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INTERNATIONAL INFORMATION KSYSTEM ON PLANT GENTIC RESOURCES

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I. GENERAL INTRODUCTION

1. In adopting Resolution 8/83, International Undertaking on Plant Genetic Resources, the 22nd FAO Conference "stressed the importance of evaluation and documentation of plant genetic resources and agreed that a central focus for plant genetic resources information would be desirable in order to provide all users with the most recent plant genetic resources data necessary for the improvement of their most important crops".

It consequently "recommended that the Director-General initiate the adoption of measures aimed at establishing an International Information System on Plant Genetic Resources, under the co-ordination of FAO, including an analysis of its financial implications".[1/]

2. The Director-General presents this report to the 1st Session of the commission on Plant Genetic Resources in pursuance of that recommendation and as a first step towards initiating the adoption of relevant measures.

3. This study has used information from the Report of the Director-General to the 22nd Session of the FAO Conference on Plant Genetic Resources (C 83/25), various reports, publications and unpublished material from the International Board for Plant Genetic Resources (IBPGR), which is one of the International Agricultural Research Centres (IARC) of the Consultative Group for International Agricultural Research (CGIAR).

4. It focuses on the management and dissemination of data. Such data are linked inextricably with the collection, conservation, maintenance, evaluation, exchange and use of the resource material itself. Databanks are only as good as the quantity and quality of the information they contain.

5. Information and its management are indispensable components of practical work with germplasm resources. Information is generated at all stages from initial collection to final release of new cultivars. Collection and maintenance of genetically diverse materials are of little value unless primary information on their source, character and subsequent evaluation are available and documented.

6. Important characteristics of germplasm databanks are: firstly the data refer to actual material, stored in specific locations or growing ex situ or in situ. Such databanks are essentially inventories, albeit sophisticated ones, of actual resource stocks. They are not, in general, conceptually independent information stores as are, for instance, databanks on the physical characteristics of metals. Secondly, the size of each record relating to a particular accession has to be open ended. New data continues to be generated and complements, rather than invalidates, the older data, and so the size of the file might grow although the size of the collection may be static.

1/ Report of the Conference of FAO, 22nd Session, Rome, 5-23 November, 1983.

II. THE CATEGORIES OF PLANT GENETIC RESOURCES DATA

7. Three classes of data on collections in genebanks are usually distinguished:

(a) Maintenance data on individual samples;

(b) Passport data on individual samples;

(c) Properties of the accessions, ascertained by observation and evaluation.

8. Maintenance data are essentially for stockcontrol and are primarily a management tool for the curators of collections. It is unnecessary to include them in any information exchange outside of the genebank.

9. Passport data provide basic details on the origin and source of the sample, scientific and common names, cultivar names and synonyms, together with pertinent data recorded at the time of collecting. It is needed to identify the sample and provide broad ecological and geographical data, locate duplicates and to rationalize holdings. It is also used to identify 'gaps' in collections in relation to particular ecological or geographic zones. Passport data must be considered as the absolute minimum data for each accession in a collection.

10. More detailed information on the habitat of the origin of the sample, including agroclimatic characteristics, are valuable and complement the passport data. Such data are seldom included in the databases of genebanks. However, the special requirements of in situ conservation management, including forest tree genetic resources, are such that any database for those purposes must have such information available (see document CPGR:85/5). The efficient utilization of such databases requires more powerful computer facilities.

11. For data on properties of accessions three groups are distinguished by the IBPGR in increasing order of observation and evaluation efforts:

(a) Characterization data;

(b) Preliminary evaluation data;

(c) Further evaluation data.

12. Characterization data cover a limited number of characters observed both in the field whilst growing-out and in the laboratory post-harvest, usually as part of the multiplication or regeneration operations. Those characters are observed which are highly heritable, and with only a few alternative states or simple measurements. They are easily observed and recorded, and are most. valuable in verifying putative duplicates, and hence more of value to curators than to plant breeders.

13. Preliminary Evaluation data include a minimal set of characters which plant breeders would like to have information on when they receive samples. The types of data vary with the crop and have been chosen by groups of specialists for each crop. The characters give more hints to the user in selection of parents for crosses.

14. Further Evaluation data include an open-ended list of possible attributes to be observed under field, glasshouse, phytotron or laboratory conditions, e.g. stress susceptibility, specific pest and disease reactions, agro-chemical sensitivities, cytological characters, specific identifiable genes, alloenzyme analyses, autogamy percentages and amino-acid ratios. The work requires not only a high degrees of familiarity with the particular crop but also specialized expertise in both the character observed and the test procedure used.

15. Passport data have to be provided by collectors or suppliers of the sample, whereas characterisation and 'preliminary evaluation are usually regarded as the responsibility of the curators, and are carried out by them or at their instigation by active collections or relevant institutions.

16. Further Evaluation is beyond the scope of the curators responsibilities and almost universally beyond the scope of facilities available to genebanks. The cost of Further Evaluation is high, and the number of samples that can be screened at any one time is usually low.

17. In the past it was assumed that specialized data from Further Evaluation of germplasm would build up gradually through testing and screening by plant breeders. Results so far are disappointing. Firstly, because an orderly feed-back of such data to genebanks has been organized in only a few cases and, secondly, because breeders are mainly interested in germplasm whose important characteristics are already known.

18. Further Evaluation around a clearly defined objective (e.g. resistance to a particular disease or a particular quality characteristic) has to be arranged between genebanks and a well identified group of specialized institutions, and not only those responsible for plant breeding. A few examples of such evaluation systems exist but it is necessary to develop many more. Financing of such evaluation could not be expected to be the responsibility of a genebank.

19. An important source of evaluation data commonly available for those obsolete and current cultivars maintained in genebanks is the information on multi-site variety testing available from national variety lists and other sources. Such information needs to be systematically stored together with the respective germplasm accession in genebanks.

20. The exchange of information on genetic resources will be greatly facilitated when there is some degree of standardization in the descriptors used, and their specific interpretation, in all the categories of data.

21. For a number of years IBPGR has been active in pursuing the standardization of data collection on plant genetic resources. To form a framework for data capture 50 descriptor lists have been published so far and an additional 11 are under preparation. These cover passport, characterization and evaluation data of all major crop species and have been widely adopted by international, regional and national centres. It is a requirement for support from IBPGR that their descriptor lists be used wherever possible for characterization of samples collected with that support. Where appropriate the lists have been produced jointly with other organizations, e.g. with the IARCs for their mandate crops, with 01V for grape, etc. Hence there is already a degree of standardization in the information entering the various databases, a prerequisite for easy merging later to form regional or global databases.

III. THE STATE OF INFORMATION AVAILABILITY IN GENEBANKS AND MAJOR COLLECTIONS

22. Recording of data on germplasm in individual genebanks and major collections is the starting point for any international information system. The IBPGR is actively attempting to assess the state of information gathering and handling in existing genebanks. Genebanks differ widely in the completeness of their data records. Comprehensive and definitive figures on the extent of information readily available on collections are difficult to assess due to the wide range of recording systems. However, on the basis of what is known it is estimated that, of the 2,000,000 accessions held in active collections worldwide, 65% have no passport data, 80% have no evaluation data whilst less than 1% can be considered as having very extensive evaluation data available. It is also known that, too often, samples sent for inclusion into collections are not accompanied by passport data - the absolute minimum level of data needed.

23. For material already contained in collections there is also the need for obtaining passport data retrospectively by data-capture from original collecting sheets and personal notebooks. Genebanks will often not have sufficient resources to undertake such tasks and the links to plant breeders might not be sufficiently developed for them to transfer their characterization and evaluation data to an easily exchanged format for inclusion in databases without further incentives.

24. Currently many collections rely on manual searching of data files in the form of ledgers, card indexes or print-outs of computer inventories. Considerable further efforts are required to upgrade data systems in individual genebanks.

25. Databases exist for most of the major food crops, but with great variations in their content and completeness. They are to a great extent identical with recognized base collections, and provide the base on which the development of an information system has to build. A list of significant genetic resources databases is given in Table 1.

Table 1: Major or Global Crop-Specific Databases on Plant Genetic Resources

Crop	Sponsor (Lead Agency)	Coverage
African Rice	IITA [1/]	Global [2/]
Apple	ECP/GR//IBPGR (East Malling, UK)	European as first stage
Barley	ECP/GR (ZIGuK)	Europe, ICARDA & PGRC/E
Barley	IBPGR (IBPGR Wheat–Barley Officer)	Others
Barley	ICARDA	(Global planned)
Chickpea (Kabuli)	ICARDA	Global
Chickpea	ICRISAT	Global
Citrus	IBPGR (INRA/IRFA, Corsica)	Mediterranean
Citrus	IBPGR (Fruit Tree Res. Sta., Japan)	East Asia
Cotton	IBPGR (IRCT)	Global
Cowpea	IITA	Global
Forages	ECP/GR (various centres on a species-specific basis)	European
Forages	IBPGR (IBPGR Forages Officer)	Global
Groundnut	IBPGR (Texas A & M University)	Latin American Collections
Lentil	ICARDA	Global
Maize	CIMMYT	Own collection
Maize	IBPGR (INTA)	'Southern Cone' Group, South America
Millets	ICRISAT	Global
Multicrop	USDA (GRIN)	All USA public collections
Okra	IBPGR (ORSTOM)	All African material
Phaseolus vulgaris	IBPGR (Gembloux University)	Global
Pigeonpea	ICRISAT	Global
Potato	CIP	Global
Prunus spp	ECP/GR (NGB)	European
Rice	IRRI/IITA	Global
Rye	ECP/GR (IHAR)	European
Sorghum	ICRISAT	Global
Soyabean	IBPGR (INTSOY)	All major collections
Sugarcane	IBPGR (ISSCT)	Global
Sunflower (Wild)	ECP/GR (IFVC)	European
Sunflower(Cultivated)	ECP/GR (CRI)	European
Vicia faba	CNR, Bari, Italy	European and Mediterranean
Vicia faba	ICARDA	Near East
Vitis spp.	FAO/IBPGR (OIV)	Global
Wheat	IBPGR (IBPGR Wheat-Barley Officer)	Global
Wheat	CIMMYT	Own collection

1/ For list of acronyms see Annex I.
2/ Global means universal coverage representing the widest possible diversity.

26. The available catalogues have been acquired by IBPGR or the Seed Service of FAO as appropriate and constitute the basis of a referral system. The Directories to Crop Germplasm Collections published by IBPGR provide a concise summary guide to primitive germplasm collections, whilst the computerized Seed Information System concentrates on commercially available cultivars.

27. The experience of IBPGR from 10 years work with information aspects of plant genetics resources shows that the most viable unit is the regional or universal crop-specific database, sited in a specialized centre for that crop.

28. The siting of the database in a centre of excellence for the crop has several advantages. Appropriate expertise is available to scan new data for obvious anomalies, to act as an intelligent interface between enquirer and database, and to interpret results to indicate possibly misleading information. However the availability of such expertise relies on the acquiescence of the host institute, acknowledgment of an on-going commitment by the host to the development of the database and willingness of the experts to become involved in assisting database build-up, maintenance and retrieval activities at the expense of other activities.

IV. THE COST OF DATA GENERATION IN CHARACTERIZATION AND EVALUATION

29. Realistic costings for the various operations in characterization and evaluation of germplasm are not available from most genebanks. They vary considerably from country to country and between individual crops. Costs of characterization and preliminary evaluation are often included in the general running costs of collections, whilst figures are only available for estimated costs within the USDA system.

Table 2: Estimated characterization and evaluation costs per single sample (Crop Advisory Committees of the USDA)

A. For Common Bean:		
1.	Assessment of 4 physiological parameters and resistance to 3 diseases and 1 pest	$ 311
2.	Characterization	$ 20
B. For Rice:		
1.	Assessment of 2 physiological parameters and resistance to 2 diseases and 1 pest	$ 27
2.	Characterization	$ 6.50
C. For Sugar Beet:		
1.	Assessment of resistances to 6 diseases and 2 pest	$ 750
2.	Characterization	$ 100

(These estimates are for operation costs only, i.e. assume usage of existing facilities (land, equipment, buildings) at nominal cost)

30. The costs vary in direct relationship to the complexity of growing the crop, and the above disparity of costs reflects the agronomic differences of the three. Costs will also increase if it is necessary to grow material at sites distant to the genebank due to climatic constraints.

31. Characterization costs are estimated by IBPGR to be, on average, about $20(10-30) per accession. Assuming that known duplicates are evaluated only once, there are probably about 1.2 million samples needing characterization, and an estimate of funds required is $ 24,000,000. Evaluation for diseases, stress, etc. will require at least 10 times that amount ($ 240,000,000).

32. On the basis of known costs for operating large databases, a single crop-specific database is estimated to cost $.50,000. per annum to operate

33. A hidden factor related to the cost of characterization and evaluation is the lack of available trained manpower and, often, physical facilities in quite a number of genetic resources centres. Both have to be built up over a number of years. The IARCs of the CGIAR and some major genebanks in advanced countries are in comparably favourable positions because they are actively linked with major programmes and expertise in plant breeding. Many developing countries on the contrary are very weak in this area, including their plant breeding programmes. A more rapid build-up of their expertise would contribute considerably to an expanded evaluation and documentation of genebank resources.

V INFORMATION AVAILABILITY AND THE USE OF GENEBANKS

34. The present use of genebanks is small in relation to their potential value and directly related to the extent of information available on individual accessions. Published figures, whilst far from comprehensive, show wide variation between genebanks.

35. A recent survey [1/] indicates that (i) there is in general a low level of interest by breeders in the collections; (ii) the use of genebanks is far higher when linked closely to a major breeding programme; (iii) small, multicrop collections have attracted little interest; (iv) the existence of substantial working collections with plant breeders tends to lower their use; and (v) the bulk of requests to genebanks are for improved material, rarely for landraces and almost never for wild species.

36. The survey further reveals that one of the main reasons for the lack of use of genebanks is the lack of meaningful information provided by genebanks on the material they hold. This is particularly true for primitive material, which is more likely to find the attention of plant breeders if detailed information is available on specific characters of importance to respective breeding programmes.

37. There is increasing interest in Passport data in order to identify material from particular eco-niches. But data from Characterization and Preliminary evaluation recorded from one location are of questionable value, as the often polygamic characters recorded are subject to wide variations depending on the growth environment. The value of such data can be improved only if they are accompanied by precise data on the environmental conditions under which they have been recorded, or through multi-site testing.

38. The limited use of genebanks by developing countries can be attributed, apart from a lack of information, foremost to the lack of plant breeders and breeding facilities.

1/ Peeters, J.P. and Williams, J.T., 1984 : Towards a better policy for genebank use with special reference to information, AGPG:IBPGR/84/140.

VI INFORMATION SYSTEMS RELEVANT TO PLANT GENETIC RESOURCES

A. Past and Present Developments

39. The importance of international information exchange has been recognized from the early beginning of work on plant genetic resources. Already in 1965 a group of experts convened by FAO and IAEA recommended three courses of action to establish standards for crop data recording and processing: (i) the production of a multilingual controlled thesaurus for standardization of descriptors used in recording characteristics of germplasm collections; (ii) standards for computer file formats; (iii) standard sets of descriptors for particular crops. Efforts were also made to resolve differences between hardware and software systems. No effective consensus was reached on standardization.

40. Between 1950 and 1963 FAO published lists of genetic stocks available around the world as a first directory of genetic resources, but they were confined to a few major crops. This work was discontinued due to lack of resources. With the later development of a programme on crop ecology and genetic resources, special emphasis was oriented, starting in 1973, towards the compatibility of computer software and hardware for information exchange between genetic resources centres. This Crop Genetic Information Programme was continued with the establishment of IBPGR in 1974, first under joint financing and later financed solely under IBPGR in collaboration with the University of Colorado and formed the basis for the development of the GR/CIDS systems EXIR and TAXIR. In a critical assessment in 1979, it was found too ambitious for international use and IBPGR decided to withdraw its support. The GR/CIDS effort was modified to form the basis for the USDA GRIP system, which is now being implemented as the USDA GRIN network.

41. Recognizing the prime need to improve data gathering and handling at the level of individual genebanks, IBPGR has operated on two fronts in the documentation field. Firstly working towards internationally agreed standard sets of descriptors for use in recording data on accessions, and, secondly, encouraging the setting up of networks co-operating to produce unified databases of accessions. Both these activities are largely on a crop basis. By encouraging standardization of descriptors and merging of these standardized lists it is hoped that it will be possible to obtain a true idea of the size and scope of collections by the identification of duplicates, and to identify "gaps" in collecting coverage.

42. As individual genetic resources centres and collections have developed in different ways, their data systems in descriptors, software and hardware differ greatly and are usually incompatible. The development and publication of unified descriptors by IBPGR through expert groups working on a crop by crop basis has led the way to the setting up of standards for compatibility of crop genetic resources data. However. their general acceptance requires a detailed and long-term effort.

43. Institutes of 26 countries within a European Co-operative Programme for Genetic Resources (ECP/GR) (a UNDP supported project first operated by FAO and more recently by IBPGR) are working together on a crop basis to produce unified databases on six *major* crops. One institute assumes responsibility for the merging of databases supplied by others having differing computer facilities.

44. Other individual crop databases are placed in a centre of excellence for that crop. The advantages of this approach are that crop expertise is available to screen information before data entry and prevent obviously erroneous data being added to the database, and that that scientific expertise is available to provide an intelligent interface between enquirers and the information in the database.

45. In order to provide a first link between different genetic resources databases IBPGR has published 11 Directories to Crop Germplasm Collections, which list, in summary form, collections, where they are, what they hold, and their storage conditions. Some information is given on the extent of evaluation and the documentation form, but *the* information supplied for the Directories is, on the whole, inadequate for definitive assessments of databanks. The Directories cover all major and many minor C crops and are the only extensive guide to collections worldwide. They cater for most requests for information on sources of primitive germplasm that at present come to IBPGR or FAO.

46. The information in the Directories is being computerized in an IBPGR database, which in addition records all available data on samples collected through IBPGR programmes.

47. FAO is at present developing a computerized Seed Information System covering carrent cultivars, adaptations, seed supply sources and equipment. (see Annex II)

B. Current Computer and Telecommunications Usage

48. The tendency towards independent, ad hoc development of germplasm data banks becomes very apparent when the current pattern of computer and telecommunications usage is reviewed. There are at least 50 significant germplasm databanks using computers, of which a recent survey by IBPGR obtained information on 45.

49. A wide range of equipment is in use: from large mainframe computers, through powerful minicomputers, to very modest microcomputers. This variety is further reflected in the heterogeneity of the operating systems, programming languages and software packages currently being employed. Viewed as the potential components of a global network, the existing systems would present difficulties if computer-to-computer data transfer were contemplated, and more formidable problems for remote online searching.

50. In general, curators of genebanks have had to work either with existing data-processing installations of their parent institutions, or such equipment as they have been able to justify for their own special purposes. In the latter case, the equipment obtained has often been modest both in price and computing capacity, although frequently there exists an actual or potential facility to link into a more powerful installation.

51. For data exchange, in machine readable form, between systems used in the various genetic resources centres certain compatibility requirements are mandatory, others desirable. Hardware compatibility factors, (for magnetic tape, floppy discs) relate to physical dimensions, number of tracks and recording density. There is sufficient industry uniformity for this to be only a marginal problem in magnetic tape exchange. There is less standardization for floppy discs so that compatibility problems could arise. These would not be technically insoluble, but would involve costs for intermediate conversion.

52. Software dependent factors relate to the codes, file and record formats used. If data is to be exchanged between centres, an agreed communication format needs to be adopted. This format enables all co-operating centres to transmit data according to common protocols, whilst leaving freedom at the local level for internal operations. Transmission through non•--standard formats requires at least the development of special conversion programmes *with* consequent delays and additional costs. In some cases this would not be possible or extremely expensive, and manual reworking of the data would be required, with the accompanying costs and danger *of error* introduction. New developments in optical character recognition *technology* for direct data entry from typewritten copy may change this situation

53. Online input and retrieval via remote terminals and telecommunications links is an increasingly attractive possibility. However, this requires that data (and software) be kept available on hard discs and the host computer to be accessible (for an. international clientele) virtually 24 hours per day. Very few germplasm databanks are currently capable of being accessed in this way. Also, to the present, remote on-·line searching has not been an expressed need by either breeders or curators In any case, more conventional means of access the users to the information system are available in the form of telex and facsimile.

54. Better accessibility could promote more but. *a pore* significant factor would be, as mentioned above, quality improvement of the databanks in terms of their content of characterization and evaluation data.

VII. ACTIONS TOWARDS AN INTERNATIONAL INFORMATION SYSTEM ON PLANT GENETIC RESOURCES

55. From the assessment provided in the first part of this paper it is obvious that a whole spectrum of information activities relate to plant genetic resources.

56. The assessment moreover indicates that the *present* level of requests for information from genebanks is limited. As this can to a large extent be attributed to a lack of data, it can be assumed, with a high degree of certainty, that with increased quantities of better quality data available in an information system the demand from users will increase accordingly.

57. The following measures can be identified for the further development of various components required to pursue the concept of an International Information System on Plant Genetic Resources:

A. Strengthening of Information systems in Individual Genebanks

58. Individual genebanks, national or international, form the backbone of genetic resources activities worldwide. The improvement of their data recording and information systems is a prerequisite for any international data exchange. The allocation of sufficient funds for information activities, including staffing, should be provided by the authorities responsible for each genebank. However, assistance might be required, particularly for developing countries, in setting up an information system, training personnel and for acquisition of appropriate documentation hardware and software. Such assistance is being provided by the IBPGR within its available budget but would need to be expanded or complemented by bilateral or multilateral assistance. Advanced countries might consider twinning operations to upgrade the information system of genebanks in developing countries.

59. Specific information activities to be upgraded in individual genebanks would include the following:

1. Establishment or upgrading of internal monitoring systems for the maintenance of genetic resources. Inadequate viability monitoring in many genebanks threatens the survival of some material.

2. Completion of at least the minimum descriptors - passport data - for all material conserved, and speeding up the transfer of available data into computerized databases.

3. Improvement of links with plant breeders to encourage evaluation of material for characters relevant to priority problems of plant breeding programmes, and arrange for the flow of information.

B. Strengthening and Breeding Capabilities in Developing Countries

60. The actual use of information on plant genetic resources in many countries is generally hampered by weaknesses in their plant breeding capacities, including lack of qualified and trained personnel. This also has particular bearing on their capability for arranging and participating in genetic resources evaluation. While not directly related to the development of an international information System on Plant Genetic Resources, the strengthening of plant breeding capabilities is nevertheless a crucial factor in the use of information and the actual resources, and in the generation of data required for the system as a whole.

61. An assessment should therefore be made of the relative strengths and weaknesses of plant breeding capabilities in developing countries and a programme designed to mobilize further assistance to upgrade their physical, organizational and manpower deficiencies. Such an assessment would best be undertaken by FAO in collaboration with the countries concerned.

C. Development of Crop.-Specific Databases

62. Experience so far has shown that the interest of plant breeders s greater in the more comprehensive genetic resources collections, especially those amalgamating data from various sources on a crop-specific basis. Such crop-specific databases would best be centered at base collections of the respective crop as recognized in the international Undertaking on Plant Genetic Resources.

63. Crop-specific databases provide the best instrument to internationally harmonize, or even standardize, crop descriptors and to provide the focal point both for the organizing of further characterization and evaluation of germplasm and the subsequent incorporation of the generated data into the database.

64. National collections of genetic resources tend to be multicrop orientated and thus their data management systems comprise a number of smaller crop-specific sub-files. It is to their advantage that their crop-specific data would be gradually integrated with the large crop-specific databases, becoming in this way part of a more comprehensive system. Such participation should lead to the harmonization of descriptors on a crop by crop basis.

65. Crop-specific databases do not always have available information as to where samples of any particular accession identified may be obtained. The inclusion of such information in replies to enquiries would facilitate the users obtaining the material. This would reduces the administrative workload in genebanks by eliminating requests for material not available at the time.

66. The development of crop-specific databases of major crops as promoted so far by IBPGR should receive continuous support to enable the host institutions to operate and update these systems in the future as major parts of an International Information System. Annual operation costs are approx. US$ 50,000 per database. Additional crop-specific databases need to be developed.

67. The IBPGR intends to assess the links between base and active collections, and has started to collect information about the documentation systems of all genebanks. A full assessment is likely to be available by 1986.

68. As crop-specific collections are considered as providing a worldwide service, there is a need to consider their international linkage with other genebanks as well as plant breeders. Each crop-specific database could therefore have an international advisory body of specialists to guide its development, its communications and its links with plant breeding programmes to stimulate their use.

D. Development of Evaluation Programmes

69. The lack of evaluation data on genetic resources is considered as the main hindrance to their wider use in plant breeding programmes. The size of the task involved certainly does not allow an all-out effort. Evaluation has to be pursued on a crop-specific basis with well defined objectives and with close liaison between plant breeders and genebanks. As a number of effective evaluation networks are in operation they can serve as models to gradually expand coverage on a crop by crop basis.

70. FAO should promote, in collaboration with IBPGR, the establishment of such evaluation networks with the participation crop--specific databases, genebanks and relevant institutions, and mobilize additional funding required from international donor sources.

71. Further scientific development aimed at identifying the portions of, collections in genebanks which need priority evaluation will facilitate the task of evaluation.

E. International Linkages

72. A first overall link in information is provided by the Directories to Crop Germplasm Collections as published by IBPGR. They are periodically updated and reissued. This task should be placed on a regular basis, and not left to occasional. consultants, to become more and more comprehensive as information becomes available. At present they are only available in English. Their value would be enhanced by their being available in other languages.

73. New developments in communications technology have to be kept under review and their feasibility assessed from time to time in order to improve interlinkages of crop genetic resources databases as needed and as users require.

74. The computerized Seed Information System in FAO needs to be developed to comprehensively cover information on current cultivars of major crops.

F. International Information System on Plant Genetic Resources.

75. A more formalized framework for increasing international co-operation in the field of plant genetic resources information might be feasible in the future as the comprehensiveness of the elements of the information systems worldwide further develop and the demand justifies its establishment. However the present priority should be to strengthen national capabilities for participation in data generation and exchange. A first step towards an integrated information system would be the harmonization of relevant activities through the Commission and the establishment of a referral system to sources of information. In monitoring the progress made in harmonization the Commission might later on recommend the setting up of a more formal framework for co-ordination. In this context the example set by FAO in the establishment of the AGRIS system should be borne in mind, whereby a small central secretariat co-ordinates activities dispersed at the national or regional level. The information originates from, and is processed by, the national and regional centres. The Co-ordinating Centre has provided for standardization, for support td participating centres, for training and for final collation and publishing of the information.

76. In order to assist in harmonization and monitoring of developments it would be useful if an expert consultation were convened, in co-operation with IBPGR, to consider any recommendations which the Commission might make, in order to advise on their implementation and to make further proposals for practical action.

ANNEX I

ACRONYMS

CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical – CGIAR
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo – CGIAR
CIP	Centro Internacional de la Papa – CGIAR
CNR	Consiglio Nazionale delle Ricerche (Italy)
CRI	Cereals Research Institute (Hungary)
ECP/GR	European Co-operative Programme for Conservation and Exchange of Crop Genetic Resources – UNDP/IBPGR
EXIR	Executive International Retrieval (system)
FAO	Food and Agricultural Organization of the United Nations
GR/CIDS	Genetic Resources / Communication, Information and Documentation System
GRIN	Genetic Resources Information Network – USDA/LISA
GRIP	Genetic Resources Information Project – USA
IAEA	International Atomic Energy Agency
IARC	International Agricultural Research Centre
IBPGR	International Board for Plant Genetic Resources – CGIAR
ICARDA	International Centre for Agricultural Research in Dry Areas – CGIAR
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics – CGIAR
IFVC	Institute of Field and Vegetable Crops (Yugoslavia)
IHAR	Plant Breeding and Acclimatisation Institute (Poland)
IITA	International Institute for Tropical Agriculture – CGIAR
INRA	Institute national de la recherché agronomique (France)
INTA	Instituto Nacitonal de Technologia Agropecuaria (Argentina)
INTSOY	International Soybean Programme
IRCT	Institut de recherches du cotton et des textiles exotiques (France)
IRFA	Institut de recherches sur les fruits et agrumes (France)
IRRI	International Rice Research Institute – CGIAR
ISSCT	International Society of Sugarcane Technologists
LISA	Laboratory for Information Science in Agriculture (USA)
NGB	Nordic Gene Bank
OIV	Office international de la vigne et du vin
ORSTOM	Office de la recherché scientifique et technique outre-mer (France)
PGRC/E	Plant Genetic Resources Centre / Ethiopia
RCA	Research Centre for Agrobotany (Hungary)
TAXIR	Taxonomic Information Retrieval (system)
UNDP	United Nations Development Programme
USDA	United States Department of Agriculture (USA)
ZIGuK	Zentralinstitut fur Genetik und Kulturpflanzenforschung (German DR)

ANNEX II

AGP/SIDP/84/166 Rev.
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SEED INFORMATION SYSTEM

In order to improve the flow of information on the seed status of FAO Member Countries, a computerized Seed Information System has been developed. This system is structured into self-contained sub-systems, viz. Seed Review Sub-system, Cultivar Sub-system, Seed Exchange Sub-system and Seed Equipment Sub-system.

Seed Review Sub-system

The Seed Review Sub-system includes data maintenance and retrieval possibilities on variety improvement and evaluation, variety release and registration, seed quality control, seed production and distribution of 87 Member Countries.

Cultivar Sub-system

The Cultivar Sub-system includes 15 crop species in 80 countries, and gives the names of cultivars actually in production. It will be gradually developed into a Cultivar Data Bank to provide information on description of cultivars, particularly with regard to their agroecological adaptability.

Seed Exchange Sub-system

The Seed Exchange Sub-system includes information on seed sources and in particular, about 6 300 addresses of seed suppliers, organizations and firms, in 161 countries.

Seed Equipment Sub-system

The Seed Equipment Sub-system provides information on 1 100 pieces of equipment and on 82 seed equipment producers in Asia, Africa, Europe, North America and South America.