CROP-SPECIFIC GENEBANK STANDARDS FOR ORTHODOX SEEDS

Agreed by the Wheat Working Group

January 2016

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 – Wheat genepools (*Triticum, Aegilops, Secale, XTriticosecale*)** *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.	All seed samples recently added to the genebank collection have been acquired legally with relevant technical documentation.	This information is not always available for accessions received a long time ago. It depends on the update on the history of introduction.
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.		
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	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. This number could be lower for wild or endangered species.	

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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.		
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.		
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.	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. However, when samples are stored in airtight containers, relative humidity in the storage room is of no relevance.	
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.	For medium-term conditions (active collection) samples should be stored under refrigeration at 5-10°C and relative humidity of 15 ± 3 percent, whenever possible.	Medium-term conservation at 15 ± 3 percent RH can be very expensive and technically difficult to attain in case of large cold rooms.
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.	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. This period can be exceeded in case it is necessary to break seed dormancy.	CWR usually have dormancy. It can exceed 12 months.

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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[1] 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.	Viability monitoring test intervals should be set at one-third of the time predicted for viability to fall to 85 percent[1] 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 20 years for species expected to be long-lived and 10 years or less for species expected to be short-lived.	Intervals are too short for -18°C, as clearly indicated in the literature for wheat species (Nagel et al. 2009; Nagel and Borner 2010).
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.		
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.		

[1] 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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4.4.2	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.		
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.		
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.	As far as possible, evaluation trials should be carried out in at least three environmentally diverse locations and data collected over at least three years.	For technical and economic reasons it is not realistic to carry out multi-environmental evaluation for all accessions conserved in a genebank.

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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.		
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.		

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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.		

References

Nagel M, Börner A. 2010. The longevity of crop seeds stored under ambient conditions. Seed Science Research 20:1–12.

Nagel M, Rehman Arif MA, Rosenhauer M, Börner A. 2010. Longevity of seeds - intraspecific differences in the Gatersleben genebank collections. In: 6. Tagung der Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs. pp. 179–182.