Occupational Safety and Health requirements and protocols where applicable.		
4.10.3 A genebank should employ the requisite staff to fulfil all the routine responsibilities to ensure that the genebank can acquire, conserve and distribute germplasm according to the standards.		