CROP-SPECIFIC GENEBANK STANDARDS FOR ORTHODOX SEEDS

Agreed by the Cucurbits Working Group

April 2015

Note: the "FAO Genebank standards for orthodox seeds" listed in the first column correspond to Chapter 4, pp. 17-63 in: FAO. 2014. Genebank Standards for Plant Genetic Resources for Food and Agriculture. Rev. ed. Rome. (www.fao.org/docrep/019/i3704e/i3704e.pdf)

FAO Genebank standards for orthodox seeds	**Crop-specific genebank standards for orthodox seeds - Cucurbit spp.** *No comment in this column means agreement with FAO standard*	**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.		
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.	Cucurbit seed development will go on even after the fruit is removed from the vine. If, because of frost or other unfavourable circumstances, fruits are harvested before they have matured, they should be stored for 1 or 2 months before seed extraction. In general germination rates will increase if harvested fruits are stored for one week before extracting seeds.	
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.		

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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.	If the number of plants available in a given accession is 10 to 15 it can still be collected. Due to the big size of cucurbit plants, the number of plants available is rarely higher than the above figures. Also, regeneration costs would become extremely high. These lower figures are justified as breeding impression in cucurbit crops is low.	See also standard 4.4.2.
	4.1.6 Seed cleaning (NEW) Persistent placental material must be removed from the seeds to reduce chance of preserving viruses, bacteria and fungi. [1]	(This standard is not provided by FAO)
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.	Seeds should be dried as quickly as possible. If controlled drying conditions are not available cucurbit seeds can be spread out to dry under warm (less than 35°C air temperature), well-ventilated, shaded conditions. Final moisture content in seeds of 5-6 % can be reached after drying with silica gel	
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.	The most advisable way to store cucurbit seeds is as dried seeds kept in airtight containers at a temperature of -18°C.	

[1] Embedded seeds of watermelon, cucumber, melon, wax melon and squash can be removed by chopping the fruits. When water is added to the mixture, seeds will sink and the flesh debris, which floats, can be poured off. (See also the General guidelines for regeneration, processing and storage of cucurbit species)

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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 ± 3 percent.		
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.		
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.		
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.	Material with high initial germination rates, kept under long- term storage conditions, must be monitored before 25 years of storage.	
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.		

[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/).

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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.	At least 10 plants per accession should be used. For heterogeneous accessions at least 15 plants must be used to ensure the preservation of genetic diversity.	Because of low inbreeding depression and high regeneration cost of cucurbit crops, a lower number of plants should be adequate.
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.		
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.		
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.		

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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.		
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.		
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.		

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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.		
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.		
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.		