



**COMMISSION ON GENETIC RESOURCES
FOR FOOD AND AGRICULTURE**

Fifth Extraordinary Session

Rome, 8 - 12 June 1998

ANNEX TO DOCUMENT CGRFA-Ex5/98/Inf.1

**RELEVANT CHARACTERISTICS OF THE CROPS AND GENERA IN THE
TENTATIVE LIST OF CROPS ANNEXED TO ARTICLE 11 OF THE
CONSOLIDATED NEGOTIATING TEXT**

The Fourth Extraordinary Session of the Commission on Genetic Resources for Food and Agriculture requested the International Plant Genetic Resources Institute (IPGRI), in consultation with the Commission's Secretariat, to prepare a study of the technical aspects of the *Tentative list of crops* annexed to Article 11 of the Consolidated Negotiating Text. Document CGRFA-Ex5/98/Inf. 1, supported by this Annex, replies to that request.

This Annex provides, in tabular form, in order to facilitate the work of the Commission, some illustrative additional information on the crops in the *Tentative List*, prepared by the Fourth Extraordinary Session of the Commission, and annexed to Article 11 of the Consolidated Negotiating Text. For ease of reference, the crops are listed in the same order as they appear in the *Tentative List*. It should be recognized that in a number of respects the information is incomplete (recorded as "not known"); that it may not always reflect the most recent findings; and that, by its nature, it includes questions of judgment on the part of the compilers. Authorities sometimes differ for example, on the number of species in a genus or the boundaries of gene pools. The material has been collated from a number of widely available compilations of information¹. Where more than one species is identified with a crop or genus, the gene pools are described with reference to the most important or first mentioned species.

¹ The most used sources are:

J. Smartt and N.W. Simmonds (eds.), 1995. *Evolution of Crop Plants*, Second Edition, Longman, UK.

L. Watson and M.J. Dallwitz, 1992. *The Grass Genera of the World*, CAB International, UK.

J. Smartt, 1990. *Grain Legumes: Evolution and Genetic Resources*, Cambridge University Press, Cambridge, UK.

**RELEVANT CHARACTERISTICS OF THE CROPS AND GENERA
IN THE TENTATIVE LIST OF CROPS
ANNEXED TO ARTICLE 11 OF THE CONSOLIDATED NEGOTIATING TEXT**

Crop		Rice	Oats	Rye	Barley
Genus		<i>Oryza</i>	<i>Avena</i>	<i>Secale</i>	<i>Hordeum</i>
Number of species in genus ⁽¹⁾		II	II	I	II
Species/crops cultivated in genus		<i>O. sativa</i> - Asian rice; <i>O. glaberrima</i> - African rice	<i>A. sativa</i> - oats; <i>A. nuda</i> - naked oats; <i>A. byzantina</i> ; <i>A. abyssinica</i>	<i>Secale cereale</i> - rye	<i>H. vulgare</i> - barley
Genepools	Primary	Approx. 7 species constitute “ <i>sativa</i> complex” of the “A” genome spp.	4 wild and cultivated species	Wild and cultivated taxa of <i>S. cereale</i> species complex	2 spp. (<i>H. vulgare</i> and <i>H. spontaneum</i>)
	Secondary		Other <i>Avena</i> spp.	Not defined	<i>H. bulbosum</i>
	Tertiary	Other species in genus	Other cereal species	Other cereal spp.	Other <i>Hordeum</i> spp.
Use of genepools in breeding research	Primary Genepool	Extensive - major contribution of key characters (e.g. <i>O. nivara</i>)	Extensive	Not known	Extensive
	Secondary and tertiary genepools	Not known	Not known	Not known	<i>H. bulbosum</i> important for haploid production
Notes			<i>Avena</i> spp. form a polyploid series from diploid to hexaploid	The crop <i>Triticale</i> is the product of wheat/rye hybridization	

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Pearl millet	Foxtail millet	Finger millet	Proso millet
Genus		<i>Pennisetum</i>	<i>Setaria</i>	<i>Eleusine</i>	<i>Panicum</i>
Approx. number of species in genus ⁽¹⁾		III	III	I	III
Species/crops cultivated in genus		<i>P. glaucum</i> - pearl millet	<i>S. italica</i> - foxtail millet	<i>E. corocana</i> - finger millet	<i>P. miliaceum</i> - proso millet; <i>P. sonorum</i> – sauwi; <i>P. sumatrense</i> - sama
Genepools	Primary	2 wild species (<i>P. violaceum</i> , <i>P. sieberanum</i>)	1 conspecific taxa (<i>S. italica</i> ssp. <i>viridis</i>)	Wild <i>E. africana</i> often considered conspecific with <i>E. corocana</i>	Not known
	Secondary	Not known	Not known	<i>E. indica</i>	Not known
	Tertiary	Not known	Not known	Not known	Not known
Use of genepools in breeding research	Primary genepool	Slight	Slight	Not known	Not known
	Secondary and tertiary genepools	Not known	Not known	Not used	Not used
Notes		Natural crossing between cultivated and wild forms of primary genepool is common			Several spp. of <i>Panicum</i> are valuable forages

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Fonio	Maize	Sorghum	Wheat
Genus (cultivated species)		<i>Digitaria</i>	<i>Zea</i>	<i>Sorghum</i>	<i>Triticum</i>
Approx. number of species in genus ⁽¹⁾		III	I	II	I note also related genus <i>Aegilops</i> with 22 spp.
Other crops cultivated in genus		<i>D. exilis</i> - fonio; <i>D. sanguinilis</i> - manna; <i>D. cruciata</i> - raishan; <i>D. iburua</i> - black fonio	<i>Z. mays</i> - maize	<i>S. bicolor</i> - sorghum	<i>T. aestivum</i> - bread wheats, (6 botanical vars.); <i>T. turgidum</i> - emmer wheats, durum wheats etc (8 botanical vars.); <i>T. monococcum</i> - einkorn wheats (2 botanical vars.)
Genepools	Primary	Not known	All spp. in genus <i>Zea</i>	Includes wild and cultivated forms of <i>S. propinquum</i> and <i>S. bicolor</i>)	All ABD <i>T. aestivum</i> subsp.
	Secondary	Not known	Other members of tribe Maydeae (includes <i>Tripsacum</i>)	<i>S. halepense</i>	Many <i>Triticum</i> and <i>Aegilops</i> spp. with A, B or D genomes or combinations of these
	Tertiary	Not known		<i>S. purpureosericeum</i> , Australian spp.	Related species in the tribe Triticeae including <i>Hordeum</i> , <i>Secale</i> , <i>Agropyron</i>
Use of genepools in breeding research	Primary Genepool	Not used	Extensive (significant natural crossing also occurs)	Introgression from wild forms important in crop evolution. Estimated that 21% of released cultivars possess genes obtained from wild materials	Very extensive
	Secondary and tertiary genepools	Not used	Seldom used	Intergeneric (<i>Sorghum</i> x <i>Saccharum</i>) crosses have been made	Substantial and significant
Notes		A number of <i>Digitaria</i> spp. are grown as crops in very localized regions. Fonio remains important in W. Africa.		Important forage types also found and developed from interspecific crosses	Classification used follows Feldman <i>et al.</i> in Simmonds and Smartt (1995). Genepools defined with reference to bread wheat

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Peanut	Cowpea	Peas	Beans
Genus		<i>Arachis</i>	<i>Vigna</i>	<i>Pisum</i>	<i>Phaseolus</i>
Approx. Number of species in genus ⁽¹⁾		III	III	I	II
Species/crops cultivated in genus		<i>A. hypogaea</i> - peanut, groundnut	<i>V. unguiculata</i> - cowpea; <i>V. Subterranea</i> - Bambarra groundnut; <i>V. radiata</i> - mungbean; <i>V. mungo</i> - black gram; <i>V. angularis</i> - Adzuki bean; <i>V. Aconitifolia</i> - moth bean; <i>V. Umbellata</i> - rice bean	<i>P. sativum</i> - peas	<i>P. vulgaris</i> - common, or snap bean; <i>P. lunatus</i> - lima bean; <i>P. coccineus</i> - runner bean; <i>P. polyanthus</i> - the year bean; <i>P. acutifolius</i> - tepary bean
Genepools	Primary	<i>A. hypogaea</i> , <i>A. monticola</i> and other wild tetraploid forms	Wild and cultivated ssp. of <i>V. unguiculata</i> .	<i>P. sativum</i> , (<i>sensu lato</i>)	<i>P. vulgaris</i> ,
	Secondary	Wild spp of section <i>Arachis</i> (approx. 12 spp.)	Viable interspecific crosses have not yet been reported	<i>P. fulvum</i>	<i>P. coccineus</i> , <i>P. polyanthus</i>
	Tertiary	Other members of genus		<i>Vicia</i> , <i>Lathyrus</i> , <i>Vavilovia</i>	All other spp. of the genus
Use of genepools in breeding research	Primary genepool	Used in breeding for yield and resistance to biotic and abiotic stresses	Little used	Extensively used	Used
	Secondary and tertiary genepools	Used in breeding for biotic stress	Not used	Little used	Used
Notes		A few <i>Arachis</i> species also cultivated as forages	A substantial number of <i>Vigna</i> spp. are cultivated and used as forages	<i>P. sativum</i> , <i>P. elatius</i> and <i>P. humile</i> are interfertile and have been classified in a single species (<i>P. sativum</i>)	Each domesticated <i>Phaseolus</i> spp. has a GP1 consisting of its domesticated and wild components. In this table genepools are identified for <i>P. vulgaris</i>

(1) I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Lentils	Soybean	Potato	Sweet Potato
Genus		<i>Lens</i>	<i>Glycine</i>	<i>Solanum</i>	<i>Ipomoea</i>
Approx. Number of species in genus ⁽¹⁾		I	I	III	I
Species/crops cultivated in genus		<i>L. culinaris</i> - lentil	<i>G. max</i> - soyabean	<i>S. tuberosum</i> - potato; <i>S. melongena</i> - eggplant (see note); <i>S. quitoense</i> - tulo; <i>S. muricatum</i> - pepiño; <i>S. topiro</i> - cocona	<i>I. batatas</i> - Sweet Potato
Genepools	Primary	<i>L. culinaris</i> , <i>L. orientalis</i> ,	<i>G. soja</i> - wild and domesticated taxa	<i>S. tuberosum</i>	<i>I. batatas</i> - wild and cultivated taxa
	Secondary	<i>L. odemensis</i> , <i>L. nigricans</i>	None	<i>S. acaule</i> , <i>S. spegazzinii</i> , <i>S. stoloniferum</i> , <i>S. vernei</i> , <i>S. demissum</i>	Other spp. in genus.
	Tertiary	Remaining spp. in genus	Other spp. in genus	Other spp. in genus	
Use of genepools in breeding research	Primary genepool	Little	Some	Extensive	Used
	Secondary and tertiary genepools	Not used	Not used	Limited use	Not known
Notes			Genetic isolation exists between most spp. of the genus	A considerable number of <i>Solanum</i> species are cultivated for their tubers including <i>S. stenotomum</i> , <i>S. phyreja</i> , <i>S. goniocalyx</i> , and interspecies hybrids	

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Yams	Cassava	Bananas, Plantains	Citrus
Genus		<i>Dioscorea</i>	<i>Manihot</i>	<i>Musa</i>	<i>Citrus</i>
Approx. number of species in genus ⁽¹⁾		III	III	II	II
Species/crops cultivated in genus		West African: <i>D. rotundata</i> - white yam; <i>D. cayenensis</i> - yellow yam; <i>D. dumetorum</i> - trifoliolate yam; Asian: <i>D. alata</i> - water yam; <i>D. esculenta</i> - Chinese yam; Asian and African: <i>D. bulbifera</i> - aerial yam; American: <i>D. trifida</i> - cush-cush yam	<i>Manihot esculenta</i> - cassava	<i>M. acuminata</i> ; <i>M. balbisiana</i> ; (<i>Eumusa</i>); <i>Australimusa</i> ; Fe'i bananas; <i>M. textilis</i> - Manilla hemp	<i>C. aurantifolia</i> ; <i>C. sinensis</i> ; <i>C. media</i> - citron; <i>C. reticulata</i> - mandarin; <i>C. maxima</i> - pummelo
Genepools	Primary	Wild relatives of similar geographic origin	Local or introduced landraces, improved cultivars and related wild spp. Wild <i>M. tristis saxicola</i>	Wild <i>M. acuminata</i> ; <i>M. balbisiana</i> ; <i>M. schizocarpa</i> for bananas and plantains	<i>C. media</i> , <i>C. reticulata</i> , <i>C. maxima</i>
	Secondary	Other spp. of the genus	Wild <i>M. glaziovii</i>	<i>M. textilis</i> , other <i>Eumusa</i> spp.	Other spp. in genus.
	Tertiary		Not known	Section <i>Callimusa</i> and other spp. in genus	Other related genera. See note
Use of genepools in breeding research	Primary Genepool	Little	Moderate	Extensive	Moderate
	Secondary and tertiary genepools	Not known	Little	Not used	Moderate
Notes				A substantial number of species cultivated as fibre, forage, medicine, etc. Genepool designation of fe'i bananas and manilla hemp differs from above	At least 5 spp. in other genera, <i>Fortunella</i> , <i>Poncirus</i> , <i>Microcitrus</i> , <i>Eremocitrus</i> , <i>Clymenia</i> , can be crossed with Citrus

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Sugarcane	Beet	Pumpkins, squashes	Tomato
Genus		<i>Saccharum</i>	<i>Beta</i>	<i>Curcubita</i>	<i>Lycopersicon</i>
Approx. Number of species in genus ⁽¹⁾		I	II	II	I
Species/crops cultivated in genus		<i>S. officinarum</i> - noblecanes; <i>S. edule</i>	<i>B. vulgaris</i> – sugarbeet; chard, spinach beet, forage beet, beetroot	<i>C. argyrosperma</i> , <i>C. ficifolia</i> , <i>C. moschata</i> , <i>C. maxima</i> , <i>C. pepo</i>	<i>L. esculentum</i> - tomato
Genepools	Primary	<i>S. robustum</i> , <i>S. spontaneum</i>	All species of section <i>Beta</i>	Wild or weedy forms of cultivated species	<i>L. esculentum</i> , <i>L. esculentum</i> var. <i>cerasiforme</i> , <i>L. pimpinellifolium</i> , <i>L. cheesmannii</i>
	Secondary	Not determined	Other species in genus	Some wild species of genus	<i>L. chmielewskii</i> , <i>L. hirsutum</i> , <i>L. parviflorum</i> , <i>L. pennellii</i>
	Tertiary	Other genera of Poaceae		Most species of genus	<i>L. chilense</i> , <i>L. peruvianum</i> , <i>Solanum lycopersicoides</i> , <i>S. tuberosum</i>
Use as genepools in breeding research	Primary Genepool	Substantial	Used	Some	Substantial
	Secondary and tertiary genepools	Significant	Use of section <i>Patellares</i> attempted	Occasional	Significant
Notes		Vigour and disease resistance provided by the wild spp. <i>S. spontaneum</i> have had a major impact on world production	Breeding for disease resistance, using wild spp. is important	The domesticated spp. are generally reproductively isolated from one another. Genepools of individual species overlap and definition is difficult. Hybrids between some cultivated species have been developed as cultivars	

^{c(1)} I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Coconut	Tannia	Taro	Cabbages, rape, mustard
Genus		<i>Cocos</i>	<i>Xanthosoma</i>	<i>Colocasia</i>	<i>Brassica</i>
Approx. number of species in genus⁽¹⁾		I	I	I	II
Species/crops cultivated in genus		<i>C. nucifera</i> - coconut. Both wild and domestic types are suitable for commercial production	<i>X. sagittifolium</i> - tannia	<i>C. esculenta</i> - taro; <i>C. fallax</i> - vegetable; <i>C. affinis</i> var. <i>Jenningsii</i> (ornamental)	Six spp of <i>Brassica</i> provide many oilseed, fodder and vegetable crops. <i>B. carinata</i> , Ethiopian mustard; <i>B. juncea</i> - oilseed rape and vegetables; <i>B. napus</i> - oilseed rape, swede; <i>B. nigra</i> - mustard; <i>B. oleracea</i> - cabbage, cauliflower, kale, brussels sprout, etc; <i>B. rapa</i> - oilseed rape, forage rape, turnip, Chinese cabbages
Genepools	Primary	Wild types of species	Wild and weedy forms of species	Cultivated and wild taxa	<i>B. oleracea</i> - several wild spp.; <i>B. rapa</i> and <i>B. nigra</i> also exist as wild forms
	Secondary	Not known	Not known	<i>Colocasia</i> spp.	Some interspecies crosses involving the 6 cultivated spp. are possible, e.g. <i>B. napus</i> x <i>B. rapa</i> . Some intergenus crosses are also possible (<i>B. oleracea</i> x <i>Raphanus sativus</i>)
	Tertiary	Not known	Not known	Not known	Many spp. from tribe Brassicaceae (50 genera, 217 spp.) can be intercrossed using embryo rescue
Use of genepools in breeding research	Primary Gene pool	Used	Not known	Little used	Routine and extensive
	Secondary and tertiary genepools	Not used	Not known	Not used	Significant
Notes		A monospecific genus			Not all crops have been listed. Related genera with similar crops include <i>Sinapis</i> - mustard, <i>Raphanus</i> - radish, <i>Lepidium</i> - cress, <i>Diplotaxis</i> and <i>Eruca</i> - rocket

^{c(1)} I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Onion, leek, garlic	Chickpea	Faba bean	Pigeon pea
Genus		<i>Allium</i>	<i>Cicer</i>	<i>Vicia</i>	<i>Cajanus</i>
Approx. number of species in genus ⁽¹⁾		III	II	III	II
Species/crops cultivated in genus		<i>A. cepa</i> - bulb onion; <i>A. cepa</i> var. <i>ascalonicum</i> - shallot; <i>A. cepa</i> var. <i>aggregatum</i> - potato onion; <i>A. schoenoprasum</i> - chive; <i>A. tuberosum</i> - Chinese chive; <i>A. fistulosum</i> - Japanese bunching onion; <i>A. sativum</i> - garlic; <i>A. ampeloprasum</i> var. <i>porrum</i> syn. <i>A. porrum</i> - leek; <i>A. chinense</i> - rakkyo	<i>C. arietinum</i> - chickpea	<i>V. faba</i> - faba bean	<i>C. cajan</i> – pigeonpea
Genepools	Prim ary	Wild spp.	<i>C. arietinum</i> , and <i>C. reticulatum</i>	<i>V. faba</i> spp. <i>faba</i> , <i>V. faba</i> spp. <i>paucijuga</i> Cultivated taxa	Cultivated taxa
	Seco ndary	<i>A. fistulosum</i>	<i>C. echinospermum</i>	Not known	<i>C. acutifolius</i> , <i>C. albicans</i> , <i>C. cajanifolius</i> , <i>C. lanceolatus</i> , <i>C. latisepalus</i> , <i>C. lineatus</i> , <i>C. reticulatus</i> , <i>C. scarabaeoides</i> , <i>C. sericeus</i> , <i>C. trinervius</i>
	Terti ary	Not known	<i>C. bijugum</i> , <i>C. judaicum</i> , <i>C. pinnatifidum</i> , <i>C. cuneatum</i> , and possibly all remaining <i>Cicer</i> spp.	Other species in genus	<i>C. goensis</i> , <i>C. heynei</i> , <i>C. kerstingii</i> , <i>C. mollis</i> , <i>C. platycarpus</i> , <i>C. rugosus</i> , <i>C. volubilis</i> , other <i>Cajaninae</i> (eg. <i>Rhynchosia</i> , <i>Dunbaria</i> , <i>Eriosema</i>)
Use as genepools in breeding research	Prim ary Gene pool	Little	Little	Little	Little
	Seco ndary and terti ary genepools	Little	Not used	Little	Little
Notes		Another 18 spp. are used as fresh vegetables, flavouring or pickled. There is often low fertility between bulb onion and its wild relatives. Embryo rescue offers the possibility of increasing the number		Some degree of self pollination within the spp. So far it has not been possible to produce viable inter-specific hybrids with <i>V. faba</i>	

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop		Melons	Flax	Sunflower	Cotton
Genus		<i>Cucumis</i>	<i>Linum</i>	<i>Helianthus</i>	<i>Gossypium</i>
Approx. number of species in genus ⁽¹⁾		II	III	III	II
Species/crops cultivated in genus		<i>C. sativus</i> - cucumber; <i>C. melo</i> - melon; <i>C. anguria</i> – West Indian gherkin; <i>C. metuliferus</i> - African horned cucumber or jelly melon	<i>L. usitatissimum</i> - flax, linseed	<i>H. annuus</i> - sunflower; <i>H. tuberosus</i> - Jerusalem artichoke	<i>G. arboreum</i> , <i>G. herbaceum</i> , both African-Asian diploids; <i>G. hirsutum</i> , <i>G. barbadense</i> , both New World tetraploids
Genepools	Primary	<i>C. sativus</i> var. <i>sativus</i> , <i>C. sativus</i> var. <i>hardwickii</i>	7 species, particularly <i>L. angustifolium</i>	<i>H. annuus</i> , weedy and wild races, <i>H. agrophyllus</i> , <i>H. petiolaris</i>	Closely related diploid species in genus
	Secondary	<i>C. melo</i> , <i>C. metuliferus</i> , <i>C. anguria</i> , <i>C. zeyheri</i>	Other species in genus	<i>H. tuberosus</i>	Other species in genus
	Tertiary	Not known		Not known	
Use of genepools in breeding research	Primary Genepool	Little	Little	Moderate	Substantial
	Secondary and tertiary genepools	Little	Not used	Little	Moderate
Notes		Molecular level studies necessary to resolve the systematic and phylogenetic problems of the genus			Definition of genepools is complex and depends on species concerned. Modern cultivars developed from these 4 domesticated spp.

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species

Crop	Oil Palm	
Genus	<i>Elaeis</i>	
Approx. number of species in genus ⁽¹⁾	I	
Species/crops cultivated in genus	<i>E. guineensis</i> - oil palm; <i>E. oleifera</i>	
Genepools	Primary	<i>E. guineensis</i> , <i>E. oleifera</i>
	Secondary	Not known
	Tertiary	Not known
Use of genepools in breeding research	Primary Genepool	Moderate
	Secondary and tertiary genepools	Moderate
Notes	Major breakthrough in breeding is provided by the possibility of vegetative reproduction through tissue culture	

⁽¹⁾ I = 1-15 species ; II = 15-50 species ; III = over 50 species