Current genebank practices for forage legumes

	ILRI	ICARDA	CIAT	Genetic Resource Centre for Temperate Pasture Legumes, Perth	SARDI, Adelaide	IGER, UK	Millennium seed bank, UK	USDA Fort Collins	EMBRAPA
Registration:	Check documentation and free of pests and diseases and give consecutive number.			Quarantine checks imported seed for insects. Imported seed documented on file. Collecting number used to name the accession.					
Sample processing	Machine threshing, followed by air screen cleaning. Final cleaning by blowing or hand cleaning. If infested with insects, place seeds in deep freeze for 3 days	Combine for mechanical harvesting and threshing large plots. Final cleaning using air blower, gravity equipment. Small plots handled manually	Physical purity	Clean by hand using rubber mats and aspiration. If insects present seed oven dried at 60degC for 2 hours.	Grown in post entry quarantine.		Visual inspection, hand cleaning using sieves and aspirator.		
Seed drying	Paper bags in dehumidified drying room 25% RH and 15^{o}C	Paper or cotton bags in dehumidified rooms at 13-15 % RH and 20-25 ^{o}C	Mesh boxes at 10% RH and 15^{o}C	Calico bags at 10% RH and 15^{o}C		self-indicating silica gel	Dried at 15% RH and 18^{o}C		
Storage moisture content	5% $\pm$ 2% moisture content except soyabean not less than 8%	5-7% with critical moisture content of 3-	6% moisture content	Seed is dried to equilibrium moisture content (approximately		5% moisture content	Seed is dried to equilibrium moisture content (approximately	6-10% moisture content	5-6% moisture content

		4%		5%)			5%)		
Germplasm testing									
Seed moisture content									
Seed moisture content determination methods	Modified ISTA method	ISTA method							
Sample frequency, size, sampling and grinding	Sampled once at end of drying period to determine moisture for storage	Random sampling frequency							
Viability testing									
Viability testing laboratory methods	Follows ISTA method or ILRI standard method. A minimum of four replicates of 50 seeds	Follows ISTA (4 reps of 100 seeds) or sequential method (4 reps of 10 seeds)				Prior to entry into the genebank, seeds are tested to determine germination	1 rep of 20 seeds on water agar	AOSA guidelines. Two reps of 50 seeds	
Monitoring intervals	10 years above 50% germination 5 years below 50% germination	5 years initially and longer if high viability			10 to 20 years		10 years	10 years	
Health diagnosis									
Pests and diseases of quarantine importance	Fungi: *Colletotrichum sp., Fusarium oxysporum, Rhizoctonia solanum, Penicillium* sp. Virus: Bean common mosaic virus (BCMV), Bean yellow mosaic virus	Fungi: *Ascochyta* sp., *Phoma* sp., *Botrytis cinerea* Weeds: *Orobanche* spp., *Cuscuta* spp Various virus	Fungi: *Cercospora canescens Colletotrichum sp. Macrophomina phaseoli Phaeoisariopsis griseola Phoma sp. Rhizoctonia solani*						

	(BYMV), alfalfa mosaic virus (AMV), Cowpea mosaic virus (CPMV), Peanut mottle virus (PeMoV), Soybean mosaic virus (SMV)		*Sclerotium rolfsii* *Drechslera sp.* *Curvularia sp.* *Helminthosporium sp.* *Pyricularia sp.* *Botrytis sp.* *Macrophoma sp.* *Phomosis sp.* Bacteria *Pseudomonas syringae* pv. *Phaseolicola* *Curtobacterium flaccumfasciens* *Xanthomonas sp*. *Pseudomonas fluorescens* Virus Potyvirus Group Bean common mosaic virus (BCMV) Bean southern mosaic virus (BSMV)						
Provide options for testing procedures	Blotter test with 100 seeds for fungi. ELISA and TIBA tests for virus.	Freezing blotter test and PDA for fungi. ELISA for virus and filter wash test for weeds.	Blotter test with 100 seeds for bacteria and fungi. ELISA tests for virus						

Storage monitoring									
Routine monitoring methods	Routine testing for seed viability at regular intervals Stock control system queried to determine accessions for regeneration	1000 seeds or low germination (Cultivated species 85% Wild species: 75 %)							
Monitoring frequency	> 85% germination - Every 10 years < 85% germination - Every 5 years								
Conservation									
Base collections									
a) Minimum sample size	4000 seeds of 90% germination	1000 seeds of 80% germination for wild species and 90% germination for cultivars. 5g for perennial species.		500 seeds with an average 3,000 seeds per accession				2000-3000	4000 seeds of 85% viability
b) Seed requirements	3-7% moisture	5-7% moisture	6% moisture content	Equilibrium moisture content (approximately 5%)		5% moisture		6-10% moisture	4-6% moisture content
c) Packaging	Laminated aluminium foil envelopes	Laminated aluminium foil envelopes with vacuum	Laminated aluminium foil envelopes	Laminated aluminium foil envelopes		Laminated aluminium foil envelopes	Laminated aluminium foil envelopes	Laminated aluminium foil envelopes	Tin cans
Storage specifications									
a) Assigning location codes	Location codes made from freezer,	Location codes made		Location fully coded and					

	shelf and box number	from unit/block number, row shelf number, shelf number, and tray number		computerised					
b) Storage conditions	-20^{o}C	-18 to -22^{o}C	-15 to -20 ^{o}C	-18^{o}C	-18^{o}C	-20^{o}C	-18^{o}C to -20^{o}C	-18^{o}C and -175^{o}C in Liquid nitrogen	-18^{o}C to -20^{o}C
Active collections									
Sample specifications									
a) Minimum sample size	500g and above 85% of original germination	1500 seeds of 80% germination for wild species and 90% germination for cultivars		100 seeds. Usually about 30g per accession					
b) Seed requirements	3-7% seed moisture content	5-7% seed moisture content	10% seed moisture content	Equilibrium moisture content (approximately 5%)		5% seed moisture content			5-6% moisture content
c) Packaging	Laminated aluminium foil envelopes	Permeable plastic containers with screw cap	Laminated aluminium foil envelopes	Laminated aluminium foil envelopes		Laminated aluminium foil envelopes			Aluminiumized paper bags
Storage specifications									
a) Assigning location codes	Location codes made from store, rack, shelf and box number	unit/block number, row shelf number, shelf number, and tray number		Location fully coded and computerised					

b) Storage conditions	8 °C	3 °C ± 2 °C		3°C	5°C	0 °C			-5 °C
Safety duplication									
Sample specifications									
a) Minimum sample size	1000 seeds of more than 85% viability but 500 seeds for Svalbard	300 seeds of 80% germination for wild species and 90% germination for cultivars		500 seeds			150 seeds		
b) Seed requirements	3-7% moisture content	5-7% moisture content							
c) Packaging	Laminated aluminium foil	Laminated aluminium foil envelopes with vacuum		Laminated aluminium foil envelopes			Sealed plastic boxes with silica gel		
4.4.2 – Storage specifications				Long-tern duplicate store in Canberra	Long-tern duplicate store in Canberra				
a) Assigning location codes	Box number	Box number							
b) Shipping method	Courier or air freight	Courier or air freight							
c) Storage conditions	Black box, long term storage	Black box, long term storage		Long term storage at -18 °C			Long term storage at -20 °C		
d) Legal arrangements	Agreement			None – fee for service					
Regeneration	Regenerated in isolation in environment to which they are adapted.	Field planting with isolation cages		Regenerated in environment to which they are adapted with irrigation.		Isolation glasshouses pollinator-proof (legumes) isolation chambers			
Number of plants				60 plants of Trifolium, 5 to 20					

				plants of Ornithopus and Biserrula					
Isolation methods				Open pollinated, separation in space by mixing species, cereal buffers between rows					
Harvesting methods						Seed samples to be stored in the active collection are formed by taking a balanced bulk. For the long term storage, the seed of each plant is kept in a separate foil pouch and mixed in equal numbers for future regeneration cycles			
Characterization	Use ILRI descriptors for forages	Mediterranean type of climate. International descriptors		Growth vigour; flowering time; growth habit; seed yield; stem thickness; leaf size; flower colour; pod characters; seed retention; and leaf markers and pigmentation					

Distribution of plant materials									
Policies and regulations	Follow the International Treaty on Plant Genetic Resources for Food and Agriculture for in trust germplasm using the SMTA and Plant Breeders Rights for varieties.	Follow the International Treaty on Plant Genetic Resources for Food and Agriculture for in trust germplasm using the SMTA	Follow the International Treaty on Plant Genetic Resources for Food and Agriculture for in trust germplasm using the SMTA	International Treaty on Plant Genetic Resources for Food and Agriculture for international requests. National policy under review following cessation of national funding and rationalization of Centres	Use SMTA under the International Treaty on Plant Genetic Resources for Food and Agriculture				
Process followed	Respond to requests with lists of materials, forms and conditions of access, SMTA. Provide passport and germination data with requests. Small quantities of seed free of charge.	Free of charge		Respond to requests with lists of materials available. Provide small quantities of seed with passport data and any relevant MTAs . Site habitat data available on request.					
Information									
Passport data				Passport descriptors: country; province; collector; collection date; location; latitude;					

				longitude; altitude; aspect; slope; rainfall; drainage; parent rock; soil depth; soil texture; soil pH; surface hardness; surface stoniness; species abundance; species spatial distribution; habitat; associated species; and grazing pressure					