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BASE COLLECTIONS OF PLANT GENETIC RESOURCES

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I. INTRODUCTION

1. The International Undertaking on Plant Genetic Resources as adopted by Resolution 8/83 of the 22nd session of the FAO Conference states under 'International Arrangements' (sub-article 7.1a) that 'there develops an internationally coordinated network of national, regional and international centres, including an international network of base collections in genebanks, under the auspices or the jurisdiction of FAO, that have assumed the responsibility to hold, for the benefit of the international community and on the principles of unrestricted exchange, base or active collections of the plant genetic resources of particular plant species'.

2. This report has been prepared to inform the FAO Commission on Plant Genetic Resources on the purpose, nature and present state of base collections, which together with the active collections will form the core of any international network on plant genetic resources, and to seek its views on the further development and particular actions required for the development of such a network. In cooperation with national and international scientific institutions, the International Board for Plant Genetic Resources (IBPGR), has designated base collections for major and minor crop plants which form the IBPGR global network of genebanks.

II. THE NATURE AND ROLE OF BASE COLLECTIONS

3. The concept and definitions of base and active collections were developed by an FAO Panel of Experts on Plant Exploration and Introduction during meetings in 1970 [1/] and 1973 [2/] and also clearly described to the international community at an FAO/International Biological Programme (IBP) Technical Conference held at FAO in 1973. Genetic resources centres may be composed of either or both of the following components:

(i) base collections, for long term storage;

(ii) active collections for:
  (a) medium term storage;
  (b) regeneration;
  (c) multiplication and distribution;
  (d) evaluation;
  (e) documentation.

4. If they are not situated in the same institution collaborative links between them will be necessary to ensure availability of germplasm for distribution and exchange.

Base collections, are those considered to include substantial variability and are for long term storage under adequate conditions; they are not to be used as a routine source for distribution. The major role of a base collection is to act as a custodian of the genetic resources in its care. Materials are only removed from base collections for infrequent regeneration when seed viability has started to decline below an acceptable regeneration standard, or when stocks of an accession are no longer available from an active collection.

Active collections are those from which seed samples are drawn for distribution, multiplication and evaluation. Storage conditions are less stringent because seeds are not stored for long periods.

Breeders working collections were regarded by the FAO Panel as outside the scope of a genetic conservation framework but they may generate useful information about the materials held in the active and base collections.

5. Only the base collections of the major crops, whose genetic resources can be stored in the form of seeds, are considered in detail in this report. The report does

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1/ Report of the 4th Session of the FAO Panel of Experts on Plant Exploration and Introduction. FAO, Rome.

2/ Report of the 5th Session of the FAO Panel of Experts on Plant Exploration and Introduction. FAO, Rome.

not attempt to deal with active collections, working collections nor vegetative collections in field genebanks [1/].

6. It was envisaged by the. FAO Panel that base collections would require considerable capital and financial expenditure for establishment as well as maintenance. A relatively small number of such collections were considered sufficient to conserve the world's germplasm, taking due account of practical constraints.

7. When the IBPGR Was created in 1974, it adopted the above definitions of the role of base and active collections as well as the principle of free availability of genetic resources.

III. THE ESTABLISHMENT OF AN INTERNATIONAL NETWORK, OF BASE COLLECTIONS

(a) HISTORICAL BACKGROUND

8. The FAO Panel made proposals towards the establishment of an international network, considering a series of regional genebanks to service a number of countries within specific regions related to the centres of genetic diversity of crop species and existing international centres dealing with crops.

9. In 1971 the Consultative Group on International Agricultural Research (CGIAR) was established which provided a funding mechanism for the International Agricultural Research Centres (IARC's). A proposal by FAO and its Panel of Experts was submitted to the CGIAR for an international programme on crop genetic resources and this led to the creation of IBPGR in 1974 by the CGIAR.

10. A few genebanks with storage facilities suitable for conservation of base collections were in existence in the early seventies in industrial countries. Two new regional centres [2/] were established with bilateral support as proposed by the FAO Panel.

11. During the developmental phase (1975 - 1980) the IBPGR adopted approaches based on the importance of crops, the emergency to preserve endangered germplasm and their geographical distributions in relation to their centres of diversity. The IBPGR had proposed a number of regional cooperative programmes. However, it became obvious from attempts to operate regional programmes that in many cases a regional approach met with considerable difficulties due to sensitivities of neighbouring countries. Therefore emphasis was directed to national centres and programmes as the operating units, with the exception of the already established regional centres and International Agricultural Research Centres under the financial support of CGIAR.

12. The net result was a pragmatic approach in designating base collections organized on a crop by crop basis. The network evolved after extensive discussion with participating institutes and took into account their interest, expertise and available funding.

13. The initial recommendation by the FAO Panel to have the base collections situated in the centres of crop diversity was not implemented. As an immediate solution, institutes with good seed storage facilities and important collections of genetic resources of specific crops were considered suitable to be invited to participate in this network. Consequently, the global network consisted initially of base collections mostly situated in institutes in developed countries. It has been the conscious policy of the IBPGR to alter this balance and have the base collections of crops more equitably distributed as soon as facilities could be provided, notably those of the IARCs.

1/ Conservation of collections of vegetative material is usually carried out in field genebanks. The living material is maintained as specific genotypes in the field, orchard or plantation. For species such as potato and cassava, in-vitro techniques for medium-term conservation are also available.

2/ Centro Agronomico Tropical, de Investigacion y Ensenanza (CATIE), Costa Rica and Plant Genetic Resources Centre (PGRC/E), Ethiopia

(b) THE IBPGR NETWORK OF GENEBANKS

14. The IBPGR developed a network based on existing centres to hold base collections of the major crops and their wild relatives. The establishment of the network began in 1976, when five centres agreed to collaborate. Since then it has grown to include 35 institutes situated in 28 countries, which have either formally agreed to participate or have been invited and are currently considering the commitments involved in participation (Annex I). It has been considered that about 50 base collections would form a reasonably complete network and in order to complement the existing network a further seven institutes will be invited by the IBPGR to participate when long-term seed storage facilities are available, making a total of 42 genebanks holding base collections in the network [1/].

15. The ideal would be to ensure that for each major food crop there is a minimum of two centres that accept the responsibility for holding a global base collection as part of a network of participating centres. Further collections would be held for security purposes either as global collections or as specific regional collections to duplicate the materials held in the major base collections. Global collections include as wide a range of genetic variation as possible from all centres of diversity of that crop. Regional collections complement global collections in that they contain the major variation found in specific regions. These are especially important for centres holding collections from regions of primary or secondary crop diversity.

16. The storage conditions used for conservation of base collections must be adequate to maintain viability over long periods. Genebanks which have taken the responsibility for holding base collections must attain the highest standards whenever possible. However, not all base collections are currently stored under conditions that adhere strictly to these standards, although several genebanks are up-grading their seed storage facilities to the new standards for long-term storage of base collections [2/].

IV. RANGE OF GERMPLASM IN BASE COLLECTIONS

17. At present base collections conserve germplasm of all the major temperate and tropical crops, including the major cereals, food legumes and vegetables which either have a wide distribution or are of considerable economic importance and have seeds which are suitable to be kept under long-term storage conditions.

18. The inclusion of root and tuber crops in a network of base collections is limited to those which can be stored as seeds. To date cassava, potato and sweet potato are included in base collections due to the feasibility of storing such germplasm as seed. Other major tropical tuber crops such as yam, cocoyam and taro are not stored in the form of seed and base collections have therefore not been designated.

19. Several crops which are not used directly for human consumption, but are important for livestock or industry and have important germplasm which is in danger of erosion, are being stored in base collections. These include germplasm of beet, sugarcane, cotton and tree species used for fuelwood or environmental stabilisation in arid areas. Other crops, including forages, sunflower and grape have been the subject of working groups and expert consultations and recommendations have been made concerning the conservation of threatened germplasm. Suitable centres will be invited by the IBPGR to take the responsibility for conserving base collections.

20. Some other crops, not usually conserved by seed storage, are outside the scope of this report. However, several national institutes hold large vegetative collections and ensure their adequate conservation. These crops include banana, cocoa, rubber, apple, sugarcane, coconut, oil palm and *Citrus*. The centres holding large collections of these crops are listed in the appropriate IBPGR crop directories.

1/ Hanson, J., Williams, J.T. and Freund R. 1984. Institutes conserving crop germplasm: The IBPGR global network of genebanks.

2/ Report of the Third Meeting of the IBPGR Seed Storage Advisory Committee

V. QUANTITY AND VARIATION OF GERMPLASM HELD

21. Estimates of the amount of variation stored in base collections are unreliable due to lack of documentation of existing collections, but no base collection contains the complete range of variation of any crop. However, base collections include germplasm showing considerable variation from the centres of diversity of the major crops.

22. Wild and weedy species related to crop plants provide a source of germplasm of potential importance in plant breeding for specific characters. In some cases the wild relatives have been collected along with the crop and where collections are available and of special importance to plant breeders, centres have already taken responsibility for conserving these in base collections, as in the case of wheat, rice, rye, brassicas, cucurbits, tomato, potato, soyabean, Phaseolus, Vigna and groundnut. The numbers of accessions of wild species held in base collections varies from crop to crop, depending both on the amount of collecting that has been carried out and the degree of emphasis on wild species within crop improvement programmes. In the future more emphasis should be placed on the inclusion of germplasm of related wild species in base collections.

23. Despite the gaps in collections, the amount of germplasm held in genebanks is already considerable. A true estimate of numbers of distinct accessions held in storage is extremely difficult to arrive at because of duplication. However, in order to give some indication of the numbers involved, the total numbers of accessions held in base collections within the IBPGR network are given in Annex II. These figures take no account of duplication between base collections. It should be pointed out that the number of accessions of any crop is not a reliable guide to the amount of variation which is included in a base collection.

VI. SECURITY AND DUPLICATION

24. In order to ensure the continued safety of base collections, all accessions should be duplicated in at least one other alternative site. The strategy for the selection of sites for the storage of duplicate samples of genetic resources should consider physical security, high scientific standards and interest in the germplasm, so that the maintenance of the base collection does not become a burden.

25. The present status within the developing network is that in most cases a minimum of two centres have agreed with the IBPGR to hold the base collections for the major food crops and in many cases up to four different genebanks have jointly accepted the responsibility (Annex I). The number of participating centres has been determined by those expressing positive interest in the crop and willing to hold a base collection in adequate facilities. While all the staple cereals have several sites responsible for their conservation, several other crops have only one centre designated to hold a base collection.

26. Although sites have been identified and genebanks have taken on the responsibility in collaboration with the IBPGR for holding base collections, complete duplication of collected germplasm has yet to be achieved for any of the major food crops. An estimated 50 per cent of the collections per crop have been duplicated in other base collections and is also duplicated in several active collections, where it undergoes characterization and evaluation and from where it is available for distribution. Duplication of accessions between the base collections has been hindered by practical constraints, such as the quantity and quality of seed required and quarantine restrictions.

VII. LEGAL STATUS OF GENETIC RESOURCES IN BASE COLLECTIONS

27. Little information is available about the legal status of genebanks which have been recognised by the IBPGR as holders of base collections. There is also no complete information on the rules and procedures governing their management.

28. All institutes recognised as holding base collections for particular crops have been established under the national laws of the countries in which they are located. This is also true for International Agricultural Research Centres supported by the CGIAR which are granted an autonomous character governed by a Board of Trustees.

29. Genetic resources deposited in base collections of national institutes are the property of the institute and of the respective country because all institutes designated so far are public institutions. The actual status may vary according to national laws. Base collections of genetic resources in the IARC's are the property of that centre and under the jurisdiction of the Board of Trustees.

30. These governmental or institutional property rights do not necessarily conflict with unrestricted access to the germplasm. Germplasm collections often depend on such exchange to acquire new material and therefore usually have provision for free exchange in their charter. The letter of agreement issued by the IBPGR in designating a base collection includes the commitment of the respective institute to guarantee unrestricted access to the germplasm contained in the collection. This implies that the distribution from base collections is indirect, through active collections which take responsibility for regeneration and multiplication in collaboration with base collections.

31. Governments or institutions agreeing to give effect to the International Undertaking on Plant Genetic Resources agree with the principle of unrestricted access to plant genetic resources contained in base collections and exchange from active collections. Notifying the Director General of FAO that they wish the base collection or collections for which they are responsible to be recognised as part of the international network of base collections, in genebanks under the auspices of FAO, would imply the acceptance of unrestricted exchange.

32. Each institution accepting to function as a base collection for a particular crop or group of crops within the Undertaking should make provision in its charter or terms of reference to include provision for unrestricted access to germplasm as one of its basic principles of operation.

CONSIDERATIONS FOR FUTURE DEVELOPMENT

33. Base collections have to be considered as the major world depositories of genetic resources for those plant species whose genetic diversity cannot be easily conserved in situ. They are therefore of particular importance to the international community as a whole, in order to avoid the risk of losing such genetic diversity and to ensure its availability for present plant breeding needs and for future generations.

34. So far base collections have been designated or are in the stage of being designated by IBPGR for 55 major crops or groups of crop plants which can be conserved as seeds in 42 national or international institutes. The main criteria for the selection of the respective institutes has been pragmatic and considered expertise, the importance of germplasm collections in the institutes and the standards of the facilities for secure storage of germplasm.

35. If endorsed by the Commission, the Director-General will approach the respective governments or international institutions to notify him that they wish the base collection or collections for which they are responsible to be recognised as part of the international network of base collections in genebanks under the auspices of FAO as outlined in the International Undertaking on Plant Genetic Resources. This notification should include the declaration of readiness to make material in the base collections available to participants in the Undertaking through relevant active collections for unrestricted mutual exchange.

36. Furthermore the Commission might wish to consider the suitability of crop and geographical coverage of germplasm in this network of base collections and to recommend improvements and complementation.

37. As the base collections are being considered as international security collections to maintain genetic variability on a crop by crop basis and to halt genetic erosion, an assessment should be made of the comprehensiveness of the collections. Such an assessment is closely related to improved documentation of passport and characterization data of individual samples, as outlined in document CPGR:85/5. Nevertheless, it must be recognised that for the larger part of genetic resources not in immediate demand, it would be sufficient to have it maintained in base collections for potential use. This would reduce the burden on active collections. Assessments of this kind could be provided by FAO in collaboration with the IBPGR and advice given at the same time on gaps to be filled and rationalisation of genetic resources maintenance.

38. Closely related to such an assessment of comprehensiveness is progress in the duplication of base collections, needed to ensure against losses by man-made or natural catastrophes. Efforts have only been started and have to be urgently pursued. FAO should, with the assistance of the IBPGR, systematically negotiate such arrangements, including the mobilization of financial resources if required.

39. In this context, possibilities should be explored to establish international security base collections in particular environments, e.g. dry, cold climates, where maintenance costs could be low.

40. The development and designation of 'base' in vitro collections for vegetatively propagated major crop plants needs to be strongly pursued. As the development of depositories using cryo-preserved tissue culture will develop only gradually, the IBPGR might consider to develop its network of field genebanks (where clonal materials are maintained as a 'living collection' or clonal repository in field, orchards or plantations) or active in vitro culture genebanks (where materials are maintained as tissue cultures) as main world in vivo collections, functioning as quasi base collections, as long as the status of cryo-preservation cannot be attained. Particular safety measures including quarantine might need to be worked out on a crop specific basis for these in vivo collections.

41. Institutes holding designated base collections are expected to ensure that their standards of conservation and maintenance of the collections conform to acceptable international scientific standards. This requires sufficient financial support and trained manpower, including a seed physiologist and a documentation expert in each genebank.

42. Institutes holding base collections as part of the international network of the International Undertaking on Plant Genetic Resources should invite FAO/IBPGR to assess the quality and standard of their operation and management. Assessment missions should also seek information on the rules and procedures under which the respective genetic resources centre operates and on its financial security.

43. Curators involved with the conservation of a particular crop should cooperate with all others working with that crop to ensure adequate duplication of samples, to rationalise responsibilities and to avoid duplication of effort. This may require cooperative agreements between governments and the legal aspects of such agreements must be considered.

44. For each base collection, clear established links should exist with active collections for the regeneration and exchange of germplasm. Such links need to be documented in a register which should be published by FAO in collaboration with the IBPGR.

45. Active collections are the main instruments through which germplasm exchange takes place. Each substantive national plant breeding programme will attempt to establish its own active collection in support of its plant breeding efforts. Active collections have also been established for groups of countries sharing genetic resources to reduce costs of maintenance and operation.

46. Active collections of genetic resources in developing countries are very commonly in need of stronger support, either for their establishment or even for maintenance, training of manpower and organization. Needs of developing countries should be assessed and support generated as warranted from national, bilateral or international sources. This assessment should include the links to national plant breeding programmes to ensure increased evaluation of genetic resources and their actual use in crop development. FAO might assist in these assessments and in generating support.

47. The Commission will regularly review the development of the international network of base collections. The inclusion of other crops in the network will be considered in these reviews in the light of changing priorities for conservation. Germplasm which was regarded as safe may become endangered due to many factors and it may be necessary to form base collections to ensure its safety.

Annex I.

IBPGR designated base collections for seed crops

Crop	Species/Type	Representation	Institute
CEREALS			
Barley	Cultivated and Wild	Global	PGR, Ottawa, Canada
		European	NGB, Lund, Sweden
		African	PGRC, Addis Ababa, Ethiopia
		Asian	NIAR, Tsukuba, Japan
Maize	Cultivated	New World	NSSL, Fort Collins, USA
		Asian	NIAR, Tsukuba, Japan
		Asian	TISTR, Bangkok, Thailand
		European	VIR, Leningrad, USSR*
		South European	Portuguese Genebank, Braga
Millets	Pennisetum spp.	Global	NSSL, Fort Collins, USA
		Global	PGR, Ottawa, Canada
		Global	ICRISAT, Hyderabad, India
	Eleusine spp.	Global	PGRC, Addis Ababa, Ethiopia
		Global	ICRISAT, Hyderabad, India
	Minor millets	Global	NBPGR, New Delhi, India
	Eragrostis spp.	Global	PGRC, Addis Ababa, Ethiopia
	Panicum miliaceum	Global	ICRISAT, Hyderabad, India
	Setaria italica	Global	ICRISAT, Hyderabad, India
Oats	Cultivated and Wild	Global	PGR, Ottawa, Canada
		Global	NGB, Lund, Sweden
Rice	Oryza sativa – indica	Global	IRRI, Los Banos, Philippines
	javanica	Global	IRRI, Los Banos, Philippines
	javanica	Global	NIAR, Tsukuba, Japan
		African	IITA, Ibadan, Nigeria
		Temperate	NSSL, Fort Collins, USA
	Wild Species	Global	IRRI, Los Banos, Philippines
Rye	Cultivated and Wild	Global	Polish Genebank, Radzikow
		Global	NGB, Lund, Sweden
	Wild Species	Global	ARARI, Izmir, Turkey*
Sorghum	Cultivated and Wild	Global	NSSL, Fort Collins, USA
		Global	ICRISAT, Hyderabad, India
Wheat	Cultivated and Wild	Global	VIR, Leningrad, USSR*
		Global	CNR, Bari, Italy
		Global	NSSL, Fort Collins, USA
	Wild Species of Triticum and Aegilops	Global	PGI, University of Kyoto, Japan

Crop	Species/Type	Representation	Institute
FOOD LEGUMES			
Chickpea		Global	ICRISAT, Hyderabad, India
Faba bean		Global	CNR, Bari, Italy
Groundnut	Cultivated and wild	Global	ICRISAT, Hyderabad, India
		South American	INTA, Pergamino, Argentina
		Global	CENARGEN/EMBRARA, Brazil
Lupin	Cultivated	Global	ZIGuK, Gatersleben, GDR
		European	INIA, Madrid, Spain
Pea	Cultivated	Global	NGB, Lund, Sweden
		South European	CNR, Bari, Italy
		Central and East European	Polish Genebank, Radzikow
Phaseolus	Cultivated and wild	Global	CIAT, Cali, Colombia
		Global	NSSL, Fort Collins, USA
		European	FAL, Braunschweig, FDR
	Wild species	Global	University of Gembloux, Belgium
Pigeon pea		Global	ICRISAT, Hyderabad, India
Soyabean		Global	NSSL, Fort Collins, USA
		Global	NIAR, Tsukuba, Japan
	Perennial species	Global	CSIRO, Canberra, Australia
Vigna spp.	Vigna radiata	Global	IPB, Loas Banos, Philippines
		Global	AVRDC, Province of Taiwan, China
	Vigna unguiculata	Global	IITA, Ibadan, Nigeria
		Global	NSSL, Fort Collins, USA
	Vigna angularis	Global	NIAR, Tsukuba, Japan
	Wild species	Global	University of Gembloux, Belgium
Winged bean		Global	IPB, Los Banos, Philippines
		Global	TISTR, Bangkok, Thailand
VEGETABLES			
Allium		Global	NVRS, Wellesbourne, UK
		Global	NSSL, Fort Collins, USA
		Global	IVT, Wageningen, Netherlands
		Asian	NIAR, Tsukuba, Japan
		European	RCA, Tapioszele, Hungary
	Vegetative	Global	Israel Genebank, Israel
Amaranthus		Global	NSSL, Fort Collins, USA
		Asian	NPBGR, New Delhi, India
Capsicum		Global	CATIE, Turrialba, Costa Rica
		Global	IVT, Wageningen, Netherlands

Crop	Species/Type	Representation	Institute
Crucifers	Brassica crinata	Global	FAL, Braunschweig, FDR
		Global	PGRC, Addis Ababa, Ethiopis
	B. capestris	Global	FAL, Braunschweig, FDR
		Global	PGR, Ottawa, Canada
		Global	NVRS, Wellesbourne, UK
		Asian	NIAR, Tsukuba, Japan
	B. juncea	Global	FAL, Braunschweig, FDR
		Global	PGR, Ottawa, Canada
		Global	NVRS, Wellesbourne, UK
		Asian	NIAR, Tsukuba, Japan
	B. napus	Global	FAL, Braunschweig, FDR
		Global	PGR, Ottawa, Canada
		Global	NVRS, Wellesbourne, UK
		Asian	NIAR, Tsukuba, Japan
	B. oleracea	Global	NVRS, Wellesbourne, UK
		Global	IVT, Wageningen, Netherlands
		Asian	NIAR, Tsukuba, Japan
	Raphanus spp.	Global	NVRS, Wellesbourne, UK
		Asian	NIAR, Tsukuba, Japan
	Sinapis alba	Global	FAL, Braunschweig, FDR
		Global	PGR, Ottawa, Canada
		Asian	NIAR, Tsukuba, Japan
	Wild species	Global	Universidad Politécnica, Madrid, Spain
		Global	Tohoku University, Sendai, Japan
Cucurbits	Benincasa spp.	Global	IPB, Los Banos, Philippines
	Citrullus spp.	Global	NSSL, Fort Collins, USA
		Global	INIA, Madrid, Spain
		Global	VIR, Leningrad, USSR*
	Cuccumis spp.	Global	NSSL, Fort Collins, USA
		Global	INIA, Madrid, Spain
		Global	VIR, Leningrad, USSR*
	Cucurbita spp.	Global	NSSL, Fort Collins, USA
		Global	VIR, Leningrad, USSR*
	Lagenaria siceraria	Global	CATIE, Turrialba, Costa Rica*
	Luffa spp.	Global	IPB, Los Banos, Philippines
	Momordica spp.	Global	IPB, Los Banos, Philippines
	Sechium edule	Global	CATIE, Turrialba, Costa Rica*
	Trichosanthes spp.	Global	IPB, Los Banos, Philippines
Eggplant		Global	IVT, Wageningen, Netherlands
		New World	NSSL, Fort Collins, USA
Okra		Global	NSSL, Fort Collins, USA
		African	OSTROM, Abidjan, Ivory Coast
Tomato		Global	CATIE, Turrialba, Costa Rica
		Global	ZIGuK, Gatersleben, GDR
		Global	NSSL, Fort Collins, USA
		Asian	IPB, Los Banos, Philippines
Southeast Asian Vegetables		South-east Asian	IPB, Los Banos, Philippines

Crop	Species/Type	Representation	Institute
ROOT CROPS			
Cassava	Seeds of wild and cultivated species	Global	CIAT, Cali, Colombia
Potato	Seeds of wild and cultivated species	Global	CIP, Lima, Peru
Sweet potato	Seeds	Global	NSSL, Fort Collins, USA
		Global	NIAR, Tsukuba, Japan
		Global	IITA, Ibadan, Nigeria*
		Asian	AVRDC, Province of Taiwan, China
INDUSTRIAL CROPS			
Beet		Global	FAL, Braunschweig, FDR
		Global	NGB, Lund, Sweden
		South European	Greek Gene Bank, Thessaloniki
		European	NVRS, Wellesbourne, UK
Sugarcane Seed		Global	NSSL, Fort Collins, USA
		Global	NIAR, Tsukuba, Japan
Cotton		European	Greek Gene Bank, Thessaloniki
OTHERS			
Forages		European	INIA, Madrid, Spain
		European	CNR, Bari, Italy
Tree spp.	Arid zone environmental stabilization and fuel	Global	Royal Botanic Gardens, Kew, UK

* Under discussion or awaiting formal agreement

Annex II.

Distribution of germplasm within the IBPGR designated base collections

Crop	National Centres	International Centres	Total number of centres	Approx. number of accesssions
Cereals				
Barley	5	1	6	48 500
Maize	5	1	6	34 000
Millets	5	1	6	22 000
Oat	2		2	17 500
Rice	2	2	4	101 000
Rye	3		3	1 500
Sorghum	1	1	2	37 000
Wheat	4		4	103 500
Food Legumes				
Chickpea		2	2	17 000
Faba bean	1	1	2	4 000
Groundnut	2	1	3	10 500
Lentil		1	1	5 500
Lupin	1		1	1 000
Pea	3		3	5 000
Phaseolus	3	1	4	37 000
Pigeon pea	1	1	2	10 000
Soyabean	4		4	12 000
Vigna	5	2	7	20 000
Windged bean	2		2	500
Vegetables				
Allium	5		5	500
Amaranthus	4		4	1 000
Capsicum	3		3	1 700
Crucifers	9		9	5 000
Cucurbits	8		8	17 000
Eggplant	5		5	600
Okra	5		5	2 000
Tomato	4		4	7 000
Root and tuber crops				
Cassava		1	1	+
Potato		1	1	14 500
Sweet potato	2	2	4	1 700
Industrial crops				
Beet	4		4	400
Sugarcane	3		3	+
Cotton	4		4	7 500
Others				
Arid zone tree species	1		1	50

+ Major collections held in vegetative form

Annex III.

Key to acronyms

ARARI	- Aegean Regional Agricultural Research Institute (Turkey)
AVRDC	- Asian Vegetable Research and Development Center (China)
CATIE	- Centro Agronomico Tropical de Investigacion y Ensenanza (Costa Rica)
CENARGEN	- Centro Nacional de Recrusos Genéticos (Brazil)
CIAT	- Centro Internacional de Agricultura Tropical – CGIAR
CIP	- Centro Internacional de la Papa – CGIAR
CNR	- Consiglio Nazionale delle Ricerche (Italy)
CSIRO	- Commonwealth Scientific and Industrial Research Organization (Australia)
EMBRAPA	- Empresa Brasileira de Pesquisa Agropecuaria (Brazil)
FAL	- Institut für Pflanzenbau und Pflanzenzüchtung der Bundesforschungsanstalt für Landwirtschaft (Federal Republic of Germany)
ICRISAT	- International Crops Research Institute for the Semi-Arid Tropics – CGIAR
IITA	- International Institute of Tropical Agriculture – CGIAR
INIA	- Instituto Nacional de Investigaciones Agrarias (Spain)
INTA	- Instituto Nacional de Tecnologia Agropecuaria (Argentina)
IPB	- Institute of Plant Breeding (Philippines)
IRRI	- International Rice Research Institute – CGIAR
IVT	- Institute for Horticultural Plant Breeding (Netherlands)
NBPGR	- National Bureau of Plant Genetic Resources (India)
NGB	- Nordic Gene Bank
NIAR	- National Institute of Agrobiological Resources (Japan)
NSSL	- National Seed Storage Laboratory (USA)
NVRS	- National Vegetable Research Station (UK)
ORSTOM	- Office de la recherché scientifique et technique d’outre-mer (France)
PGI	- Plant Germplasm Institute, University of Kyoto (Japan)
PGR	- Plant Gene Resources of Canada (Canada)
PGRC	- Plant Genetic Resources Centre (Ethiopia)
RCA	- Research Centre for Agrobotany (Hungary)
TISTR	- Thailand Institute of Scientific and Technical Research (Thailand)
USDA	- United States Department of Agriculture (USA)
VIR	- N.I. Vavilov Institute of Plant Industry (USSR)
ZIGuK	- Zentralinstitut für Genetik und Kulturpflauzenforschung (German Dem. Rep.)