INTERNATIONAL BOARD FOR PLANT
GENETIC RESOURCES

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CONSULTATIVE GROUP ON
INTERNATIONAL
AGRICULTURAL RESEARCH

The International Board for Plant Genetic Resources (IBPGR) is an autonomous international scientific organization under the aegis of the Consultative Group on International Agricultural Research (CGIAR). The IBPGR was established by the CGIAR in 1974. The basic function of the IBPGR is to promote and coordinate an international network of genetic resources centres to further the collection, conservation, documentation, evaluation and use of plant germplasm and thereby contribute to raising the standard of living and welfare of people throughout the world. Financial support for the core programme is provided by the Governments of Australia, Austria, Belgium, Canada, China, Denmark, France, Federal Republic of Germany, India, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, and the USA as well as the World Bank. FAO of the United Nations provides the Headquarters.

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The designations employed, and the presentation of material in this Annual Report, and in maps which appear herein, do not imply the expression of any opinion whatsoever on the part of the International Board for Plant Genetic Resources (IBPGR) or the Food and Agriculture Organization of the United Nations (FAO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

FOREWORD

The *Annual Report 1985* listed a number of management and operational changes which had resulted from the growth of the IBPGR programme over the first decade of its existence and from the need to respond to changing demands. It is pleasing to note that the *Annual Report 1986* reflects the start of the implementation of the changes, although the full re-structuring will only be effected in 1987.

In order to identify the specific areas of work under the new structure, the Programme Committee of IBPGR was particularly active throughout 1986. A brochure was published at the end of the year which gave details of IBPGR activity in terms of functional programme and subprogramme elements. This was issued to inform the donors of the IBPGR, the TAC of the CGIAR and cooperating institutes in IBPGR's global network so that the overall effort of IBPGR can be better understood in the wider context of work on genetic resources by other organizations.

As the global programme of IBPGR has evolved so too has the recognition of the leadership role which IBPGR can play internationally: never before have so many requests been made to IBPGR for advice, policy guidance and background scientific information to major international organizations as those made in 1986.

The basis of IBPGR's programme, of course, remains the work carried out by the global network of activities which has resulted from IBPGR's stimulation. IBPGR must act, due to the very limited size of its annual budget, only as a catalyst and enhancer of global action; it remains poignantly aware of the need for inputs at all levels into the scientific work of its cooperating centres.

The ultimate safety of the large amounts of germplasm collected to date depends, in the main, on the national programmes performing their work to at least minimal internationally-agreed scientific standards. Unless this is assured, the germplasm collections will not be secure. IBPGR was therefore extremely active in 1986 in monitoring the scientific standards of centres which have been designated to hold base collections of germplasm for long-term storage. This exercise has enabled IBPGR to begin to assess the strengths and weaknesses in this area.

Additionally the national programmes initiated by IBPGR have to become self-sustaining. IBPGR's mandate does not permit it to support organizational structures. Its funds are used to initiate urgent action on the basis of international priorities and are not intended to support continually the work of each centre. In this respect it is salient to note that by the end of 1986 only about 15% of the national programmes had clear, scientifically justified and financed plans for collecting germplasm, either to fill gaps in the representation of diversity in collections or because germplasm is under threat locally. A high proportion of these 15% were in developed countries which along with the International Centers of the CGIAR continued their commitment to the global efforts. The lesson to be learned is that national programmes must take commitments to genetic resources sufficiently seriously to back them with adequate financial and manpower resources.

In relation to financial resources, apart from IBPGR, I reported to International Centers Week in November 1986, that the numerous international debates on genetic resources and attendant publicity have, in real terms, not led to the availability of any additional funding for genetic resources work globally, compared with what was available in 1981.

Certain areas of strategic research are currently very necessary to IBPGR to increase the knowledge base for specific genetic resources activities, but the initiation of some of this has been slow. The reason in some cases was that no competent institute could be found to which to contract the often highly-specialized research; also such applied research is sometimes less popular in universities than topics which may be more open-ended. This *Annual Report* notes some major advances in this area, and future ones are likely to report much more on this topic as the new staffing structure of IBPGR, particularly for those involved in research, is established in 1987. The new staffing structure of the IBPGR Field Programme was implemented at the end of 1986, despite some delays which were beyond the control of IBPGR.

As always it is a pleasure to record the strong support of the donors to IBPGR, the cosponsors of the CGIAR and the scientific community.

J.T. Williams
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INTRODUCTION

The IBPGR has a mandate to ensure that the genetic resources of crop plants are collected and conserved in genebanks, and thereby made available for use by plant breeders and other scientists. The resources encompass the genetic diversity of cultivars, landraces, wild progenitors and species related to crops; all of which are significant for use in food production. IBPGR is largely involved with collection and conservation of landraces and wild species.

IBPGR's major emphasis is to collect germplasm which is of immediate use, or which is at risk as a result of genetic erosion, the steady and irreparable loss of genetic diversity, which is occurring throughout the world in the areas of variability.

Because of the rate at which genetic erosion has advanced, the bulk of the material collected by IBPGR has consisted of landraces. Such material has often been of immediate value in breeding new cultivars by contributing specific ecological tolerances, disease or pest resistances, as well as yield or quality factors. The cooperative work of IBPGR and the other International Agricultural Research Centres of the CGIAR has demonstrated the success of this approach and, since IBPGR's creation 12 years ago, considerable progress has been made in collecting, conserving and using germplasm of most major crops.

Advances in breeding may depend also on the incorporation of genes from wild species into crops. Most breeding uses as its source materials the available cultivars. However, along with cultivars, the wild ancestral or related species collectively comprise the genepool of the crop. This is considered practically as being at three levels: primary, secondary and tertiary. (The primary genepool—the cultivated form and usually some wild species—can all be crossed and so genes can be transferred to the cultigen without difficulty. In the secondary genepool, gene flow is possible via interspecific hybrids, whilst in the tertiary genepool, though hybridization is possible, the hybrids produced are usually infertile or unstable.)

Until 1984 there had been relatively little germplasm acquisition of the secondary and tertiary genepools, but their significance and potential impact is becoming increasingly realized. The newer techniques in molecular biology may well transcend their distinctions in practical applications, and in view of this, the techniques will be addressed more fully by IBPGR in 1987.

A FIRST MODEL *IN VITRO* GENEBANK

IBPGR has spent some years laying the foundations for genebanks which will store tissue cultures (*in vitro* cultures). Modification of culture protocols to ensure slow growth provides a means of establishing active *in vitro* genebanks which will form medium-term collections.

In vitro storage is, in many cases, complementary to other forms of conservation, for example with potato and cassava, in which most genetic conservation is assured through storage of seed. Nonetheless, there are reasons to conserve particular clones *in vitro*, one being as a back-up security measure for clones in field genebanks.

In 1985 IBPGR established the scientific basis for running an *in vitro* genebank including the testing of stability at various stages through the sub-culturing regime. There are obviously numerous ways of doing this; in order to test the options IBPGR reached an agreement in 1986 with CIAT to establish a model *in vitro* genebank for cassava. The data produced will enable specifications for the *in vitro* genebank to be further refined for practical application.

IBPGR has recently devoted greater resources to the collection of the wider genepools. It will continue to do for the next five years or so, whilst, at the same time, filling gaps in the range of variability in collections.

IBPGR has been instrumental in the collection of over 130 000 samples of crops in over 100 countries. In 1986 collecting continued but with a shift in emphasis away from collecting predominantly landraces towards wild species of crops. This trend has been implemented following the accumulation of data by IBPGR on what has been collected and where, as well as on crop genepool distribution and diversity.

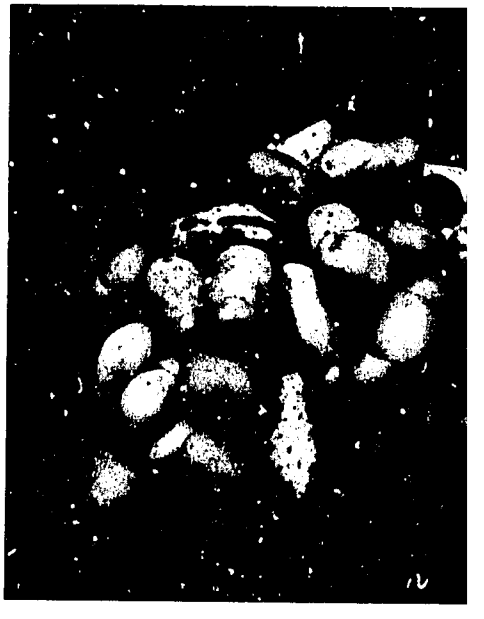
There are now substantial germplasm collections of landraces of most major crops, and thus further collecting now needs to be closely targeted, particularly to areas of documented threat of diversity loss. Whilst considerable collecting remains to be done, the catalytic action provided by IBPGR, especially to programmes operating at a national and regional level, has created a rational scientific basis for future work.

Soon after IBPGR was created lists were drawn up of global priorities for collecting. In the 1970s collecting was urgent in numerous countries and the priority rating given to specific crops reflected their importance initially as staple foods of large numbers of people but also the need to initiate speedy action because of genetic erosion. Other crops and forages were ranked as priorities later. Lists of such priorities were working documents to guide the progress of field work, and were reviewed periodically as material was acquired and as new information came to light.

As a basis for more scientifically-targeted field work, IBPGR Headquarters has created data bases to store the large quantity of information on collecting missions in which IBPGR had some involvement for the past 12 years. Assembling the data bases, and testing them for abstracting purposes, was an essential prerequisite to the efficient functioning of much of the day-to-day activities of IBPGR, in addition to forming a basis for future planning. Use of the system is a routine activity at IBPGR Headquarters and

Crop plants were derived through evolution and selection from wild plants. In the case of most major food crops both the cultivated forms and their ancestors may be noted for their 'opportunism', an anthropocentric and unscientific term, but one which appropriately describes those characteristics of the wild plants which enabled them to colonize disturbed habitats that were often created by man. Further success of the domesticates was contingent upon plasticity and adaptability, or ability to thrive in areas and environments distant from and different to those of their wild progenitors. For millennia, in the primary areas of origin, crop plants were to be found growing in association with their wild ancestors; collectively the complex of cultivated, weedy and related species form the genepool.

The largest areas of production of many crops are now in regions where the species are not native: maize, rice, wheat, soyabean, *Citrus* and potato are all highly important world crops which are virtually ubiquitous throughout a wide climatic and geographic range, but have dis-



the data base is updated continually.

The data base has been analyzed in various ways, and in 1986 preliminary computerized maps were drawn up on the extent to which countries had been collected for crops, to allow comparison with initial collecting priorities. Crops were considered on a genepool basis. The aim of this analysis was to enable IBPGR to confirm, modify or in some cases eliminate the original priorities for collecting. Based on those data available up to mid-1986 from several hundreds of field missions, the results represent a significant start towards determining the value of collecting efforts to date. Of the major crops, some such as rice and wheat have now been well collected for landraces. Other crops fairly well collected to date have been maize, barley, pearl millet, sorghum, *Lupinus*, the chenopods and amaranths and *Vicia*. Whilst the study did not include material collected by other organizations in which IBPGR did not have a significant involvement, it included the work of the IARCs.

It should be stressed that in relation to collecting a number of constraints, over which IBPGR has had little or no control, are always present, e.g. the lack of collecting in several important areas due to political reasons. To this extent the overall collecting strategy has continued to involve a combination of scientific planning, what can be carried out expediently and the availability of scientific expertise.

An additional use during 1986 of the data base was an attempt to obtain a clearer picture of the deposition of collected samples in designated genebanks with base storage distributed throughout the world to ensure that the materials are safely conserved. The compilation of up-to-date data has been delayed in many cases by the tardy response of genebank curators. Further follow-up on the fate of materials collected will emerge after careful analysis of a data base in which information on ongoing and relevant characterization and evaluation is stored. This was created in 1986 due to numerous activities world wide and the need to maintain a clear overview.

GENETIC DIVERSITY AND GENETIC VULNERABILITY

Fig. 1. Considerable variation is evident in the tuber-bearing plant Ullucus, *an important crop in the Andes. These tubers are from a single farmer's field in Peru*

tinct and fairly limited areas of origin and primary diversity. Similarly, rubber and cocoa are widely grown in Southeast Asia but are native to Amazonia. As crops were dispersed historically by man so too did their patterns of variation change. Such resultant secondary diversity is also important as genetic resources.

Epidemics of plant diseases have often had disastrous consequences because of the tendency, in recent times, for crops to have become more uniform by conscious breeding. Populations in primitive agricultural situations were much more diverse: in cases of disease attack many individuals survived; however, many modern cultivars may be uniformly susceptible to a particular race of pathogen or pest. The emerging realization of the significance of such vulnerability, in terms of world food production and security was a major prompting factor which in the 1960's led to international awareness of the need to collect and conserve plant genetic resources and culminated in 1974 in the creation of IBPGR.

Fig. 2. Investigations by IBPGR are providing useful information on more comprehensive collecting and survey techniques (see ***Germplasm Acquisition*** *section) and research on reactions of seeds during long term storage, which point to methods of more efficient and cost effective storage (see* ***Conservation*** *section). Activities involve interaction between national and regional institutes, such as the collection and characterization of* Panicum *in Burundi (IBPGR IRAZ project, left) as well as development of in vitro techniques (tissue cultures) to supplement, and for certain crops, replace, conventional storage as seed*

COLLECTING IN 1986

Details of the field work carried out by IBPGR are summarized beginning on p. 9. Several collecting missions in 1986 yielded quite unexpected and exciting discoveries, many previously unknown to science, which may lead to taxonomic revisions of whole groups of plants or new theories on origin and domestication of specific crop plants. Examples include a recent discovery of populations in Brazil which could be truly wild cassava (*Manihot esculenta*), hitherto considered to be known only in cultivation. Some populations of the wild cassava which are similar morphologically to cultivated cassava may exchange genes with the cultigen. Until recently the wild perennial soyabean (*Glycine*) species which grow in Australia, and which are somewhat distantly related to the annual cultivated Asian soyabean, were an imperfectly understood group of plants and were almost completely absent from genebanks. Three new species have been identified as a result of IBPGR-sponsored work in 1986.

Since genetic erosion is a major criterion leading to IBPGR action and since IBPGR operates on a global scale, a better mechanism is needed to assess world-wide information on the threat to genetic resources. Such data needs to be closely tied to data on species distributions, but these are often poorly documented. The need for such data is now especially pertinent as new strategies for collecting are devised and carried out.

A systematic approach is required, and in 1986 a pilot project was initiated to quantify the degree and nature of genetic erosion of specific crop genepools in eastern Africa, and hence to alert IBPGR to the need for urgent collecting. Aspects of environmental change and land-use such as the development of large scale irrigation schemes, overgrazing or growth of urban areas are all pertinent. If a scheme can be devised which will lead to objective data, IBPGR Field Officers can report upon developments which significantly affect genetic diversity and provide data which can be important in acquisition of diversity from truly threatened areas.

SPECIES DISTRIBUTION

Special problems apply when considering wild relatives of crop plants, because many are often understood only in general terms. IBPGR has now completed major surveys of herbarium specimens of the wild species of the genepools of okra (*Abelmoschus*), mango (*Mangifera*), cowpea (*Vigna*) and the citroids (which includes all of the *Citrus* crops). Other studies are in progress with *Beta*, *Brassica*, *Pennisetum*, *Solanum* (specifically the African eggplant) and selected parts of the grass tribe Triticeae related to wheat, barley and rye. Associated work is also underway with groundnut (*Arachis*). These studies, which include, in addition to herbarium data, information on genetic erosion, will be used in strategic planning for collecting wild species and research on patterns of genetic diversity.

Some of these studies will be wide-ranging, e.g. the germplasm of wild species of *Vigna* is needed for use both for breeding of cultivated cowpea, and for direct use and selection for forages. Little is known about the potential of many species as forage crops. The origin of the cultivated cowpea is also not completely clear in terms of areas of origin and relationships between the wild species—of which over 70 have been recognized in sub-Saharan Africa. Only better field work and subsequent research will provide the answers.

GENETIC RESOURCES IN THE SADCC COUNTRIES

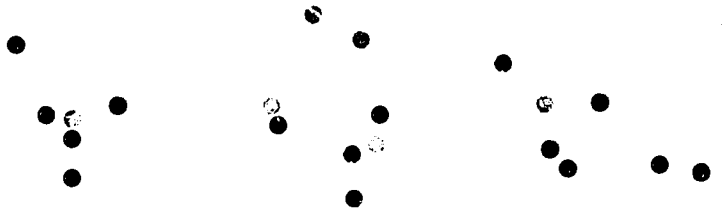
Political, climatic and environmental influences have all combined to restrain and in many cases reverse agricultural progress in the last decade in southern and central Africa, while population has grown apace. Potentially, though, a number of the countries in the Southern Africa Development Coordinating Conference (SADCC)—Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe—are able to achieve self-sufficiency in food production, whilst others, notably Zimbabwe, can be significant exporters of staple crops to neighbouring countries, and also earn foreign exchange by export to other parts of the world.

Stability in agricultural yields is often lacking in many regions, so now several of the International Agricultural Research Centres of the CGIAR are establishing outreach programmes to effect crop improvement and transfer appropriate agricultural technology, e.g. CIAT in Tanzania (*Phaseolus* beans), CIMMYT in Zimbabwe (maize), ICRISAT in Malawi and Zimbabwe (sorghum, millet and groundnut), IITA in Tanzania and Zimbabwe (*Vigna* beans) and IRRI in Tanzania (rice). In addition, the CIP programme on potato in Kenya and Rwanda, and the ILCA programme on forage crops in Ethiopia and Kenya (although these countries do not belong to SADCC) interact with the SADCC regional grouping.

The success of broadly-based breeding programmes will owe much to the capacity of international and national centres to marshal skilled manpower and the very latest techniques, but have in many cases as a bulwark of their programmes the germplasm collected and made available through the efforts of IBPGR.

A significant meeting of scientists and agricultural administrators from all of the SADCC countries and also from many of the IARCs met at the invitation of IBPGR in Lusaka, Zambia in September 1986 to discuss their respective roles in genetic resources work in the next vital decades. The meeting resolved to take further action to collect and conserve the germplasm of a number of crops in the region. It was a forum for fostering dialogue, for highlighting significant research imperatives and for resolving policy issues.

One gratifying result of the meeting was that proposals for a regional genebank for southern Africa, to be based in Lusaka, were considered for funding by a number of donor agencies. The Nordic agencies are considering the proposal and may well fund the establishment of such a genebank and its operational costs for 10 to 20 years.



○ Field Staff ● Collectors ● Interns

Fig. 3. IBPGR Field Staff, Collectors and Interns are strategically placed throughout the world to assist national programmes and to deal with specific regions or crops

Another example relates to wild species of *Pennisetum*. Research carried out recently on this genus at the USDA Coastal Plain Experiment Station in Georgia, USA has involved wide crosses using wild species collected in the Sahel by IBPGR in 1984. Some of the early generation material has now been supplied to the ICRISAT Sahelian Center at Niamey, Niger to be tested in pearl millet breeding.

The genetic resources of crops on a world-wide basis are dispersed throughout numerous genebanks. In the case of most crops IBPGR has designated one genebank as having world-wide responsibility as a base storage centre. This genebank is often the largest one holding a particular crop, and must have adequate finance and facilities to do its job well. The smaller collections of crop germplasm should be duplicated in the world collection for safety. Similarly, a number of centres have been designated as field genebanks to hold clonal materials. These, of course, are not base collections but will complement other types of storage, e.g. *in vitro*, yet to be developed.

After collected germplasm is deposited in genebanks, it needs careful description. Ignorance of the genetic basis of many of the characteristics in plants is a major obstacle in this work although, in principle, description is divided into characterization which covers supposedly highly heritable characters, and evaluation which covers those which are less so—but often of more value to plant breeders.

Characterization, along with passport data, enables the curator to assess the range of variability in relation to origin. True assessments of the patterns of variation in collections are largely lacking and this was addressed by IBPGR in 1986.

Germplasm collections are often very large (e.g. the IRRI rice collection—*ca.* 81 000 accessions; the CIAT *Phaseolus* collection—*ca.* 36 000 accessions), and their evaluation and documentation is a long-term process. IBPGR has recently adopted the concept of a 'core collection' which will comprise a sub-sample of the whole collection, selected according to specific criteria, and they are expected to significantly improve the extent of germplasm utilization by breeders by providing ready access to collections.

Good scientific work in the genebanks must ultimately rely on good computerized management systems as well as data bases. Although different genebanks may have different computer systems, in terms both of hardware and software, for storing and retrieving germplasm data, the magnetic tapes or discs can often be transferred, with relatively minor changes, to another data base to be accessed by a central computer facility. This has been the basis of some recent work with several crops. IBPGR has

ORIGIN AND EVOLUTION OF *CITRUS*

Collectively the several *Citrus* crops constitute the second most important group of fruits after bananas and plantains (*Musa*), and they are a major commodity in world trade; many countries are highly dependent upon their production and export and they are also grown for local consumption. The current taxonomy of the group is, however, far from satisfactory, as breeding barriers between many 'species' are slight, and some can exchange genes equally with related genera, such as *Poncirus* and *Microcitrus*, all of them members of the tribe Citreae of the sub-family Aurantioideae of Rutaceae. They are characterized by the typical fruit containing juice-filled vesicles in several segments, the hesperidium. Their classification presents a major problem to curators of germplasm collections because the species range from 16 to over 140 depending on the treatment.

IBPGR initiated a major field survey of wild *Citrus* in Sumatra, Indonesia in 1986 with the joint aims of clarifying taxonomic relationships and of directing much-needed collecting in later years on a rational basis. It is not unlikely that surveying and collecting in some remote forest areas in Southeast Asia will result in the identification of new taxa within the group, will facilitate an objective re-evaluation of the taxonomic systems which have been developed hitherto, if not a new one, and will clarify some of the problems associated with domestication, as only one species, *C. grandis* (pummelo), is known to have a wild progenitor. IBPGR is actively cooperating in this work (and also on similar work with mango – *Mangifera*) with WWF/IUCN so that a spin-off of the project will be to recommend that certain particularly species-rich areas are designated, in due course and with the support of local governments, as *in situ* reserves.

Fig. 4. The genetic contributions of these members of the family Rutaceae, collected in Indonesia, may prove significant in the breeding of Citrus *crops*

recently been able to demonstrate with certainty for many of the major crops that the extent to which germplasm has been used in breeding is closely related to the quality and coverage of the data bases.

THE GLOBAL NETWORK

The IBPGR global network is a delicate web; its threads of influence extend widely to plant breeding organizations, genebanks and university departments far from its Headquarters. Yet it has had significant influence in its relatively short life in initiating completely new activities in over 100 countries and in overseeing the development of an infrastructure for plant genetic resources work on a world scale.

The IBPGR global network comprises interlocking institutional arrangements and operational strategies that function together; its multi-faceted action can be and is instrumental in effecting the transfer of technology from the developed to the less-developed world. In charting its activities for the next decade, IBPGR will harness the new technologies to improve the scientific standards of genetic resources work throughout the network.

In looking to the future, it is well to remember that the IBPGR global network, because of its cooperative nature, is inherently fragile but will be backed by: the provision of improved technology, an enlarged research base and a continued close association with the IARCs of the CGIAR. The IBPGR is to appoint a public affairs officer in 1987 to improve communication with the public and with administrators, and to stress the functional importance of genetic resources, a topic which has remained largely unknown to the general public.

RESEARCH

IBPGR is currently undergoing many changes. Staffing changes were reported in the *Annual Report 1985*. This year's *Report* reflects numerous changes in activities. The early work of IBPGR on collecting as an emergency and rapidly establishing an interactive network of centres to preserve endangered crop germplasm has formed the framework of the Field Programme. 1986 shows a major shift to include a broad and carefully-designed research programme.

The IBPGR is in a unique position to head and coordinate interdisciplinary work in several areas of the plant sciences simultaneously, both applied (e.g. *in vitro* methods of conservation) and basic (e.g. patterns of variation), as components of a planned research strategy. Its use of interrelated disciplines and ability to contract to centres of expertise anywhere in the world will enable IBPGR to draw together ongoing pieces of research to enable it to be refocussed as strategic research.

In this way better scientific standards can be developed which will ensure the safety and enhanced use of germplasm. And in this respect the training programme was reorientated in 1986 to increase the number of IBPGR Interns working on mission-orientated research—rather than supporting the Field Programme as hitherto. Similarly, specialized training courses will continue to place emphasis on scientific principles and the better use of recent research results.

One major new study initiated in 1986 was on the genetic principles and permissible limits in practices of multiplication of seed crops, especially those which outbreed. Preliminary indications are that very few institutes anywhere in the world apply acceptable scientific standards. IBPGR has a major role to play in this area.

Research of the IBPGR will, because the IBPGR Field Programme is already in place, lead to more effective transfer of technology than has been possible before.

GERMPLASM ACQUISITION

The IBPGR programme on germplasm acquisition is wide-ranging, and in addition to the collection of germplasm, involves many pre- and post-collecting activities. There are four subprogrammes:

(i) Monitoring of genetic erosion;
(ii) Collecting crops or species which are threatened by genetic erosion;
(iii) Collecting germplasm to fill gaps in existing collections; and
(iv) Distribution and exchange of germplasm.

Because IBPGR's germplasm acquisition programme is closely linked with a programme of research on genetic diversity (which includes taxonomic and ecogeographic studies), this is also described in this section.

The *Annual Report 1985* emphasized the need to ensure that existing collections build up a wider representation of wild species related to crops. Accordingly, the number of collecting missions for wild species was greatly increased in 1986 and more attention was given to taxonomic and ecogeographic studies. Of the 72 collecting and survey projects in 1986 in 56 countries (see Fig. 5), 17 dealt exclusively with wild genepools, and 16 in addition were for potential forage species. Wild species were also collected in most of the missions which were largely to collect cultivars. To illustrate this change in emphasis Fig. 6 shows the increase in the percentage of wild material collected for three major staple crops: pearl millet (*Pennisetum*), *Phaseolus* beans and sweet potato (*Ipomoea*).

Reference has been made in the Introduction to the major effort which was made in 1986 to expand and update the computerized data bases on IBPGR-supported germplasm collecting missions, and to create an efficient information system on them. In conjunction with this exercise, a preliminary study was undertaken comparing established IBPGR collecting priorities with actual collecting undertaken during the past 12 years; the project will continue in 1987. The usefulness of these efforts is shown, for example, by comparison of the major genepool areas for sorghum and the collecting undertaken by IBPGR in Fig. 8. Although much collecting has been done in the priority areas designated earlier by IBPGR, some collecting work is still required for cultivars in certain areas of Africa.

MONITORING AND ASSESSMENT OF GENETIC EROSION

Genetic erosion, or the loss of variation in wild and cultivated species, may be caused by numerous factors operating in various time-spans. Its rate

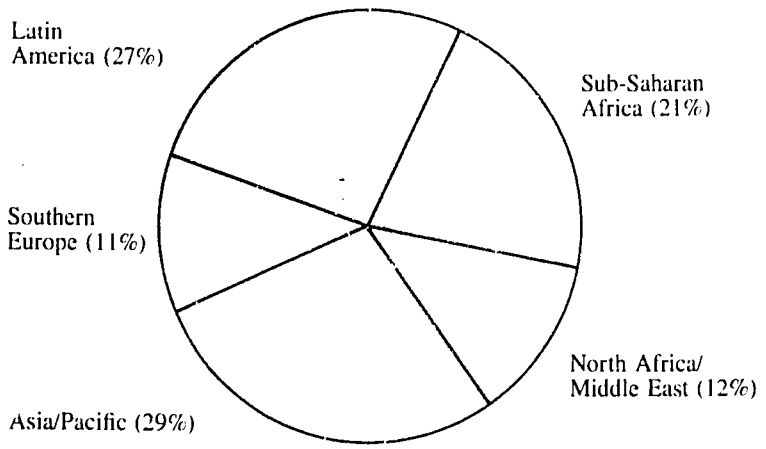


Fig. 5. IBPGR germplasm acquisition projects in 1986, by region, show emphasis placed on areas of the world holding genetic diversity of priority crops. IBPGR conducted 72 collecting and/or survey projects in 56 countries. In addition to primitive cultivars and landraces, wild relatives of crops and potential forage germplasm were also sampled

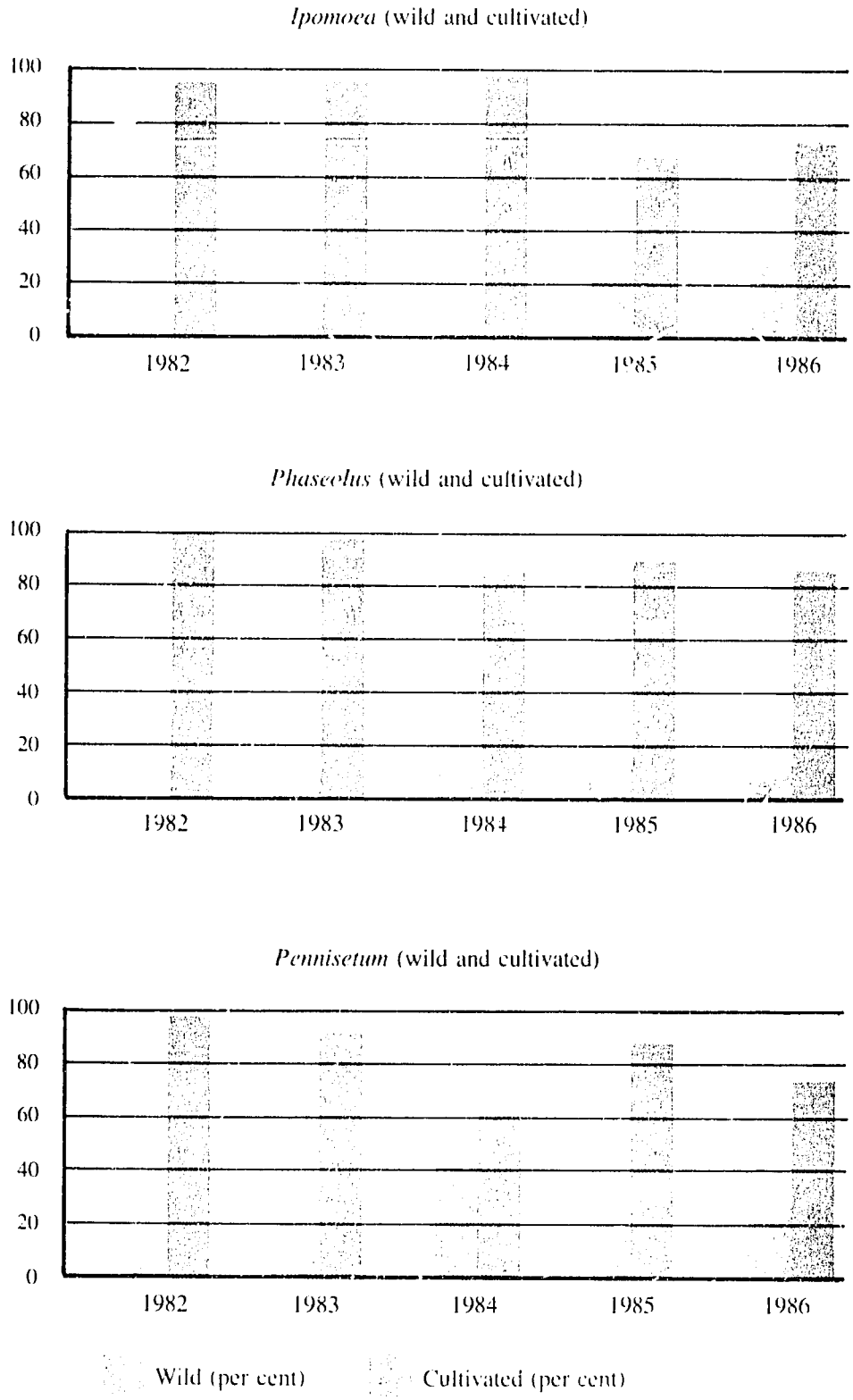


Fig. 6. An increasing emphasis on the collecting of wild species is reflected in these summary tables for three crops: Ipomoea, Phaseolus *and* Pennisetum, *which show the relative percentages of wild and cultivated germplasm collected for years 1982-86*

determines the need for collecting in any area. All of the factors involved, together with considerations of time-scale, proximity to the areas of priority assigned by IBPGR, and the extent of knowledge available, need to be brought together and assessed objectively. The major factors influencing genetic erosion are:

A. Predictable factors:

(1) *Long-term*
- (i) Desertification

(2) *Medium-term*
- (i) Resettlement and migrations of people;
- (ii) Deforestation (logging);
- (iii) Expansion of grazing into new lands and overgrazing;
- (iv) Development projects—irrigation, hydro-electricity, mining, oil exploration, roads, urbanization;
- (v) Expansion of agriculture into new areas, or major changes in agricultural practices;

(3) *Short-term*
- (i) Seed improvement schemes, with the introduction of new cultivars;
- (ii) Farmer education and new cultural practices,
- (iii) Changes in traditional farming systems, such as shorter rotations in shifting cultivation due to land being lost to erosion, urbanization, etc.;
- (iv) Greater use of trees for fuel.

B. Unpredictable factors:
- (i) Natural disasters—floods, droughts, volcanic activities and abrupt climatic changes;
- (ii) Civil disturbances.

IBPGR is in the course of developing a system to facilitate objective assessment of the threat of genetic erosion. This model will be used by IBPGR to focus better on collecting targets.

COLLECTING LANDRACES AND PRIMITIVE CULTIVARS

In 1986, IBPGR organized, or assisted in the organization of, 39 projects for the collecting of landraces and/or primitive cultivars. A summary of each mission is provided below in alphabetical order of country. Table 3 also gives an overview of material collected and shows which crop species have been collected and where.

In order to fill one of the last major gaps in maize collections in the Southern Cone of Latin America,

Fig. 7. Collecting sorghum in Rwanda, as part of the IBPGR/IRAZ project

field work was initiated to collect maize landraces in the provinces of Neuquén, Río Negro, Mendoza and western Chubut in Argentina. The project was carried out by INTA, Pergamino and in 1986, 185 samples were collected.

A two-year (1986-87) project for the collection of cassava and sweet potato germplasm in the lowlands of Bolivia is being carried out by IBTA, in association with CIAT (cassava) and CIP (sweet potato). In 1986, 102 samples of sweet potato were collected as well as 42 samples of sweet potato relatives.

CENARGEN is carrying out a number of IBPGR projects for the collection of landraces and primitive cultivars in Brazil. These include:

- (i) Maize in northeastern Brazil (1984-86)
- (ii) Groundnut, including wild *Arachis* species (1984-87) in collaboration with Texas A & M University (USA) and the Universidade Nacional del Nordeste, Corrientes (Argentina). In 1986 field work took place in the

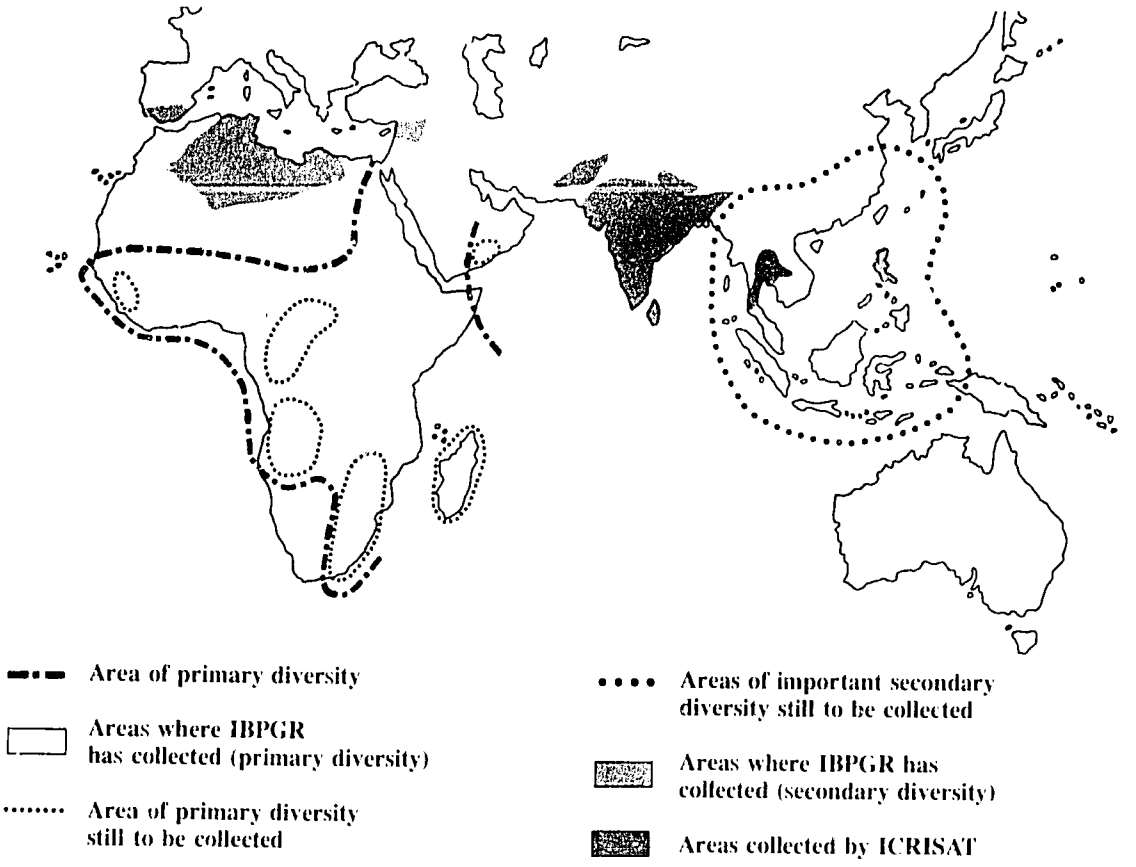


Fig. 8. Preliminary studies on sorghum (as illustrated above) and other crops were underway in 1986 to compare IBPGR collecting priorities with the actual collecting done over the past 12 years. Comparisons were made of the genepool areas to show where future collecting should be targeted

southeastern Amazon and the Pantanal region in the states of Mato Grosso and Mato Grosso do Sul;

(iii) Cotton (1984-86); and

(iv) Cassava, including wild *Manihot* species (1984-86). In the first mission in 1986 in February-March the States of Minas Gerais and Goiás were visited. One of the major objectives of the mission was to confirm the existence of *M. esculenta* growing in the wild. *M. pilosa*, which is morphologically close to cultivated cassava, was found in the State of Minas Gerai and in the area of Serro; 4 cultivated cass va and 64 wild *Manihot* spp. were collected. The second mission in 1986 was carried out in May, in the States of Mato Grosso, Rondonia and northern Goiás. Wild populations of *M. esculenta*, which were highly variable (mainly in habit and pubescence), were found in the areas of Pontes and Lacerda. One population of the rare *M. flemingiana* was found and collected. In total 74 samples were collected, of which 18 were *M. esculenta* and 56 were of 7 wild species.

In Burkina Faso, ISP, University of Ouagadougou, is carrying out a three-year (1985-87) project on the collection and evaluation of pearl millet. In 1986, 116 samples were collected.

In Colombia three projects are being carried out for the collection of landraces and primitive cultivars. These are:

(i) Cocoa germplasm along the Atlantic Coast of the Antioquía Department by ICA;

(ii) Sweet potato and yam in the Atlantic coastal area by ICA in collaboration with the IBPGR/CIP Sweet Potato Collector. In 1986, 285 samples of sweet potato and 248 wild relatives were collected; and

(iii) Cassava collecting in the Oriental jungle of Colombia by the Universidad Nacional de Colombia. The mission took place in February-March and 157 samples were collected.

A three-year project (1985-87) for the collection of native potato germplasm in Ecuador is being undertaken by INIAP, Quito, in association with CIP. During 1986 the following missions were carried out:

(i) 23-30 April, Provinces of Cotopaxi and Tunpurahna: 81 samples;
(ii) 19-24 May, Province of Luja: 60 samples; and
(iii) 25-31 May, Provinces of Aznay and Cañar: 75 samples.

A three-year (1985-87) project for the collection of germplasm of cultivated vegetables in Egypt, with emphasis on *Allium* spp., also includes the characterization of the material collected. Two institutes of the ARC, Giza, are coordinating this work with the assistance of IVT, Wageningen, Netherlands. In 1986 the following material was collected:

Onion (*Allium cepa*)	32
Kurrat (*A. ampeloprasum*)	8
Leek (*A. ampeloprasum*)	2
Garlic (*A. sativum*)	1
Cabbage (*Brassica oleracea* var. *capitata*)	7
Cauliflower (*B. oleracea* var. *botrytis*)	6
Turnip (*B. rapa*)	7
Radish (*Raphanus sativus*)	8
Okra (*Abelmoschus esculentus*)	9
Lettuce (*Lactuca sativa*)	9
Cucurbitaceae	26

An extensive grape collecting and conservation programme was initiated in *Greece* in 1982 by the Vine Institute, Lycovrissi, Athens. A field genebank was established which contains about 450 cultivars collected in 1983-84. Additional field work was organized in 1985 and 36 cultivars not previously collected were identified and collected in 1986.

A *Prunus* germplasm project in Greece was executed in 1986 by the Pomology Institute, Naoussa, on the recommendation of the ECP/GR *Prunus* Working Group (see Special Projects, p. 50). Exploration was carried out in the Peleponnesus, Sterea Hellas and in six Aegean Sea islands. A total of 162 samples was collected of the following *Prunus* species:

P. amygdalus	40
P. avium	43
P. armeniaca	25
P. cerasus	13
P. cerasifera	1
P. domestica	16
P. mahaleb	2
P. myrobalana	3
P. persica	18
P. spinosa	1

Because of the importance of Criollo types of cocoa in Guatemala, DIGESA undertook four exploration missions in 1985 and 1986 and covered vast areas of the country. Serious genetic erosion was encountered and only 6 population samples of Criollo were found.

The implementation of a two-year collecting project for germplasm of several crops in Kenya by the Ministry of Agriculture and Livestock Development was somewhat delayed. Collecting, however, will start in 1987 after a survey to determine the priority crops and the areas to concentrate efforts at the initial stages.

Early in 1986, additional rice samples were collected from the central north of Kenya by the Botany Department, University of Nairobi, hence completing the rice collecting in the Tana River delta which had been started in 1984.

The Rural Development Administration in the Republic of Korea, in collaboration with AVRDC, initiated a nationwide project for the collection of cultivated *Brassica* spp., with emphasis on *B. juncea* and *B. rapa*.

Following an ecogeographic survey, two multicrop exploration and collection missions were fielded in the Maldives:

(i) 29 April-22 June, in which 236 samples were collected; and
(ii) 23 October-22 December, in which 392 samples were collected.

A two-year (1985-87) project for the collection

Fig. 9. Collecting representative herbarium specimens during an IBPGR mission in Africa permanently records the range of variation available

Table 3. Landraces and primitive cultivars collected in 1986

Country	Cereals	Food Legumes	Roots and Tubers	Vegetables	Fruits	Industrial Crops
Argentina	* maize	* *Phaseolus*				
Bolivia			* sweet potato			
Brazil	* maize	* groundnut	cassava			* cotton
Burkina Faso	* millet					
Burundi		* *Phaseolus*				
Cameroon	* millet, sorghum					
Colombia			* sweet potato, cassava			* cocoa
Dominican Republic			* sweet potato			
Ecuador			* potato, sweet potato			
El Salvador					*	
Egypt				* *Allium*, *Brassica*, Cucurbitaceae		
Greece					* *Prunus*	* grape
Guatemala	* *Amaranthus*, maize			* *Capsicum*, *Cucurbita*	*	* cocoa
Honduras	* maize	* *Phaseolus*		*	*	
India				* *Allium*		
Indonesia					* *Citrus*	
Kenya	* rice					
Korea, Rep. of				* *Brassica*		
Madagascar						* oilpalm
Maldives	*	*		*	*	
Mexico	* maize	* *Phaseolus*		*	*	

Table 3. Landraces and primitive cultivars collected in 1986 (Continued)

Country	Cereals	Food Legumes	Roots and Tubers	Vegetables	Fruits	Industrial Crops
Morocco	* maize					
Nepal	*	*		*	*	* oilseeds
Niger	* millet, sorghum					
Pacific countries					* breadfruit	
Pakistan					* *Malus*, *Prunus*, *Pyrus*	
Panama	* maize			* *	* *	
Papua New Guinea			* sweet potato, yam, aroids		* banana	
Peru	* Andean cereals	* *Phaseolus*	* cassava, sweet potato, Andean roots & tubers	* tomato, *Capsicum*		* cotton
Rwanda	* sorghum					
Solomon Islands			* cassava, sweet potato, yam, aroids	* *Abelmoschus*		
Spain				*		
Sri Lanka	* sorghum, millet	* groundnut				* sesame
Syria				*		
Tanzania						* oilpalm
Thailand				* *Abelmoschus*	* *Citrus*	
Uganda	* sorghum, millet		* sweet potato, cassava			
Uruguay		* groundnut				
Venezuela	* maize		* cassava		* pineapple	* cocoa, oilpalm
Zaire					* banana	

and evaluation of local cultivars of maize in the major regions of traditional cultivation in Morocco, is being undertaken by the Institut Agronomique et Vétérinaire Hassan II.

Following two major multi-crop expeditions in Nepal (1984 and 1985), which were supported through Special Project Funds from the Government of Japan, IBPGR appointed an Intern in Nepal to strengthen the national genetic resources programme by assisting in the collection, characterization and evaluation of germplasm, with special emphasis on fruits. During 1986 several missions were fielded and 1269 samples were collected.

In Pakistan, PARC is executing a survey and collecting project for threatened germplasm of cultivated and wild fruit crops of the Northwest Frontier Province and Azad Kashmir, with emphasis on *Malus*, *Prunus* and *Pyrus*.

The Government of Japan also provided Special Project funding for collecting in Papua New Guinea in 1986. A mission was carried out in October and November with specific emphasis on root and tuber crops in New Britain and the North Solomons Provinces of Papua New Guinea. The following material was collected:

Colocasia	96
Dioscorea	14
Ipomoea	78
Xanthosoma	18
Musa, *Ensete*	52

Three projects for the collection of germplasm of cultivated crops were undertaken in Peru:

(i) Cotton (*Gossypium barbadense* and *G. raimondii*) collecting by INIPA in association with Texas A & M University, USA. Four major collecting missions were conducted—from September 1985-June 1986—in 11 provinces distributed among four departments in the northern coastal and mountainous regions east of the Andes. Genetic erosion is reported to be severe as wild forms and those grown in gardens and for other purposes throughout the desert coast are being destroyed. A total of 39 samples was collected. In October 1986 the IBPGR Field Officer for Latin America joined the mission and 80 *Gossypium* samples were collected, as well as a limited number of samples of *Lycopersicon*, *Capsicum* and other vegetables;

(ii) Andean roots, tubers and cereals collecting

Fig. 10. IBPGR has been actively involved in collecting germplasm in the Sahelian countries of Africa. Most are arid crops (e.g. Pennisetum*) but also included are wild rice species* (Oryza barthii, *above*) *in the Niger River delta area of Mali*

by INIPA. In missions in April and in May-June a total of 429 samples was collected; and

(iii) Cassava collecting by the New York Botanical Garden in the Upper Amazon of Peru. In 1986 this project resulted in the collection of nearly 200 samples.

A major programme on the genetic resources of root and tuber crops was initiated in Solomon Islands in 1983. IBPGR appointed an Intern to assist this programme in early January 1986, and between January and July, 242 samples were collected, including cassava, sweet potato, yam, taro and aibika (*Abelmoschus manihot*).

As a follow-up to a 1984 project, exploration and collecting missions were fielded in 1986 in Spain for vegetable germplasm in areas which had not previously been collected. The project is being carried out by the Universidad Politécnica, Valencia, in association with INIA.

Due to changes in staff, the implementation of the collection of finger millet, sorghum, sesame and groundnut in Sri Lanka had been delayed. The project was, however, started towards the end of 1986.

In 1985 a three-year project for the collection, conservation and evaluation of local vegetable cultivars was initiated by the Genetic Resources Unit of the Agricultural Research Directorate, Syria. Collecting continued in 1986.

Due to political events in Uganda, two collecting projects by the Serere Research Station were delayed. However, with the use of a vehicle from the IBPGR Office in Nairobi, collecting was resumed in 1986 for:

(i) Sweet potato and cassava; and

(ii) Sorghum and millets.

Two projects for the collection of cultivated germplasm took place in Venezuela:

(i) Pineapple and its relatives by the Universidad Central de Venezuela, in cooperation with IRFA (France). Four missions were carried out, of which two took place in 1986:
—January-February, 32 samples of pineapple and its relatives as well as 38 samples of wild and cultivated cocoa;
—February-March, 16 samples of pineapple and its relatives; and

(ii) Maize, cassava and oilpalm by FONIAP-CENIAP.

The IBPGR, in consultation with CATIE, appointed a Collector at the beginning of January 1986 to work in Meso-America. The Collector, who is based at CATIE Headquarters, Costa Rica, carried out the following missions:

(i) El Salvador: 6 samples of *Annona squamosa*;

(ii) Guatemala: 83 samples (maize, fruits, vegetables);

(iii) Honduras: 20 samples (maize, *Phaseolus*, fruits, vegetables);

(iv) Mexico: 132 samples (maize, *Phaseolus*, fruits, vegetables); and

(v) Panama: 54 samples (maize, fruits, vegetables).

Fig. 11. The genepool of the Triticeae, important for wheat breeding, being collected on the steppes of Inner Mongolia, China

A IBPGR Collector was stationed at IRAZ, Burundi from March 1985-December 1986 in order to collect, characterize and conserve crop germplasm in Burundi, Rwanda and Zaire. Collecting in 1986 concentrated on forages in collaboration with ILCA (p. 23), but some food crop germplasm was collected:

(i) Burundi, 38 *Phaseolus vulgaris* (central highlands around Gitega) in January and 18 *P. vulgaris* (mountains of the Zaire-Nile crest) in July;

(ii) Rwanda, 31 samples of sorghum from high altitude areas in August, and

(iii) Zaire-18 clones of boiling and beer *Musa* and one clone of plantain from the north Kivu Region of eastern Zaire in January.

PORIM, Malaysia, collected natural populations of oilpalm (*Elaeis guineensis*) along the shore of Lake Tanganyika (Tanzania) and in Madagascar from June-August.

In September, IBPGR approved a project for the collection from the Pacific area of breadfruit cultivars through the Pacific Tropical Botanical Garden, Hawaii, USA and the School of Agriculture, University of South Pacific. This is to include the collection of propagating material from seeded and seedless cultivars from Pacific islands. Additionally, herbarium specimens, photographs, cultivar descriptions and ethnobotanical information will be collected or recorded for each cultivar. Taxonomic studies will be made on the relationships between and within species and cultivars and the origin of sterile, parthenocarpic clones from seeded progenitors will be investigated. The missions commenced in December 1986 and will cover Fiji, French Polynesia, Kiribati, Micronesia and Western Samoa.

A team comprising Japanese and Indonesian scientists, an expert from the University of California, USA, and the IBPGR Field Officer for Southeast Asia collected cultivars of *Citrus* in Indonesia (Sumatra, Java, Madura, Bali) and eastern Thailand in July-August. 50 samples were collected in Indonesia and 13 samples in Thailand.

COLLECTING MISSIONS AND ECOGEOGRAPHIC SURVEYS FOR WILD RELATIVES OF CROPS

Table 4 summarizes information on the collection and ecogeographic surveys carried out for wild species, including wild material collected during projects which were predominantly for the collection of cultivated material. A brief description is given below of 17 projects which dealt primarily with wild species.

A second mission for *Capsicum* species in Brazil was carried out in March-April by staff of CENARGEN with the assistance of Prof. A.T. Hunziker from the Universidad Nacional de Cordoba, Argentina. The mission collected 45 population samples of *Capsicum*, 190 individual plant samples and 75 herbarium specimens.

Table 4. Collecting of wild species in 1986

Country	Specific collecting	Ecogeographic surveys and collecting
Argentina	*Phaseolus*	
Bolivia	*Ipomoea*	
Brazil	*Arachis, Capsicum, Manihot*	
Burundi	*Eleusine*	
Cameroon		*Oryza, Pennisetum, Sorghum*
Chile	*Lycopersicon*	
China	Triticeae	
Colombia	*Ipomoea, Lycopersicon, Theobroma*	
Cyprus	*Beta, Brassica*	
Dominican Republic	*Ipomoea*	
Ecuador	*Ipomoea, Solanum* (tuber-bearing)	
France	*Brassica*	
India	*Allium*	
Israel	*Beta, Brassica*	
Italy	*Brassica*	*Aegilops, Hordeum*
Jordan	*Aegilops, Triticum, Hordeum*	
Kenya	*Eleusine*	
Mali		*Pennisetum, Oryza*
Mexico	*Phaseolus*	
Niger		*Pennisetum, Grewia*
Peru	*Ipomoea, Phaseolus, Gossypium*	
Thailand	*Abelmoschus*	
Tunisia	*Brassica*	
Turkey		*Aegilops, Avena, Hordeum, Secale, Triticum*
Uruguay	*Arachis, Solanum commersonii*	
Venezuela	*Ananas, Theobroma*	
Zaire	*Coix, Eleusine, Psophocarpus, Sorghum*	

Northern Chile is one of the few remaining priority areas for the collection of wild tomato species (*Lycopersicon* spp.). Following successful collecting in October 1985, a second mission was organized by the Universidad de Tarapacá, Chile in association with the Universidad Austral de Chile, Prof. C. Rick of the University of California, USA and the IBPGR Field Officer for Latin America in April-May 1986. The 1986 mission collected 29 samples of *L. chilense*, 6 of *L. peruvianum* and 2 of *Solanum lycopersicoides*. Prof. Rick and the IBPGR Field Officer for Latin America continued this mission in Colombia and obtained 13 samples of *L. esculentum* var. *cerasiforme* and one sample of *S. juglandifolium*. A third mission is planned for 1987.

A major new project was initiated in 1986 for the collection of the genetic resources of the Triticeae in China. Two missions took place in 1986:

(i) Inner Mongolia by CAAS with the assistance of Dr. Y. Cauderon, INRA, Versailles, France;

(ii) Northwest China by the Triticeae Research Institute, Sichuan with the assistance of Prof. R. von Bothmer and Dr. J. Flink of the Swedish University of Agricultural Sciences.

IBPGR carried out a wild *Beta* collecting project in Cyprus in association with ARI, Nicosia, Cyprus. The mission took place in May-June and the following samples were collected:

B. macrocarpa	1
B. maritima	29
B. vulgaris	5
Introgressed forms of *B. maritima* with either *B. macrocarpa* or *B. vulgaris*	4

The Department of Botany, University of Kashmir, India is carrying out a three-year (1984-87) project for the collection, multiplication and evaluation of *Allium* species from India. In 1986 more germplasm was collected, and the collection now consists of 47 accessions of cultivated *Allium* and 49 accessions of over 20 wild *Allium* species.

IBPGR in collaboration with the National Council for Research and Development and the participation of staff of the Israel Gene Bank for Agricultural Crops and the Department of Botany of the Hebrew University of Jerusalem, collected *Beta* and *Brassica* in Israel in May-June. A total of 89 seed samples was collected, comprising 62 *Beta*, 10 *Brassica* and 17 *Sinapis*.

Following earlier field work on cultivated wheat and barley, in 1986 the Yarmouk University, Irbid, Jordan, in collaboration with ICARDA, Syria initiated a collecting programme for *Aegilops* spp., *Hordeum* spp., and *Triticum dicoccoides* in Jordan. In all 241 samples were collected consisting of *Aegilops* spp., *H. spontaneum*, *H. vulgare* and *T. dicoccoides*.

The Virginia Polytechnic Institute and State University, Virginia, USA initiated a two-year (1985-86) project to collect wild species of *Eleusine* in Kenya. In 1985 preparations were made through visits to herbaria and actual collecting took place in February-March 1986 in collaboration with staff of the Kenyan National Genebank and the IBPGR Field Officer for Eastern and Southern Africa. The mission explored central Kenya, the western and Kwale districts at the coast and 63 samples were obtained of which 18 were from the Kitale Agricultural Research Station. The number of samples for each species was:

Eleusine africana	15
E. coracana	1
E. floccifolia	3
E. indica	8
E. jaegari	26
E. multiflora	4
Eleusine spp.	6

IBPGR started field work to provide ecogeographic data for wild and spontaneous African rice in the inland delta of the Niger river in Mali (October 1986-January 1987), assisted by collectors from IUCN (Mali), the Institut d'Economie Rurale (Mali) and ORSTOM (Côte d'Ivoire) as well as the IBPGR Field Officer for West Africa. In 1986 they collected 34 samples of *Oryza barthii*, 57 of *O. longistaminata* and 1 of *O. stapfii*, in addition to 14 forage samples.

IBPGR organized a collecting project for okra (*Abelmoschus* spp.) in Thailand with the assistance of the IBPGR Field Officer for Southeast Asia in December 1986. The mission was led by Mr. S. Hamon (ORSTOM, Côte d'Ivoire) who in collaboration with Kasetsart University, Thailand, collected 78 samples consisting of *A. esculentus* (6), *A. manihot* (35), *A. moschatus* (32) and 5 interspecific hybrids.

An ecogeographic survey for wild wheat relatives in Turkey is being carried out by the USDA with some input by IBPGR. The second mission took place in the middle of 1986 and a total of 150 samples was collected (*Aegilops*, *Avena*, *Hordeum*, *Secale*, *Triticum*, etc.).

The Universidad de la República, Montevideo, Uruguay is carrying out a collecting project for wild species of groundnut (*Arachis* spp.) and *Solanum commersonii*. In 1986 248 samples of *Arachis* (*A. burkartii*, *A. hypogaea*, *A. villosa*) and 32 samples of *S. commersonii* were collected.

Towards the end of 1986, FONAIAP started to collect wild and primitive cocoa (*Theobroma* spp.) in the Amazon area of Venezuela.

In November IBPGR appointed an Intern/Collector for the collection of wild *Vigna* and other wild species in southern Africa. The Collector is based at the National Herbarium and Botanic Garden, Harare, Zimbabwe.

From late 1984, IBPGR employed an Intern/Collector to conduct research on *Phaseolus* based at CIAT. In 1986 this Collector undertook the following field missions:

(i) Argentina (Santa Victoria, Iruya, Salta). A total of 170 samples was collected consisting of 156 landraces of *P. vulgaris*, 10 populations of *P. vulgaris* var. *aborigineus* and 4 of *P. augustii*;

(ii) Peru (Cajamarca and Amazon). A total of 204 samples was collected:

Phaseolus vulgaris (landraces)	137
P. vulgaris (wild and weedy)	8
P. lunatus (landraces)	40
P. lunatus (wild and weedy)	10
P. polyanthus	7
P. pachyrrhizoides	2

(iii) Mexico (northeast). A total of 73 samples of 15 *Phaseolus* species was collected. Of the 15 species collected, 13 were wild relatives.

For the past two years, CIP has included sweet potato in its programme. Early in 1985, IBPGR appointed a Collector at CIP to accelerate the collection of sweet potato germplasm in its centre of origin, with emphasis on the wild relatives which are seriously under-represented in existing collections. In 1986 several missions were carried out in Bolivia, Colombia, Dominican Republic, Ecuador and Peru:

(i) Bolivia, 102 *Ipomoea batatas* and 42 wild relatives;

Table 5. Collecting forages in 1986

Country	Specific collecting for forages	Ecogeographic surveys for forages
Argentina	*Briza, Bromus, Lycium, Pappophorum, Piptochaetium, Poa, Sorghastrum, Stipa*	
Brazil	Tropical: *Aeschynomene, Bauhinia, Centrosema, Desmodium, Macroptilium, Mimosa, Stylosanthes, Zornia* Subtropical: *Aeschynomene, Arachis, Axonopus, Centrosema, Desmodium, Macroptilium, Paspalum, Setaria, Vigna*	
Burundi	*Brachiaria, Chloris, Melinis, Panicum, Pennisetum, Crotalaria, Desmodium, Macrotyloma, Neonotonia, Rhynchosia, Sesbania, Teramnus, Trifolium, Vigna, Zornia*	
Cameroon		*Andropogon, Brachiaria, Pennisetum* (forage forms), *Vigna*
Colombia	*Stylosanthes*	
Ethiopia	*Chloris, Stylosanthes, Zornia*	
Greece	*Dactylis, Festuca, Lolium, Medicago, Trifolium*	
Indonesia	*Desmodium, Pueraria, Codariocalyx, Alysicarpus, Flemingia*	
Italy	*Dactylis, Festuca, Holcus, Lolium, Lotus, Medicago, Ornithopus, Trifolium, Vicia*	*Dactylis, Festuca, Hedysarum, Hippocrepis, Lotus, Medicago, Phalaris, Scorpiurus, Trifolium, Vicia*

(ii) Colombia, 285 *I. batatas* and 248 wild relatives;
(iii) Dominican Republic, 37 *I. batatas* and 6 wild relatives;
(iv) Ecuador, 172 *I. batatas* and 21 wild relatives; and
(v) Peru, 246 *I. batatas* and 25 wild relatives.

As a continuation of earlier collecting work in the Mediterranean genepool in France, Greece, Italy, Spain and Turkey, in 1986 wild *Brassica* species were collected in July covering Tunisia, Cyprus, Italy (Sardinia) and France (Corsica and Mercantour). The leaders of this project were Dr. M. Gustafsson (Sweden) and Prof. C. Gomez-Campo (Spain) and assistance was provided by scientists from all national programmes in the countries visited. *Brassica insularis* was collected in Corsica, Sardinia and Tunisia, and for the first time, *B. hilarionis* was collected in Cyprus. Other species collected included: *Brassica campestris* and *B. napus* as well as *Raphanus raphanistrum*, *Sinapis alba* and *S. arvensis*. In addition, the opportunity was taken to collect some species of the Triticeae as well as *Daucus*, *Lactuca*, *Lupinus* and *Trifolium montanum*.

COLLECTING MISSIONS AND ECOGEOGRAPHIC SURVEYS FOR FORAGES

Table 5 summarizes information on the collection and ecogeographic surveys for forages undertaken in 1986. There were 16 specific projects and these are described in more detail below.

Two forage collecting projects are continuing in Argentina:

Table 5. Collecting forages in 1986 (Continued)

Country	Specific collecting for forages	Ecogeographic surveys for forages
Mali		*Acacia*, *Brachiaria*, *Echinochloa*, *Paspalum*, *Pennisetum* (forage forms), *Vigna*
Niger		*Acacia*, *Andropogon*, *Cenchrus*, *Panicum*, *Pennisetum* (forage forms), *Setaria*, *Vigna*
Portugal	*Dactylis*, *Festuca*, *Holcus*, *Lolium*, *Lotus*, *Medicago*, *Ornithopus*, *Trifolium*, *Vicia*	
Rwanda	*Brachiaria*, *Chloris*, *Digitaria*, *Panicum*, *Setaria*, *Macrotyloma*, *Neontonia*, *Sesbania*, *Stylosanthes*, *Teramnus*, *Trifolium*, *Zornia*	
Spain	*Dactylis*, *Festuca*, *Holcus*, *Lolium*, *Lotus*, *Medicago*, *Ornithopus*, *Trifolium*, *Vicia*	
Syria	Vicieae, *Lupinus*, *Medicago*, *Cicer*	
Venezuela	*Centrosema*, *Stylosanthes*	
Zaire	*Brachiaria*, *Canavalia*, *Cenchrus*, *Chloris*, *Cynodon*, *Digitaria*, *Macrotyloma*, *Neontonia*, *Paspalum* *Pennisetum*, *Setaria*, *Stylosanthes*, *Teramnus* *Trifolium*, *Vigna*, *Zornia*	

(i) Exploration and collection of native forage germplasm in San Luis by INTA, San Luis, with emphasis on *Briza*, *Bromus*, *Poa* and *Sorghastrum*; and

(ii) The collection of forage species native to the desert-like plateau in the province of Río Negro by INTA, Río Negro, with emphasis on *Bromus*, *Lycium*, *Pappophorum*, *Piptochaetium*, *Poa* and *Stipa*.

In Brazil, IBPGR is funding two forage germplasm collecting projects, both carried out by CENARGEN:

(i) Tropical legumes and grasses (1984-86); and

(ii) Subtropical legumes and grasses (1984-87).

IBPGR undertook an ecogeographic survey in Cameroon (Lake Chad, Waza National Park, Mandara Mountains) in September-October in collaboration with the national genetic resources programme of Cameroon and IUCN/WWF and MAB (Unesco). The mission resulted in the collection of a total of 142 samples of forages (*Andropogon*, *Brachiaria*, *Pennisetum*), wild crop relatives (*Oryza*, *Pennisetum*, *Sorghum*, *Vigna*) and some cultivated material (pearl millet, sorghum, okra).

An IBPGR Intern, based at ILCA, started work in June 1986 to assist the ILCA forage genetic resources programme and he undertook short collecting missions in Ethiopia together with ILCA staff in November-December 1986. Six samples were collected of *Chloris*, *Stylosanthes* and *Zornia*.

For the third consecutive year, IBPGR funded forage collecting in Greece by the Fodder Crops and Pastures Institute, Larissa. In 1986 central and eastern Macedonia were explored. A total of 140 samples was collected, largely consisting of *Dactylis*, *Festuca*, *Lolium*, *Medicago* and *Trifolium*.

Two forage projects were executed in 1986 in Indonesia:

(i) Dr. K.L. Mehra (IBPGR Forage Collector) completed a two-year assignment in March 1986. He covered mainly the islands of Indonesia east of Java in cooperation with LBN. A large number of genera and species of forage legumes and grasses was collected, with special emphasis given to the high priority genus *Desmodium*; and

(ii) CIAT carried out two collecting missions in Sumatra, one in 1985 and the other in August-September 1986. The latter covered northern Sumatra and a total of 243 samples was collected. These consisted of 101 samples of 13 *Desmodium* species and 142 samples of 25 other genera.

IBPGR undertook an ecogeographic survey of forage crops in Italy in June-July. This joint mission of IBPGR, the Ministries of Agriculture of South and Western Australia and CNR, Italy surveyed Sicily and the Eolie Archipelago, seven islands some 100 km north of Sicily. A total of 1028 samples was collected, including:

Aegilops spp.	11
Dactylis glomerata	35
Festuca arundinacea	12
Hedysarum spp.	42
Hordeum spp.	20
Lotus sp.	4
Medicago spp.	620
Scorpiurus muricatus	20
Trifolium spp.	248
Vicia spp.	7

An ecogeographic survey for forages in Mali (northwest of Bamako, the Gourma district, Vallee du Telemsi and Adrar des Iforas) was organized with the assistance of the IBPGR Field Officer for West Africa. Other members of the team were provided by the Institut d'Economie Rurale (Mali), IITA (Nigeria) and RBG, Kew (UK). The mission was carried out in October-December.

IBPGR also undertook an ecogeographic survey in the southern part of the Air Mountains of Niger in November-December. This was a follow-up to earlier field work in 1984 and 1985. In 1986 the mission was again assisted by IUCN/WWF and ORSTOM and 116 samples were collected, consisting of forages (*Andropogon*, *Cenchrus*, *Setaria*, *Pennisetum*, *Panicum*, *Acacia*), wild crop relatives (*Grewia*, *Pennisetum*) and some cultivated material (pearl millet, sorghum).

IBPGR sponsored a mission to collect germplasm of Vicieae in Syria in March-June. Three collaborating groups were involved: the Vicieae Project Group of the University of Southampton (UK), and the Genetic Resources Units of ICARDA and the Syrian National Programme. The mission focussed on the areas of Syria rich in Vicieae species: Jebel Lubnan Ash-Sharqiyah, Jebel As-Sahiliyah, Halab region, Al-Ghab and Jebel Al-Arab.

Each collection site was visited twice, once to identify the taxa present and then to collect the seed. As well as the germplasm, herbarium voucher specimens and *Rhizobium* samples were taken for a large proportion of the accessions. Sites were selected at random in the areas of high Vicieae concentrations, although repeated sampling from one population was avoided. In all, 623 *Vicia*, 384 *Lathyrus*, 71 *Pisum* and 85 *Lens* seed accessions were collected from 148 sites. In addition to Vicieae, germplasm of *Cicer* (8), *Medicago* (154) and *Lupinus* (16) species was also collected. A rare relative of *Vicia faba*, *V. hyaeniscyamus*, was located and seed, voucher specimens and *Rhizobium* cultures obtained.

A Collector of the CSIRO Davies Laboratory,

Fig. 12. Many crops and crop relatives, including this Vigna *sp., were collected from islands of the Maldives. Although relatively recently introduced by maritime traders, such crops may be useful because of their tolerance to alkaline soils.*

Townsville, Queensland, Australia in collaboration with CIAT – FONIAP CENIAP (Venezuela), the Universidad de Zulia (Venezuela) and the Universidad Nacional Experimental del Tachira (UNET, Venezuela) undertook a mission to collect specific ecotypes of natural *Stylosanthes hamata* × *S. humulis* allotetraploids and sympatric *Stylosanthes* species in Colombia and Venezuela. The mission was carried out from February-August and a total of 311 samples was obtained but this included donations by CIAT (71 accessions) and UNET (12 accessions). The samples collected in the field in Colombia and Venezuela totalled 228 of the following genera species: *Centrosema* (2), *Stylosanthes capitata* (3), *S. hamata* (214), *S. humilis* (6), *S. scabra* (1) and *Stylosanthes* spp. (2).

Burundi, Rwanda and eastern Zaire were explored for forages by a mission composed of ILCA, IRAZ (Burundi, Rwanda, Zaire), ISABU (Burundi), ISAR (Rwanda), INERA (Zaire) and RBG, Kew (UK) and assistance and coordination was provided by the IBPGR Collector for central Africa. From early May to the end of July 1986, the mission explored the region of the western arm of the Great African Rift Valley which incorporates Burundi, Rwanda and parts of the Kivu Region of eastern Zaire. A total of 168 seed samples of 26 genera was collected (78 from Burundi, 29 from Rwanda and 61 from Zaire).

IBPGR also supported a forage collecting project in Italy, Portugal and Spain, which was executed by the Grassland Division, DSIR, New Zealand. The missions took place in June-July 1986 and a total of 1244 samples was collected including: *Dactylis* (68), *Festuca* (88), *Holcus* (25), *Lolium* (209), *Lotus* (91), *Medicago* (73), *Ornithopus* (50), *Trifolium fragiferum* (23), *T. pratense* (67), *T. repens* (130), *Trifolium* spp. (150) and *Vicia* (66).

GERMPLASM DISTRIBUTION AND EXCHANGE

An extremely important follow-up to the collection of germplasm is the rapid transfer of the material to IBPGR-designated base collections. For this purpose IBPGR has for the past few years contracted the Seed Bank of the RBG, Kew, UK to act

as an IBPGR Seed Handling Unit with a full-time staff member devoted to properly cleaning, drying, testing viability and packaging samples. During 1986, 3691 samples were received from IBPGR germplasm acquisition projects and 1506 samples despatched to designated genebanks in the IBPGR worldwide network.

Since the start of the IBPGR Seed Handling Unit at Kew a total of 26 441 samples have been received. Of these 22 894 have been despatched to 36 genebanks.

Although much of the work on the despatch of collected samples is now being carried out by the REG, Kew, UK, the IBPGR Headquarters staff with the assistance of the FAO Seed Laboratory play an essential role in the exchange of germplasm, acting as intermediaries between genebanks or between genebanks and users. In 1986 the FAO Seed Laboratory received and despatched a total of 1974 samples of germplasm on behalf of IBPGR.

IBPGR is also supporting a number of projects for the multiplication and/or distribution of germplasm from existing collections to designated base collections and/or field genebanks. These include:

(i) Transfer of sweet potato germplasm from national collections in Asia and the Pacific to AVRDC;

(ii) Transfer of cassava germplasm from expeditions and national collections in Latin America to CIAT;

(iii) A specific project on the transfer of sweet potato to USDA and cassava germplasm from Peru to CIAT by the Universidad Nacional Pedro Ruiz Gallo;

(iv) Transfer of banana germplasm from Papua New Guinea to the Southeast Asia Banana Field Genebank in Davao, Philippines;

(v) The multiplication of an important wild wheat collection at the University of California, Riverside, USA so that this can be

Fig. 13. This field survey covered a relative of maize, teosinte (Zea mexicana), in Mexico. The shaded areas indicate where populations of teosinte have been found and may be used as a guide for their in situ conservation (see Table 6). This survey will be published by IBPGR in 1987

Table 6. Systematic and ecogeographic studies on crop genepools

Genus/species	Activity
Abelmoschus spp.	A survey of relevant literature and of herbarium specimens, both in Europe and in Asia, which was initiated in 1984 and reported in earlier *Annual Reports*, was almost complete by late 1986. The work will be published in 1987.
Beta spp.	Work has started on the compilation of recent research data on the origin and evolution of cultivated beets and the distribution of patterns of variation; information on the latter has resulted largely from IBPGR field work.
Brassica spp.	Wild species of this genus have been studied in the field in the Mediterranean and collected by IBPGR since 1981 in Cyprus, France, Greece, Israel, Italy, Spain, Tunisia and Turkey, following a preliminary survey of herbarium material. A publication is to follow further field collecting in 1987-88.
Citrus spp. and related genera in the subfamily Aurantioideae of the Rutaceae	A survey of all important herbarium material in institutes in Europe, Asia and North America was initiated in 1986. A planning survey was carried out in Sumatra in June-July. A book in the series will likely be published in 1987 and the field survey will start in 1988.
Mangifera spp.	This was the first publication on a crop genepool in the series, and was followed by field work in Indonesia in cooperation with IUCN/WWF. From August 1986, IBPGR appointed an Intern for this survey, which is to be extended to Malaysia and Thailand.
Solanum spp. (African eggplant)	Survey, collection and study of the African eggplant genepool was initiated in 1980. Accessions collected in Africa have been characterized and studied experimentally at the University of Birmingham, UK by several IBPGR-supported M.Sc. trainees. Parts of a Ph.D. thesis on African *Solanum* species are to be published in 1987.
Teosinte (*Zea mexicana*)	Teosinte is a close relative of maize and an important part of its genepool. Populations of teosinte in Mexico have been mapped to enable the Government to draw up plans for *in situ* conservation. The final report was offered to IBPGR for publication and it will be issued in early 1987.
Vigna spp.	An IBPGR Working Group on tropical and subtropical forages recommended that a number of *Vigna* species require further study. Primitive forms of cowpea (*V. unguiculata*) are also of potential interest as forage crops. An herbarium survey of both the progenitor and relatives of cowpea and other African *Vigna* species was conducted in 1986; the survey will be extended to include Asiatic *Vigna* species and will be continued in 1987.

more widely available:

(vi) The partial multiplication of *Leucaena* species from the primary centre by the Nitrogen Fixing Tree Association, Hawaii, USA;

(vii) The multiplication of forage grasses and legumes by INIA, Spain;

(viii) The multiplication of part of the significant *Phaseolus* bean collection at the University of Cambridge, UK and repatriation to several developing countries; and

(ix) The multiplication of African eggplant germplasm by DRA, Togo.

The IBPGR continues to assist in the repatriation of samples to developing countries when material has been lost and when requested to do so.

Many other IBPGR projects include a component on germplasm distribution, but since their emphasis is on characterization of the material, these are reported in the section on **Characterization and Evaluation**.

SYSTEMATIC AND ECOGEOGRAPHIC SURVEYS ON CROP GENEPOOLS

The lack of basic knowledge on wild species has become increasingly evident since IBPGR has been actively involved in their collection. In many cases

synonomy of species is not clear; biological species concepts have not been applied and distribution maps are found to be inaccurate. In many cases ecological data are completely lacking. It is therefore essential that systematic and ecogeographical studies are undertaken, either prior to or at the same time as, major collecting missions.

The first publication in the series *Systematic and Ecogeographic Surveys on Crop Genepools* was published towards the end of 1985 and covered the taxonomy and distribution of *Mangifera* species based on literature and herbarium studies. This is now being followed by actual field surveys in Indonesia and Malaysia and a monograph of the genus prepared by Prof. A. J. Kostermans will result from this stimulatory work of IBPGR. Several similar projects have been initiated and are summarized in Table 6. An example of this kind of survey is shown in Fig.13, which is from a publication on teosinte in this series to be published in early 1987.

Fig. 14. Recent surveys and collecting in Indonesia by IBPGR and WWF/IUCN have resulted in the identification and location of relatives of the cultivated mango, following a study of herbaria and other data. This tree in Kalimantan is Mangifera rufocontata

CONSERVATION

Plant genetic resources can be conserved in the following ways: as seed, as growing plants in field genebanks, as tissues *in vitro* and in the natural environment *in situ*. These methods may either be used alone or in combination for the conservation of a given crop but in general are complementary.

Dried seeds may be conserved at low temperatures either as base collections for long-term storage only, or as active collections. Crops which are conserved in field genebanks include some, including potato and yam, which are normally clonally-reproduced and may produce seeds only rarely, and others, for example cocoa and coconut, the seeds of which cannot be stored at low moisture content and temperature without a severe or complete loss of viability. These may occupy extensive areas of land. As yet there are no functional *in vitro* genebanks meeting the scientific requirements of IBPGR, and further *in vitro* research and development work is needed with many crops in order to produce methods for long-term storage of cultures or in medium-term conservation to ensure an acceptable level of genetic stability when cultures are regenerated by subculturing.

Wild populations can be conserved in their natural habitats *in situ* but for relatives of crops, with few exceptions, this method applies largely to perennial species. It is almost impossible to maintain in perpetuity disturbed and weedy habitats. Many reserves are maintained largely as nature reserves: few areas have been designed and demarcated specifically as gene reserves. The wild germplasm which reserves contain may usefully complement *ex situ* collections. Comprehensive field surveys of wild populations and taxonomic and genetic studies are necessary before designating such gene reserves.

SEED CONSERVATION

Seed conservation is the most commonly used and practicable method of conserving plant genetic resources. Seeds of most annual crop plants can be stored for long periods of time if they are dried (preferably at 15°C and 15% relative humidity) to about 5% seed moisture content and kept at low temperature in hermetically sealed containers. The temperature recommended for base storage is -18°C (at least below 0°C). Conditions required for active collections are less stringent (temperature usually less than 15°C) although seeds are still dried and kept in sealed containers.

Some species produce recalcitrant seeds which do not survive drying or cold, although major staple food crops do not fall in this category. Recalcitrant seeds can only be stored for short periods of time, in some cases less than two months. Several economically important crops such as rubber and coconut possess recalcitrant seeds. During the 21st Congress of the International Seed Testing Association which met in 1986 at Brisbane, Australia, a Working Group on Recalcitrant Seed Storage and Moisture Determination was formed. The IBPGR Advisory Committee on Seed Storage (Appendix II) has close links with ISTA Committees and this new Working Group. It is expected that IBPGR will update its earlier reports on recalcitrant seeds during 1987.

THE WORLD NETWORK OF BASE SEED COLLECTIONS

Certain genebanks have been designated by IBPGR, on the recommendation of expert committees or workshops to act as base conservation centres for major crops. Designated genebanks hold either 'world' or 'regional' collections of specific crops, and through a written exchange of memoranda accept the following commitments:

(i) The collection will continue to receive adequate operating funds and personnel and if, at some future time, this is not possible, FAO/IBPGR will be notified promptly;

(ii) Material stored will be made freely available to any qualified institution or person, if it is not available from an active collection (Note: Requests for germplasm from *bona fide* users should not be addressed to the base collec-

Fig. 15. The recently completed new genebank at AVRDC, Taiwan, China holds IBPGR-designated regional collections of specific crops

tions but to the active collections);

(iii) Authorized representatives of IBPGR will be given access to the collection and data at all reasonable times;

(iv) Arrangements will be made to duplicate the material for safety;

(v) For base storage, seeds of most crops will be dried to a moisture content of 5%, packaged and stored at temperatures lower than -5°C (ideally between -10°C and -20°C) with a viability monitoring regime as recommended by IBPGR (see FAO/IBPGR Plant Genetic Resources Newsletter, *41*:3-18); and

(vi) The samples will be regenerated in an appropriate manner which preserves the genetic integrity of the sample when seed viability begins to decline or the quantity of seed is reduced to a critical level.

Base collections thus form a security mechanism. The network of IBPGR-designated base collections is nearly complete for major seed crops, although additional genebanks are needed for forages and more duplication is required. IBPGR initiated negotiations in 1985 with eight genebanks to be designated as base collections for 20 genera of tropical and subtropical forage crops. The network of designated base collections for seed crops, as it stands in 1986, is listed in Table 7.

It should be realized that the designation of a network does not ensure that materials are transferred from all the other centres. Nonetheless, IBPGR seeks to ensure that all materials collected under its auspices are in fact deposited in these centres designated and its Field Staff try to see that other materials are transferred especially when materials are being kept under poor conditions, a situation all too common in numerous active collections.

Active collections are used for the distribution, multiplication, characterization and evaluation of germplasm; their use promotes the exchange and utilization of germplasm. The storage conditions in active collection should be such that seeds can be stored for 10-20 years without regeneration (unless they are required for distribution before that time), and all active collections should be closely associated with one or more base collections. IBPGR is currently developing guidelines for the establishment of a global network of active collections to stimulate the use of germplasm and ensure greater safety of germplasm. A long-term programme to this effect is to be initiated in 1987.

REGISTER OF GENEBANKS

In 1985 IBPGR developed and published a document listing the scientific and operational standards for seed storage in order to assist genebanks in

Fig. 16. Essential operations in cleaning seed at PGRC, Ethiopia: removal of detritus, chaff, unfilled seeds, weed seeds and off-types

Table 7. IBPGR network of designated base collections of seed crops[1]

Crop	Species covered	Scope of collection	Institute
Cereals			
Barley		Global	PGR, Ottawa, Canada
		European	NGB, Lund, Sweden
		African	PGRC/E, Addis Ababa, Ethiopia
		Asian	NIAR, Tsukuba, Japan
Maize		New World	NPGS, USA [2]
		Asian	NIAR, Tsukuba, Japan
		Asian	TISTR, Bangkok, Thailand
		European	VIR, Leningrad, USSR
		South European	Portuguese Genebank, Braga
Millets	*Pennisetum*	Global	NPGS, USA
	Pennisetum	Global	PGR, Ottawa, Canada
	Pennisetum	Global	ICRISAT
	Eleusine	Global	PGRC/E, Addis Ababa, Ethiopia
	Eleusine	Global	ICRISAT
	Minor Indian millets	Regional	NBPGR, New Delhi, India
	Eragrostis	Global	PGRC/E, Addis Ababa, Ethiopia
	Panicum miliaceum	Global	ICRISAT
	Setaria italica	Global	ICRISAT
Oats		Global	PGR, Ottawa, Canada
			NGB, Lund, Sweden
Rice	*Oryza sativa—indica*	Global	IRRI
	javanica	Global	IRRI
	japonica	Global	NIAR, Tsukuba, Japan
		African	IITA, Ibadan, Nigeria
		Mediterranean, temperate and intermediate forms from the USA	NPGS, USA
	Wild species		IRRI
Rye		Global	Polish Genebank, Radzikow
		Global	NGB, Lund, Sweden
Sorghum		Global	NPGS, USA
		Global	ICRISAT
Wheat	Cultivated species		VIR, Leningrad, USSR
		Global	CNR, Bari, Italy
		Global	NPGS, USA
	Wild species (*Triticum* and *Aegilops*)	Global	Plant Germplasm Institute, University of Kyoto, Japan
Food Legumes			
Chickpea		Global	ICRISAT
Faba bean		Global	CNR, Bari, Italy
Groundnut		Global	ICRISAT
		South American	INTA, Pergamino, Argentina
	Wild perennial species		CENARGEN, Brazil

[1] Other base collections are being designated, particularly in developing countries, but are not featured in the table due to protracted negotiations

[2] The USA has a large coordinated National Plant Germplasm System (NPGS). Seeds for base storage are normally stored in NSSL, Fort Collins, Colorado

Table 7. IBPGR network of designated base collections of seed crops (Continued)

Crop	Species covered	Scope of collection	Institute
Lupin		Global	ZIGuK, Gatersleben, German Democratic Republic
		European	INIA, Madrid, Spain
Pea		Global	NGB, Lund, Sweden
		Mediterranean	CNR, Bari, Italy
		Central and East European	Polish Genebank, Radzikow
Phaseolus	Wild species	Global	Faculté des Sciences Agronomiques de l'Etat, Gembloux, Belgium
	Cultivated species	Global	CIAT
	Cultivated species	Global	NPGS, USA
		European	FAL, Braunschweig, Federal Republic of Germany
Pigeonpea		Global	ICRISAT
Soyabean		Global	NIAR, Tsukuba, Japan
		Global	NPGS, USA
	Wild perennial	Global	CSIRO, Canberra, Australia
Vigna	Wild species	Global	Faculté des Sciences Agronomiques de l'Etat, Gembloux, Belgium
	V. radiata	Global	IPB, Los Baños, Philippines
			AVRDC, Taiwan, China
	V. unguiculata	Global	IITA
		Global	NPGS, USA
Winged bean		Global	IPB, Los Baños, Philippines
		Global	TISTR, Bangkok, Thailand
Root Crops			
Cassava (seed)		Global	CIAT
Potato (seed)		Global	CIP
Sweet potato (seed)		Global	NPGS, USA
		Asian	AVRDC, Taiwan, China
		Global	NIAR, Tsukuba, Japan
Vegetables			
Allium		Global	NVRS, Wellesbourne, UK
		Global	NPGS, USA
		South and East European	RCA, Tápiószele, Hungary
		Asian	NIAR, Tsukuba, Japan
Amaranthus		Global	NPGS, USA
		Asian	NBPGR, New Delhi, India
Capsicum		Global	CATIE, Turrialba, Costa Rica
		Global	IVT, Wageningen, Netherlands
Cruciferae	*Brassica carinata*	Global	FAL, Braunschweig, Federal Republic of Germany
	B. carinata	Global	PGRC/E, Addis Ababa, Ethiopia
	B. oleracea	Global	NVRS, Wellesbourne, UK
	B. oleracea	Global	IVT, Wageningen, Netherlands
	Raphanus	Global	NVRS, Wellesbourne, UK
	Wild species	Global	Universidad Politécnica, Madrid, Spain
		Global	Tohoku University, Sendai, Japan

Table 7. IBPGR network of designated base collections of seed crops (Continued)

Crop	Species covered	Scope of collection	Institute
	Oilseeds and green manures:		
	B. campestris, B. juncea	Global	PGR, Ottawa, Canada
	B. napus, Sinapis alba	Global	FAL, Braunschweig, Federal Republic of Germany
	Vegetables and fodders:		
	B. campestris, B. juncea, B. napus	Global	NVRS, Wellesbourne, UK
	B. napus	Global	FAL, Braunschweig, Federal Republic of Germany
	All Cruciferae crops	East Asian	NIAR, Tsukuba, Japan
Cucurbita	*Benincasa, Luffa, Momordica, Trichosanthes*	Global	IPB, Los Baños, Philippines
	Cucumis, Citrullus, Cucurbita	Global	NPGS, USA
	Cucumis, Citrullus	Global	INIA, Madrid, Spain
Eggplant		Global	IVT, Wageningen, Netherlands
		Global	NPGS, USA
Okra		Global	NPGS, USA
Tomato		Global	CATIE, Turrialba, Costa Rica
		Global	ZIGuK, Gatersleben, German Democratic Republic
		Global	NPGS, USA
		Asian	IPB, Los Baños, Philippines
Southeast Asian Vegetables		Regional	IPB, Los Baños, Philippines
Industrial Crops			
Beet		Global	FAL, Braunschweig, Federal Republic of Germany
		Global	NGB, Lund, Sweden
		Mediterranean	Greek Gene Bank, Thessaloniki
Cotton		Mediterranean	Greek Gene Bank, Thessaloniki
Sugarcane (seed)		Global	NIAR, Tsukuba, Japan
		Global	NPGS, USA
Tobacco		Mediterranean	Greek Gene Bank, Thessaloniki
Forages			
Legumes:			
Centrosema		Global	CIAT
		Global	CENARGEN, Brazil
Desmodium		Global	CIAT
Stylosanthes		Global	CIAT
		Global	CSIRO, Brisbane, Australia
Leucaena		Global	NPGS, USA
Lotononis		Global	ILCA
		Global	Seed Bank, RBG, Kew, UK
Macroptilium		Global	CENARGEN, Brazil
Neonotonia		African	ILCA
			Seed Bank, RBG, Kew, UK
Zornia		Global	NPGS, USA
			CIAT, Colombia
Trifolium		African	ILCA
		Global	Seed Bank, RBG, Kew, UK

Table 7. IBPGR network of designated base collections of seed crops (Continued)

Crop	Species covered	Scope of collection	Institute
Grasses:			
Cynodon		Global	NPGS, USA
Cenchrus		Global	Seed Bank, RBG, Kew, UK ILCA CSIRO, Brisbane, Australia
Digitaria		Global	ILCA CSIRO, Brisbane, Australia Seed Bank, RBG, Kew, UK
Pennisetum		Global	NPGS, USA
Paspalum		Global Global	NPGS, USA
Others			
Tree species		(Fuel and environmental stabilization in arid areas)	Seed Bank, RBG, Kew, UK

upgrading their facilities and management. IBPGR is now establishing a Register of Genebanks which have achieved the standards for base conservation of particular crop collections. The 37 IBPGR-designated base collections were, in 1985-86, invited to participate in the register. Of those designated a number were visited in 1986. IBPGR will vigorously pursue this action in 1987 by a series of visits. Such a register is necessary to be sure that international standards are being met.

Those genebanks visited were evaluated against the agreed international standards by an expert and a report submitted to the Board. Acceptable institutes will receive notification that they are a registered conservation collection for one or more specified crop collections. Should a genebank fail to meet standards, constructive suggestions will be made to help improve standards and the situation reassessed.

During 1985, three genebanks were evaluated and reports were submitted to the Board for consideration in February 1986. A decision on registration was postponed pending evaluation of more genebanks. In 1986 the evaluation of 18 genebanks was complete; the Board will review them in 1987.

It has been found that some genebanks achieve all of the standards, but a number are poorly managed or have unreliable or ineffective equipment. Several of the latter began immediately to upgrade their genebanks, whilst others are expected to do so in due course.

ADVISORY COMMITTEE ON SEED STORAGE

The Advisory Committee on Seed Storage is one of the two standing IBPGR advisory committees. The Committee did not meet in 1986, but its Chairman, Prof. E.H. Roberts, and several members advised on areas of research and its funding. IBPGR support to research on conservation was increased considerably in 1986 and a summary is provided below.

INVESTIGATIONS ON SEED PHYSIOLOGY

IBPGR continued to support research at the University of Reading, UK on seed physiology in 1986. One topic studied was the effect of varying light dosages on seed germination. The results will be a useful basis for providing soundly-based advice on the use of light in germination tests in genebanks.

Another major topic was on the effect of ultra-low moisture content on seed longevity and germination. For example, when the moisture content of sesame seed was reduced from 5% to 2% an increase in longevity of about 40-fold resulted. This change is approximately equivalent to that estimated to occur when the storage temperature is reduced from +20°C to −20°C, so storing seeds at 2% moisture and +20°C may be equivalent to storing them at −20°C and 5% moisture. This has implications on the facilities needed in genebanks. Clearly, refrigeration costs would be reduced, or eliminated, if seeds were stored at +20°C and 2% moisture content rather than at 5% and −20°C, but very dry seeds are easily damaged when their moisture contents are raised prior to germination. In addition, at very low seed moisture contents, more mutations accumulate for a given loss of viability. Further investigations into the lon-

Table 8. IBPGR network of field genebanks (active collections for vegetative material)

Crop	Geographical representation	Institute
Roots and Tubers		
Cassava	Global	CIAT
	Latin American	CENARGEN, Brazil [1]
	Central American	INIA, Mexico
	African	IITA
Sweet potato	Asian and Pacific	AVRDC, Taiwan, China
	Global	IITA
Fruits		
Banana	Global	Banana Board, Jamaica
	Southeast Asian	PCARRD, Philippines
	African	Delegation Generale de la Recherche Scientific et Technique, Cameroon
Citrus	East Asian	Fruit Tree Research Station, Tsukuba, Japan
	Mediterranean	INIA, Valencia, Spain
	Mediterranean and African	IRFA, Corsica, France [1]
	North American	USDA [2]
	Latin American	CENARGEN, Brazil [1]
	South Asian	IIHR, India [1]
Industrial Crops		
Cocoa	Global	University of the West Indies, Trinidad and Tobago
	Global	CATIE, Costa Rica
Sugarcane	Global	Sugarcane Breeding Institute, Coimbatore, India [1]
	Global	USDA, Florida, USA
Perennial Species		
Allium	Short-day species	Hebrew University, of Jeruselum, Israel [1]
	Long-day species	Research Institute for Vegetable Growing and Breeding, Olomouc, Czechoslovakia
A. cepa, *A. ampeloprasum*	Global	IVT, Wageningen, Netherlands
Groundnut	Wild perennials	CENARGEN, Brazil
		IVT, Wageningen, Netherlands
Soyabean	Wild perennials	CSIRO, Australia

[1] Under discussion or awaiting formal agreement

[2] Location being agreed

gevity of and potential problems in handling very dry seeds (< 5% moisture content) are needed because if seed storage costs could be reduced in certain cases one constraint, the long-term funding requirements, can be reduced.

IBPGR provided funds for the following new projects in 1986:

- Dehydration and preservation techniques for recalcitrant seeds and storage of banana seeds at the University of Pertanian Malaysia, Selangor, Malaysia;
- Storage characteristics of tea seed at the Seed Bank, RBG, Kew, UK; and
- Physiology of seeds of tropical forage species at CENARGEN EMBRAPA, Brasilia, Brazil.

SUPPORT FOR CONSERVATION FACILITIES

The IBPGR provided funds in 1986 for assistance in the upgrading of existing genebanks, and for improving medium- and long-term storage facilities in the following:

- Paraguay (genebank at DIEAF); and
- Tanzania (Tanzania Agricultural Research Organization)

The National Genebank of CAAS, China was inaugurated in October 1986 at a ceremony which was attended by representatives of IBPGR. The genebank, which has a capacity for 400 000 accessions in medium- and long-term storage, was established with the aid of the Rockefeller Foundation and IBPGR. It has agreed in principle to serve in the IBPGR network of base collections, and thus will strengthen the global germplasm conservation programme.

Equipment such as freezer chests, seed drying cabinets, heat sealers for laminated aluminium bags and seed testing equipment was supplied to:

China (BVRC; CAAS; Guangxi AAS; Guandong AAS)
Egypt (ARC)
Ghana (CRI)
India (NBPGR)
Iran (Genebank at Karaj)
Mexico (INIA)
Peru (INIPA)
Portugal (EAN)
Syria (SARD)

TECHNICAL ADVICE

IBPGR continued to provide technical advice to Governments and genebanks. In 1986 IBPGR experts

visited genebanks participating in the IBPGR network in Australia, Bangladesh, Brazil, Canada, China, Colombia, Ethiopia, Federal Republic of Germany, Syria, Turkey, USA and UK, to assess conditions and/or provide technical advice. At the request of the respective Governments, experts also advised on the construction of the new genebank at the Seed and Plant Improvement Institute, Karaj, Iran and on genebank design at the Genetic Resources Centre at Bambey, Senegal.

The Japanese Government allocated generous funding to assist the establishment of a genebank and germplasm programme in Sri Lanka and IBPGR provided technical advice to officials from Sri Lanka.

Much of the technical advice is provided regularly to institutes through direct correspondence. During 1986, such advice was given to China (BVRC), Fiji (Kornoivia Research Station), El Salvador (CENTA), Mexico (Hermosillo, Sonora), New Zealand (New Zealand Crop Germplasm Resources), Spain (IVIA, Valencia) and Syria (SARD).

IN VITRO CONSERVATION

In the 1980s, IBPGR has played an important role in promoting the use of *in vitro* culture for genetic resources conservation and in supporting research work or appropriate *in vitro* techniques. While the concept of *in vitro* conservation has been well received by the scientific community, there is a widespread misunderstanding currently among the community that any *in vitro* cultures of plants may form a conservation collection (genebank). According to the perception, definitions and needs of the IBPGR, this is not the case. Tentative standards for *in vitro* genebanks have been detailed in the 1986 IBPGR publication entitled *Design, Planning and Operation of* In Vitro *Genebanks*.

Following the suggestion in the above publication and on the recommendation of the IBPGR programme committee, IBPGR has agreed to establish for a three-year period a model *in vitro* active genebank to test out details and to identify and thereafter resolve any constraints which might arise. Funds have been allocated to CIAT to develop such a model IBPGR/CIAT *in vitro* genebank for cassava.

The Advisory Committee on *In Vitro* Storage (see Appendix II for membership) convened its third meeting on 4-6 June 1986. A report of this meeting will be published early in 1987. A brief review of the IBPGR supported research conducted to date on *in vitro* conservation indicates that:

(i) *In vitro* collecting techniques are being developed for cacao, cassava and coconut;

(ii) Techniques for the initiation and maintenance in slow growth of cultures of *Musa*,

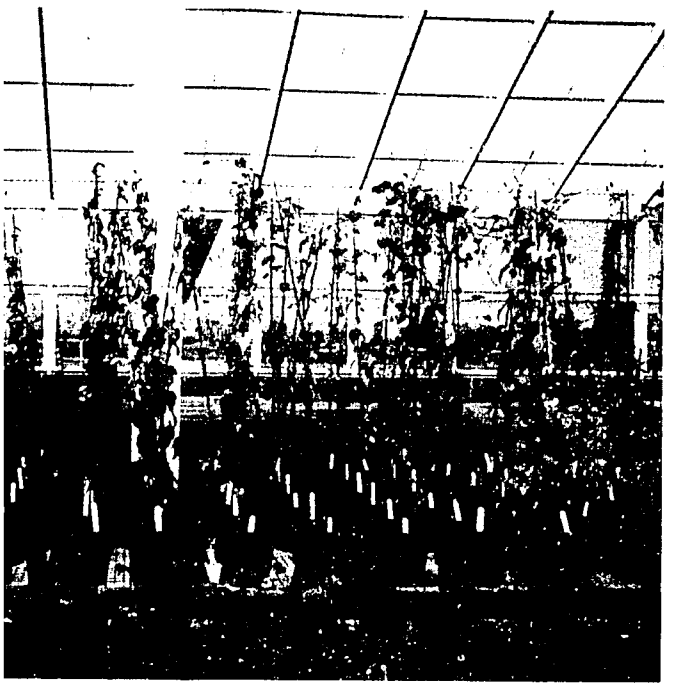


Fig. 17. Several stages are involved in successful conservation of germplasm. As exemplified by the current work of an IBPGR Collector based at CIP, Peru, on wild species (left) related to cultivated sweet potato (Ipomoea batatas), *germplasm is collected in the field as tubers, seeds or as cuttings (inset). Multiplication of each accession in the glasshouse (right) provides sufficient material for secure conservation and for planting in observation plots*

sweet potato, *Colocasia* and *Xanthosoma* have progressed;

(iii) Techniques for the *in vitro* propagation and culture of *Citrus* cacao and sugarcane have also been explored;

(iv) Attempts to cryopreserve cassava, sweet potato, *Colocasia*, *Xanthosoma*, *Musa*, cacao and *Citrus* have met with varying degrees of success, most progress to date being made with cassava;

(v) A limited amount of work has been carried out on disease indexing especially of sweet potato and potato; and

(vi) Isozyme analysis for characterization has been explored for cacao, *Colocasia* and *Musa*: cacao germplasm in Trinidad, West Indies, has been examined by an IBPGR Intern; for *Musa* the analysis relates to the stability of *in vitro* propagated material.

In view of the need the review the area of disease indexing, germplasm exchange and quarantine in the light of development in *in vitro* conservation and associated techniques, the Advisory Committee asked Member Dr. J. Moyer to convene a specialist subcommittee to address the strategies which will aid IBPGR's work in the above area. The Advisory Committee also emphasized the need to encourage the use of systems of genetic markers in conservation work and noted that molecular techniques are rapidly being developed. In addition, the committee agreed that IBPGR should issue a series of manuals entitled *Practical Manuals for Handling Crop Germplasm* In Vitro. The first manuals to be prepared will deal with sweet potato, *Musa*, cassava, taro and other aroids and *in vitro* techniques for seed genebanks. Areas for further development and applications were also identified and will be detailed in the Committee's report.

In 1986 IBPGR continued support to develop and maintain computerized literature and research data bases on *in vitro* conservation. The work is contracted to the University of Nottingham, UK. This valuable information resource has assisted the planning of the IBPGR *In Vitro* Programme and is fully accessible to all interested scientists by contacting IBPGR Headquarters.

RESEARCH

The IBPGR has significantly increased its support to *in vitro* conservation research in 1986. (In order to inform the scientific community of the *in vitro* research supported by IBPGR, a publication entitled *IBPGR Research Highlights:* In Vitro *Programme* was published in 1986.) The *in vitro* research programme has been divided into five subprogrammes, namely collection and culture technology, disease indexing and therapy, cryopreservation, genetic stability and the pilot genebank study. For the genetic stability subprogramme, IBPGR advertised for research proposals. The responses were overwhelming. After a careful review, the following two new proposals were funded by IBPGR:

- An investigation of the genetic stability of *Allium*, potato and rice plants recovered from *in vitro* storage by both slow growth and cryopreservation, University of Nottingham, UK; and

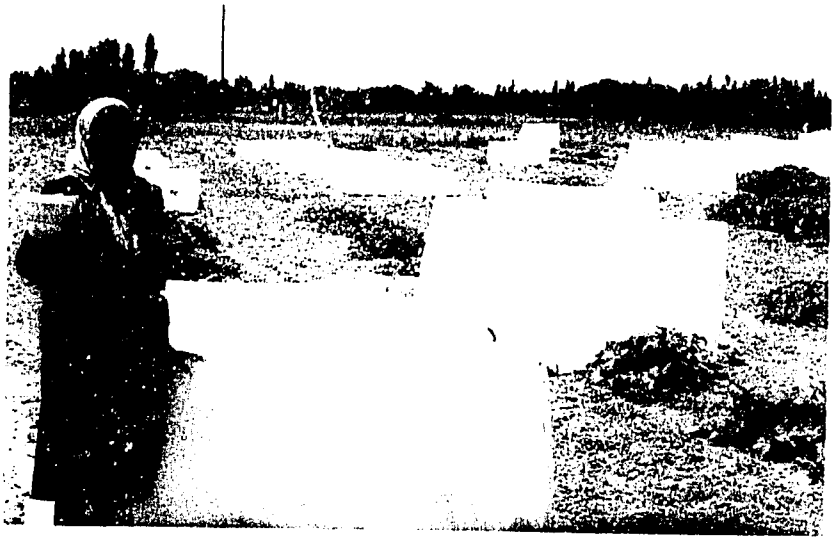


Fig. 18. These field plots are near a new genebank at Karaj, Iran, for which IBPGR has provided design and operational assistance

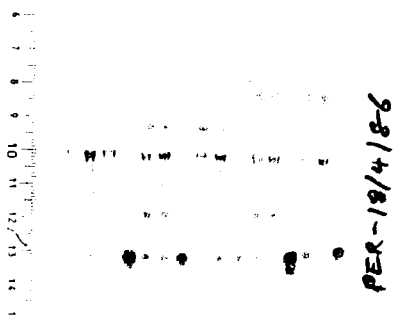


*Fig. 19. Seeds in pods of cocoa (*Theobroma cacao*, left), when collected lose viability rapidly; new* in vitro *techniques, however, facilitate the collecting of this and other difficult crops such as banana. Since accessions of cocoa may be phenotypically similar, gel electrophoresis (right) is a useful adjunct to collecting because it provides a means of distinguishing between them. Comparison on the horizontal axis indicates whether or not clones have peroxidase isozymes in common, and thus indicate their genotypic similarity*

Determination of the genetic stability of maize tissue and organ cultures under conditions of slow growth storage and cryopreservation, University of Western Ontario.

These two studies will test stability by a range of techniques including molecular and biochemical analyses and evaluation of performance *in vitro* and in the field.

In the subprogramme of collection and culture technology, the following projects were supported by IBPGR:

—Development of an *in vitro* method of collecting coconut zygotic embryos, Station de la Mé, Côte d'Ivoire. This is a three-year research project which started in 1985. Its objectives are to use *in vitro* culture-based techniques to collect mature and immature coconut embryos in the field and to optimize maintenance and transport to permit successful germination of the collected embryos for establishment in field genebanks or *in vitro* genebanks;

—*In vitro* conservation of forage grasses, ILCA. This is a two-year project which aims to develop *in vitro* collecting and cultures techniques for *Cynodon* and *Digitaria*. These grasses often do not produce seeds and therefore can be difficult to collect and conserve; and

—Continuing studies of the genetic variability in banana plants also fall within the subprogramme. The incidence and nature of variation in plants propagated by conventional and *in vitro* techniques have been compared using protein electrophoresis and field testing by the Agricultural Research Organization, Ministry of Agriculture, Israel.

In the subprogramme of cryopreservation, the following projects were funded by IBPGR in 1986:

—Interaction of *in vitro* technology and cryopreservation of dormant buds of *Prunus* species for conservation, University of Saskatchewan, Canada. This project aims to develop cryopreservation techniques that are compatible with other *in vitro* procedures including clonal multiplication and the provision of virus-free buds for future propagation and distribution. Many taxa of *Prunus* will be studied.

—*In vitro* genetic conservation systems for *Ipomoea* germplasm using slow growth and cryopreservation, Clemson University, USA. Past research has examined techniques of meristem-tip culture and *in vitro* multiplication. The objectives of this project are now to determine viability and variability of diverse *Ipomoea* germplasm stored as stem nodes, apical meristems and somatic embryos and to determine optimal storage procedures for explants under conditions of slow growth storage and cryopreservation; and

—*In vitro* conservation of *Xanthosoma* spp., Agricultural University, Wageningen, Netherlands. This project aims to develop methods for the *in vitro* maintenance of tropical aroids. Very promising results have been achieved in slow growth storage and investigation are now examining conditions for the cryopreservation of isolated meristems and shoot-tips.

Under the subprogramme of disease indexing and therapy, towards the end of 1986, research on disease indexing for bunchy top of *Musa* was initiated with the Queensland Department of Primary Industries, Australia so that IBPGR will be more ready to move wild and primitive material which will be

collected in Papua New Guinea in 1987-88.

Maintaining and transferring germplasm of sweet potato is difficult in Asia and the Pacific due to financial and disease problems. Therefore, IBPGR in 1986 provided funds to AVRDC, Taiwan, China to preserve and produce disease-free germplasm of sweet potato by *in vitro* techniques and then distribute the disease-free germplasm.

IN SITU CONSERVATION

The principles guiding IBPGR policy on *in situ* conservation were fully described in the *Annual Report 1985*; additional details are given in the FAO/IBPGR Plant Genetic Resources Newsletter, *59*.

In 1986 the IBPGR carried out a number of eco-geographic studies of wild relatives of cultivated plants and of forage crops (p. 18). Some of this work was undertaken in protected areas, where *in situ* conservation is now a possibility and the IBPGR studies contribute to a better understanding of the variability of certain species so that other organizations (e.g. WWF/IUCN) can have better data available. IBPGR continues to maintain close liaison with a number of organizations involved with *in situ* conservation (WWF/IUCN, UNEP, MAB-Unesco and FAO).

IBPGR also participated in a second meeting of the *Ad Hoc* Working Group on *In Situ* Conservation, February 1986 which coordinates the work of the agencies involved with *in situ* conservation. This provides a forum for world-wide collaboration in *in situ* conservation work.

Fig. 20. Tropical rainforests hold an inestimable number and variety of plants, including wild species related to crops which may be useful to man. IBPGR is working with other international organizations to survey and collect in these areas

DOCUMENTATION AND DATA MANAGEMENT

Meaningful documentation of plant genetic resources is essential in order to study the spectrum of genetic variation within cultivated species and their wild relatives and to facilitate the selection from accessions in genebanks of germplasm for crop improvement.

Documentation also plays a key role in the management of genetic resources at regional and global levels. It is most important that documentation work in different germplasm centres is coordinated and leads to the ready availability of unambiguous information about materials maintained in genebanks of the global network.

There are many aspects of documentation and data management which need consideration. Based on the firm assessment of information needs and feasibility of implementation of alternative approaches, IBPGR defines its documentation programme as a series of inter-related components.

This approach ensures both effective management of individual projects and flexibility in allocating limited resources to those components which at any given time have the greatest impact on the work of the network.

The basic building blocks of the system result from the formulation of standard crop descriptor lists and the promotion of their use. More than 60 IBPGR descriptor lists have been published covering most of the major, and a number of minor, crops. This programme component continues to receive high priority. In the future, however, efforts will concentrate on better definitions of descriptors and methods of recording information related to the ecology of sites where germplasm grows and also listings of gene symbols.

The installation and development of data management systems and the provision of technical assistance and specialized training are other aspects of the documentation programme, which complement those of national and international programmes. Efficient handling of vast amounts of data requires the use of computers, and computerized documentation systems have always been given preference by IBPGR. In view of rapid advances in computer technology and the ready availability of different systems to national programmes, IBPGR

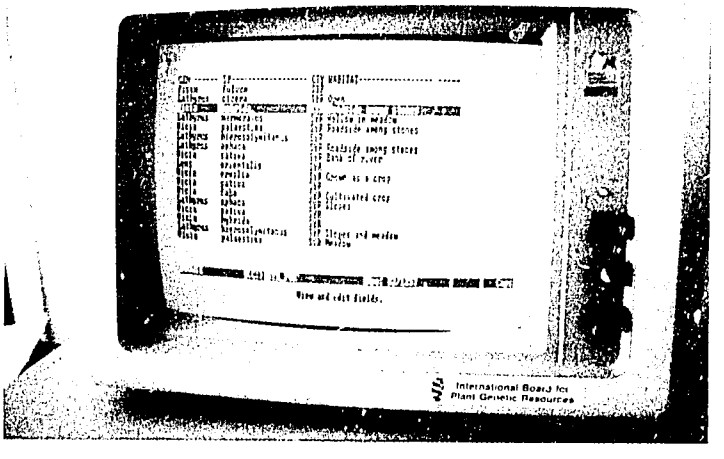


Fig. 21. Data accumulated during collecting missions are taken down on collecting forms and later may be entered in computers, as here for forage germplasm collected in Syria. Passport data recorded at the time of collection include information on the plant, its habitat and other environmental features. IBPGR devotes considerable attention to encouraging computerization of records and to their availability to a wide number of breeders and other users

is now less frequently being requested to provide assistance with hardware. This trend will probably continue and a shift towards advice on selection and use of software is evident.

As with any system involving the cooperation of a large number of institutions and individual scientists, the exchange of information is a driving force in IBPGR's work. A spectrum of complementary procedures is used to ensure the availability of information on germplasm conserved in genebanks. This involves, firstly, publication of directories of germplasm collections, secondly, assistance in preparing and publishing catalogues of individual collections when these are of special importance, while other work is aimed at the establishment of international crop data bases. Experience has shown that such heterogeneity is desirable as each of the above components has different impact.

Parallel to work on documentation of crops, IBPGR has developed information systems dedicated to specific aspects of genetic resources activities, e.g. collecting, conservation, specific literature subsets as well as systems facilitating the management of projects. Summaries of the major activities concerning data base projects are provided below.

The rapidly increasing volume of information stored in IBPGR's data bases called for the upgrading of the computer facilities at IBPGR Headquarters. In 1986, WANG PC microcomputers were added to the WANG Office Information System (OIS). The installation of an IBM AT microcomputer at the end of the year further strengthened data processing capabilities and facilitates data exchange with numerous centres which use IBM PC XT AT or compatible computers.

An IBM XT microcomputer was installed in the Field Office of the IBPGR Eastern Africa Programme. A portable microcomputer was also used, on an experimental basis, during a collecting mission in Africa; it facilitated the direct input of data in the field. In addition, a survey of small data recording devices (so-called "data loggers") was made in view of their possible use during collecting missions.

At the end of 1986, IBPGR entered the CGIAR's electronic mail system (CGNET) which provides enhanced communication capabilities in electronic transmission of messages between IARCs and numerous research institutes in the world.

CROP DESCRIPTOR LISTS

The internationally-agreed crop descriptor lists provide guidelines for description of the most important characteristics of the accessions in germplasm collections. The overall objective is to introduce a consistent methodology and format for the recording of data in the data bases of individual genebanks, so that transformation of the data for the purpose of exchange is unnecessary.

The lists follow a standard format devised in 1982 and comprise four sections: passport, characterization, preliminary evaluation and further evaluation. The first three are intended for germplasm curators while the last one, which is essentially open-ended, comprises characteristics described by plant breeders.

The IBPGR has been developing descriptor lists since 1980 which are now widely used in the IBPGR global network. In 1986 a cashew descriptor list was published and those for Bambara groundnut (in cooperation with ITA/GTZ), *Citrus*, Chinese cabbage (joint AVRDC/IBPGR), eggplant, mango, papaya, several *Brassica* cultivated species (in cooperation with NPGS and CAC) were in the course of preparation. In addition, preparation of lists for *Xanthosoma* and wild *Brassica* species was initiated.

The initiation of a data base for barley descriptors was reported in the *Annual Report 1985*. During 1986, the descriptors published by IBPGR, COMECON, BGRC, USDA, PGRC/E and IABS were recorded in a single file and cross-referenced. Similar work was also done for wheat and covered lists of IBPGR, COMECON, BFRG and PGRC/E. The data bases form a starting point for studying the differences between different descriptor schemes; such analyses will continue in 1987.

DIRECTORIES OF GERMPLASM COLLECTIONS

Directories of germplasm collections have been compiled by IBPGR since 1980 and are in the forefront of IBPGR's information service on collections. The directories serve as a ready reference for breeders and scientists involved with genetic resources work to identify collections where material and/or further information can be obtained. They provide essential data on the types of samples held in each centre, their geographical representation, maintenance, availability, characterization, evaluation and method of documentation.

In order to make directories easier to comprehend and use, a new format was adopted in 1985. A standard set of headings is included for each entry (genebank), even where no information is available to IBPGR. The directories, which are considered as working documents, may then be updated by the users themselves as new information becomes available; users are also encouraged to inform IBPGR of any additions or changes. In addition, IBPGR con-

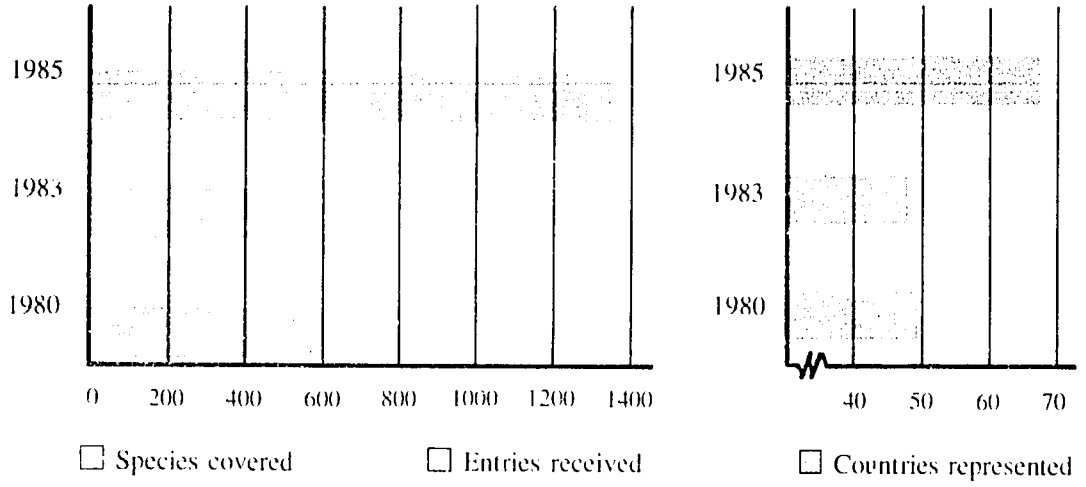


Fig. 22. The IBPGR In Vitro *Data Base at the University of Nottingham, UK has grown in both size and in use world-wide since its developmental stages in the early 1980s*

tinues to update directories based on information extracted from numerous reports, publications, personal communications, etc., a process made easier by having computerized records.

In 1986 the directories for soyabean (cooperative project with INTSOY) and a revised edition of root and tuber crops (aroids, cassava, potato, sweet potato and yam) were finalized and published. Work continued on the compilation of directories for industrial crops (beet, coffee, cotton, oil palm and rubber), a revision of food legumes (except soyabean), temperate fruits and tree nuts, and wheat (revision of a 1980 publication).

ASSISTANCE WITH HARDWARE AND SOFTWARE

The volume of information on germplasm in any sizeable collection necessitates the use of computer facilities. The IBPGR acts as a focal point for the provision of hardware/software, advice and training in the setting up and running of computerized data base systems. In 1986, with direct support from IBPGR, microcomputer systems were installed in the following centres: NBPGR, India; INIAP, Ecuador; and Institut de Recherche Scientifique et Technique, Tunisia. The installation of a microcomputer at the Field Crops Research Institute, ARC, Egypt is scheduled for early 1987. Both hardware and a data base management system package were provided to Jiangsu AAS, Nanjing, China to upgrade an existing microcomputer system. The national genebank in Morocco, located in the Institute Agronomique et Vétérinaire Hassan II, was assisted in acquiring software packages.

Specific technical assistance on diverse aspects of the documentation of the national collection was provided to the Iranian genebank at Karaj, and plans were advanced for the installation of a microcomputer there. The IBPGR also assisted in the selection of a consultant for an FAO project to help strengthen the germplasm documentation system in Pakistan.

A training course on documentation and data management was held at USDA-ARC, Beltsville, Md., USA, 11-29 August (p. 55). Participants were from centres which had acquired computer facilities for germplasm documentation in 1985-86, largely with IBPGR assistance. This was the third course with the aim of teaching the correct methodology for collation, verification, management and processing of information on genetic resources.

Several software packages were used during practical exercises concerning management of data bases and statistical analyses. All trainees were technicians responsible for documentation work in their genebanks; hence emphasis was put on intensive hands-on use of microcomputers and practical aspects of data base management. The course was directed by IBPGR staff but included a number of special lectures combined with demonstrations and site visits given by USDA experts. In particular, the GRIN system of the National Plant Germplasm System of the USA was demonstrated and used by participants.

DATA BASES

The programme component concerning development of centralized data bases has been receiving

increased emphasis since 1982-83, and in 1986 numerous projects were underway. In broad terms, there are two categories of systems:

(i) Crop data bases having as a prime objective compilation of comprehensive information on the dispersed but major collections of the crop in the network of genebanks. They provide a way of assessing the current status of preservation and characterization of genetic resources, so that the genetic variability present in collections can be evaluated, gaps can be identified, and material possessing specific attributes can be selected. In order to ensure a high standard of work, the systems are located in internationally recognized centres of excellence, and often at the same location as major designated base collections; and

(ii) Systems designed as reference sources of essential and up-to-date information on specific components of genetic resources work. The IBPGR views the development of such systems as an important task which should have major impact on future planning.

A summary of selected projects carried out in 1986 on the documentation of crops is given below.

A cooperative IBPGR/CSIRO project on the establishment of a world-wide perennial *Glycine* germplasm collection made significant progress in the development of a data base comprising passport, collection and storage data on approximately 1300 accessions of 10 *Glycine* wild species.

A global data base for *Phaseolus vulgaris* initiated in 1982 reached the stage where passport and evaluation data from 17 collections including such major ones as at CIAT; USDA, Pullman, Washington, USA; and University of Cambridge, UK were integrated. During the first four years the project was carried out by the Faculté des Sciences Agronomiques de l'Etat, Gembloux, Belgium; in 1986 the magnetic tapes were handed over to CIAT which has a global mandate for *Phaseolus*.

UNA, La Molina, Peru is conducting, with IBPGR support, a project on the collation of passport, morphological and agronomic data from expeditions that had IBPGR participation on the main Andean crops in Peru. An extension of this project was approved towards the end of 1986, to include large collections in Bolivia and Ecuador. Apart from setting up a unified data base, the publication of catalogues is foreseen. Catalogues will supplement the major channel for dissemination of data which is via magnetic media.

Work on the establishment of a *Cucumis* data base was continued at ETSIA, Valencia, Spain. The project was started in 1984 and concentrated on the documentation of germplasm held at the IBPGR designated base collection at INIA, Spain. Computerization of data facilitated the classification of the germplasm into groups using multivariate analysis.

The Greek Gene Bank has been developing an information system since 1981 following assistance by IBPGR in the installation of computing facilities. In 1986 IBPGR provided further assistance for the publication in 1987 of a catalogue of germplasm from the Greek Gene Bank and for its distribution to all major genebanks in the global network.

During 1986 IBPGR also provided support to the Institute of Germplasm Resources of CAAS, China, for the compilation of a catalogue of Chinese crop genetic resources available for exchange. The crops covered include rice, wheat, maize, sorghum, millet, soyabean and cotton and a total of 4000 accessions will be listed. The catalogue will be published in 1987.

ICARDA published its first catalogue of barley germplasm comprising passport, characterization and evaluation data for 8000 accessions. The work on description of samples was supported by IBPGR during 1983-85. Compilation of a catalogue of durum wheat germplasm has also been initiated by ICARDA.

IBPGR supported a significant genetic resources component of the FAO/UNDP Project for Strengthening Plant Protection and Root Crop Development in the South Pacific. In particular, in 1986, a comprehensive inventory of descriptors of root and tuber crop collections in Cook Islands, Fiji, Nine, Solomon Islands, Papua New Guinea, Tonga, Vanuatu and Western Samoa was finalized and is to be published.

In 1986 the US Germplasm Resources Information Network (GRIN) system was open for direct, on-line access to scientists affiliated with the IARCs. This will ensure the ready availability of data on germplasm collections maintained in the USA.

Progress was also made in the development of European crop data bases of the ECP/GR Special Project, details of which are given on p. 50.

The IBPGR gradually increased its commitment towards development and use of specific data base systems in 1986. This was valuable both for meeting the information needs of the international community as well as the IBPGR Programme Committee and Staff on specific genetic resources subjects and areas of activity.

Particular emphasis in 1986 was put on the reorganization and updating of the data base on germplasm collected with IBPGR support, which is maintained at IBPGR Headquarters. A relational data base system has been implemented, which includes files with summary data on species collected, status of preservation, and documentation of samples in

deposited genebanks as well as linkages to "paper" documentation such as mission reports, collecting sheets, maps, listings of catalogues, etc. Apart from extracting information from reports, catalogues, correspondence, etc., available at Headquarters, more than 120 institutes were contacted to provide up-to-date information, particularly on documentation of the materials.

In order to improve the management of numerous on-going IBPGR projects, a computerized system was implemented in 1986. For each project, up to 75 fields related to objectives, investigators and collaborators, funding, reports and publications, etc. are used. By providing ready access to summarized and yet comprehensive information the system serves as a managerial tool for IBPGR staff, and facilitates the timely monitoring of projects and their follow-up.

Further progress was made in the development of two IBPGR data bases. The Hebrew University of Jerusalem, Israel, has developed a data base containing information on the wild relatives of cultivated plants and related environmental data. The University of Nottingham, UK, maintains the IBPGR data bases, based on surveys in 1980, 1983 and 1985, on ongoing *in vitro* research pertinent to plant genetic resources conservation (Fig. 22).

This has proved to be an invaluable source of reference data and covers cryopreservation (*ca.* 60 entries), storage under normal growth conditions (900 entries) and by slow growth (350 entries), germplasm exchange (300), disease indexing (300), cytological characterization (200), isozyme analysis (75) etc. in 71 countries.

The IBPGR initiated a survey of the distributions of the major forage species in the Mediterranean region in 1986 as a follow-up to recommendations of the IBPGR Working Group on Forages for the Mediterranean and Adjacent Semi-arid and Arid Areas which was held in Cyprus in 1985 (see *Annual Report 1985*). Two further complementary phases are envisaged: the collation of essential passport data from genebanks which maintain germplasm collected in the region; and a survey of relevant literature and of herbarium specimens. As a start, major genebanks which contain forage crops were asked to provide provenance data on Mediterranean samples. A comprehensive data base will be established in 1987.

The aims of the International Legume Database and Information Service (ILDIS), which was inaugurated in 1985, are to develop a data base for the family Leguminosae, and to provide an international information service. ILDIS is an autonomous international organization directed by a Board (the Director of IBPGR is a member) with support from the UK Government and scientific and other input from, *inter alia*, the Missouri Botanical Garden, USA; RBG, Kew, UK; and many other cooperating institutes around the world.

The proposed data base structure includes a genetic check list (617 genera), species check list (almost 17 000 species) and tribe module (species of particular tribes). Regional check lists for a minimum set of 13 descriptors (called type 1 data) – accepted names, principal synonyms, vernacular names, legume tribe membership, habitat, distribution, life form, conservation status, economic importance, references to description, illustration and maps – were in the course of preparation in 1986 and will be continued in 1987-88. IBPGR offered to formulate a list of morphological, agronomic and other descriptors for forages (called type 2 data) to be included at a later stage, and formed a task force of forage specialists to this end. The data base will be made available both on-line by telecommunications and off-line by distribution of files on discs.

CHARACTERIZATION AND EVALUATION

IBPGR defines characterization as the recording of highly heritable characters which vary little when plants are grown in different environments. Standardized methods for the observation and recording of these characters in data banks are essential for the effective description of germplasm, and for exchange of data between collections. Characterization data provide a means for classifying germplasm and for studying patterns of variability, and are useful during regeneration of stocks.

Since its inception IBPGR has been encouraging and actively supporting characterization of priority crops. A list of projects in 1986, many of which include multiplication and deposition of samples in base collections, is provided in Table 9. Priority is given to characterization of material collected by missions organized or sponsored by IBPGR.

By contrast, evaluation refers to the scoring of characters, which may be influenced to a large extent by environmental factors. As a list of possible evaluation descriptors is potentially unlimited, the IBPGR recognizes the category of "preliminary evaluation", which consists of a limited number of traits which are relatively easy to score and considered to be the most useful by plant breeders.

Both characterization and preliminary evaluation, which are often difficult to distinguish clearly, are usually the responsibility of curators. Most of the projects listed in Table 9 include both components.

Further evaluation of germplasm is normally carried out by plant breeders in the framework of crop improvement programmes, an area which is outside the mandate of IBPGR. However, in order to promote greater utilization of germplasm collections, an External Programme Review of IBPGR in 1985 recommended that IBPGR should become more involved in evaluation.

IBPGR WORKSHOP

This led to a small IBPGR Workshop of invited persons only on "Genetic Resources and the Plant Breeder" which met jointly with IBPGR's Programme Committee at Montpellier, France, 9-12 September 1986. The meeting was attended by 30 scientists and 22 papers were presented and discussed; the proceedings are to be published in 1987. The range of issues covered included:

(i) Transfer of genes from wild or primitive genepools to elite cultivated backgrounds and

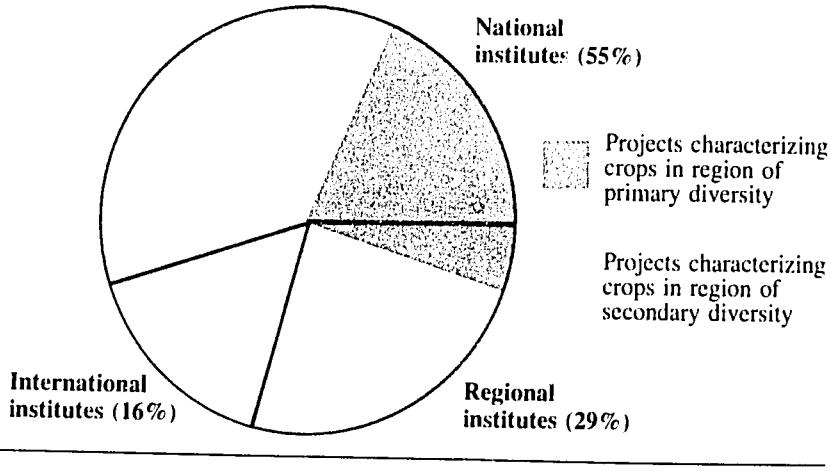


Fig. 23. IBPGR support to characterization projects is orientated towards national and regional institutes with the remainder established at international centres. Additionally, most of the crops are characterized at institutes located within each crop's primary area of genetic diversity (dark shading) or secondary area of diversity (light shading)

Table 9. Characterization projects which received IBPGR support in 1986

Institute and Country	Project	Remarks
INTA Pergamino, Argentina	Multiplication and characterization of maize populations collected in Argentina 1977-78	Multiplication is done in two ecologically different stations to minimize genetic drift
West Indies Central Sugar Cane Breeding Station, Barbados	Characterization of Caribbean collections of sugarcane germplasm	Minimum number of characters which suffice to discriminate accessions is to be determined; project includes isozyme studies
IBTA Bolivia	Multiplication and characterization of Bolivian collection of *Cucurbita* collected 1972-84	Includes multivariate analysis of the data
IDR Burkina Faso	Multiplication and characterization of eggplant collected 1980-83	Data obtained will be included in data base at University of Birmingham, UK
	Characterization of millet collected 1984-85	Evaluation of millet collected in 1984 has been completed
Jilin AAS, China	Characterization of soyabean from northern China	Includes reaction to diseases, insect pests, drought and a range of agronomic traits
AVRDC Taiwan, China	Characterization of mung bean collection	A catalogue will be published in 1987
	Multiplication and characterization of Chinese cabbage	Germplasm was duplicated at NVRS, UK and NIAR, Japan
ICA Colombia	Multiplication and characterization of maize	
CATIE Costa Rica	Characterization of *Capsicum*	About 1100 accessions which originated from Central America are being characterized
	Multiplication and characterization of *Cucurbita*	Assistance provided in species identification
ORSTOM Abidjan, Côte d'Ivoire	Characterization of okra	Based on passport and characterization data, 'core collection' was established
Université d'Abidjan Côte d'Ivoire	Characterization of *Dioscorea* collected in Côte d'Ivoire 1983-84	An illustrated catalogue of cultivar groups was prepared; two more catalogues (for wild species and with details on each accession) are being prepared
INIAP Ecuador	Multiplication and characterization of Andean roots and tubers	Materials were collected in different regions of Ecuador
	Multiplication and characterization of *Amaranthus* and *Chenopodium quinoa* collected 1982-84	

Table 9. Characterization projects which received IBPGR support in 1986 (Continued)

Institute and Country	Project	Remarks
Field Crops Research Institute, and Horticultural Research Institute, ARC Egypt	Multiplication and characterization of vegetables collected in Egypt 1985-86	
Cotton and Industrial Plants Institute Greece	Multiplication and characterization of cotton landraces from Greece	Materials are to be deposited in Greek Gene Bank and at IRCT, France
Universidad de San Carlos Guatemala	Characterization of vegetables and root crops collected in Guatemala	Project is also carried out by ICTA, Guatemala
LBN Indonesia	Characterization of *Desmodium* species and related taxa collected in Indonesia 1984-85	Preliminary catalogues were compiled 1986
NIAR Tsukuba, Japan	Multiplication and evaluation of *Vigna* and other grain legumes collected in Laos 1983	
Yarmouk University Jordan	Characterization of *Triticum dicoccoides*, *Hordeum* and *Aegilops* collected in Jordan	Includes screening for disease, salt- and drought-tolerance and isozyme work
FOFIFA Madagascar	Characterization of rice and food legumes collected 1984-85	Lists with observation data are in preparation
IAVH Morocco	Multiplication and characterization of maize collected in Morocco 1985-86	
IITA Ibadan, Nigeria	Multiplication and characterization of cowpea	
Estación Experimental Cajamarca Peru	Multiplication and characterization of *Phaseolus* from northern Peru	600 accessions are involved; data processing will be completed in INIPA, Peru and files transferred to CIAT
Universidad Nacional de Huancayo Peru	Multiplication and characterization of *Phaseolus* collected in Peru 1982-83	*ca.* 1200 accessions are involved; multiplied germplasm will be deposited in base collections
UNA La Molina, Peru	Multiplication and characterization of maize	
	Multiplication, characterization and preliminary evaluation of sweet potato from Peruvian coast and jungles	Also production of true seeds through polycrosses
Universidad San Crisbol Peru	Characterization and preliminary evaluation of root crops collected 1982-84	
Grand Anse Experimental Centre Seychelles	Characterization of mango	
INIA Badajoz, Spain	Multiplication and characterization of grasses and forages	A catalogue will be produced

Table 9. Characterization projects which received IBPGR support in 1986 (Continued)

Institute and Country	Project	Remarks
Universidad Politécnica Madrid, Spain	Multiplication and characterization of wild *Brassica* collected in the Mediterranean	Characterization work also carried out at Svalöv, Sweden
Agricultural Research Corporation Sudan	Multiplication and characterization of horticultural crop germplasm collected in Sudan 1982-84	Numerous species of horticultural crops are involved
Swedish University of Agricultural Sciences Svalof, Sweden	Multiplication and characterization of wild *Hordeum*	
Chiang Mai University Thailand	Characterization and evaluation of sweet potato collected in Thailand 1981-82	Also includes isozymes evaluation and production of true seeds through polycrosses
	Multiplication and characterization of eggplant collected in northern and northeastern Thailand	Includes work on susceptibility to bacterial wilt
Botany and Weed Science Division Department of Agriculture Bangkok, Thailand	Multiplication and characterization of sugarcane collected in Thailand since 1982	Germplasm to be deposited in in base collections
University of the West Indies Trinidad	Characterization of cocoa	Includes studies on environmental stability of descriptors
University of California (Davis) USA	Multiplication and characterization of lupin	Germplasm will be deposited in German Democratic Republic, Greece, Portugal and Spain
	Characterization of *durum* wheat	Spike and kernel data were analyzed by multivariate methods
Texas A & M University USA	Characterization of *Arachis* collected in South America 1983-86	Germplasm collected 1977-82 has been characterized and catalogue published
University of Birmingham UK	Multiplication and characterization of African eggplants collected 1980-83	Data base is to be established

evaluation consequences;

(ii) Applicability of molecular techniques to the conservation, evaluation and utilization of plant genetic resources;

(iii) Establishment of small representative collections within larger collections ('core collections') based on ecogeographical and other principles; and

(iv) Collaboration between public and private breeders, other scientists and curators in evaluation of germplasm collections, particularly in areas of germplasm enhancement.

The discussions were wide-ranging and multidisciplinary and hence also covered factors related to the comprehensiveness of collections, information available on samples and their maintenance.

The recommendations were carefully considered by the Programme Committee in October 1986 and a strategy for IBPGR action on evaluation will be developed in 1987.

During 1986, IBPGR issued a publication, *Characterization Using Isozyme Electrophoresis: A Guide to the Literature*. Although this resulted from a recommendation of the IBPGR Advisory Committee on *In Vitro* Storage, it also considered its use in characterizing accessions because, on the whole, numerous morphological data are difficult to comprehend in terms of patterns of variation among accessions and biochemical methods provide useful supplementary information. In combination with applied numerical taxonomic methods, isozyme analysis can aid in the identification of genotypes, e.g. to sort out redundancy in clonal collections.

Towards the end of 1986 funds were provided for a CIAT IBPGR University of California, Davis project on genetic diversity of *Phaseolus lunatus* using electrophoretic analysis and phaseolin.

In 1986 an IBPGR Intern at the Cocoa Research Unit of the University of the West Indies, St. Augustine, Trinidad transferred techniques already developed for cocoa to identify genotypes and cocoa group types for the international collections.

The IBPGR Programme Committee at the meeting in Montpellier referred to above also had an opportunity to discuss restriction fragment length polymorphisms (RFLP). Towards the end of the year funds were provided for a research project on comparisons of chloroplast DNA RFLPs to see how the

Fig. 24. Characterization involves the growing of large numbers of accessions in the field, as with this rice in Thailand, in order to "score" them for specific characters

Fig. 25. This project on barley evaluation in the highlands of Ethiopia operated by the Institute of Agricultural Research, Debre Zeit, was assisted in the initial stages by IBPGR

technique can elucidate species origins and genetic diversity in sweet potato. This work is being carried out by Florida International University and USDA-ARS, Experiment, Georgia.

IBPGR has agreed to increase support to research on patterns of diversity. Projects are closely related, in most cases, to analyses of passport and characterization data. Research in progress in 1985 continued in the following:

(i) Cytology, taxonomy and characterization of wild oat samples from the Mediterranean (in association with WPBS, UK and Plant Breeding Institute, Sweden);

(ii) Variation patterns of *Ipomoea* species (in association with Florida Atlanta University, USA) and an IBPGR Intern located at CIP;

(iii) Cytology and variation patterns of wild *Pennisetum* collected in the Sahel (in association with USDA, Coastal Plain Experiment Station, Georgia, USA);

(iv) Distribution patterns of wild *Mangifera* species (carried out by an IPBGR consultant) and associated with field work (see p. 26);

(v) Patterns of variation of *Abelmoschus* species (in association with ORSTOM, Côte d'Ivoire and the Agricultural University, Wageningen, Netherlands);

(vi) Variation patterns of the *Arachis* genepool (in association with Texas A & M University, USA; CENARGEN, Brazil and the Instituto de Botanica del Nordeste, Corrientes, Argentina);

(vii) Variation patterns of wild perennial *Glycine* species (in association with CSIRO Division of Plant Industry, Canberra, Australia);

(viii) Taxonomy of wild *Capsicum* species (in association with CENARGEN, Brazil);

(ix) Variation patterns of wild and cultivated African *Solanum* eggplant species (in association with University of Birmingham, UK; DRA, Togo; Universite de Côte d'Ivoire and Plant Introduction Station, Ghana); and

(x) Variation patterns of wild *Phaseolus* species (IBPGR Intern located at CIAT, Colombia).

In 1986 a new study was initiated with FAO and RBG, Kew UK on the taxonomy and distribution of wild *Allium* species and IBPGR became more involved with the work on relationships within the wild genepool of *Hordeum sensu lato* at the Swedish University of Agricultural Sciences, Svalof, Sweden. An intern was located at College Station, Texas, USA to study variation in the African wild genepeol of *Gossypium*. The research on patterns of diversity will be consolidated in 1987 under a specific programme and budget items with a staff member to oversee the work.

SPECIAL PROJECT (ECP/GR)

EUROPEAN COOPERATIVE PROGRAMME FOR THE CONSERVATION AND EXCHANGE OF CROP GENETIC RESOURCES

The European Cooperative Programme for the Conservation and Exchange of Crop Genetic Resources (ECP/GR) was established to coordinate activities related to genetic resources in Europe, and to encourage their greater use in plant breeding. Although its office is within IBPGR Headquarters, it is funded separately. The ECP/GR project was initiated in 1981 by UNDP/FAO for a Phase I of two-year duration. In 1983 the Programme came under the aegis of IBPGR.

Table 10 lists the member countries of Phase II of the ECP/GR. This phase was due to end in June 1986, but was extended until the end of the year with the agreement of UNDP, co-sponsor of the project, thus ensuring the transition to Phase III (1987-89) which will be funded on a cost-sharing basis by the 26 Governments involved. The ECP/GR Secretariat prepared, for Phase III, a plan of operation in which crop-specific objectives were defined, as well as activities necessary on the part of the countries themselves for the success of the Programme.

By end of 1986, 16 European Governments had pledged their support to Phase III, while it is expected that the remaining ten will sign.

The ECP/GR Programme is based around six Working Groups of crop specialists from several European countries who meet to prepare general strategies for collaborative work on collecting, conservation and characterization of the crops. Emphasis is put on the establishment of European crop data bases, from which catalogues are published. These include the basic passport data available on all relevant accessions in European collections.

Of the six Working Groups, those for *Allium*, *Avena*, barley and sunflower met for the second time in 1986 to review progress and make proposals for the activities in Phase III, while the *Prunus* and forage Working Groups convened their second meetings at the end of 1985. Table 11 gives the numbers of accessions for which the most essential passport data are available in the European data bases.

In addition to implementing the recommendations of the six Working Groups, the ECP/GR Secretariat also coordinates work with beet, *Brassica*, *Pisum* and *Vitis* on an *ad hoc* basis in accordance with the recommendations made in December 1985 by an advisory panel to the ECP/GR, the Technical Consultative Committee.

Table 10. Member countries of the ECP/GR (Phase II)

Austria	Ireland
Belgium	Israel
Bulgaria	Italy
Cyprus	Netherlands
Czechoslovakia	Norway
Denmark	Poland
Finland	Portugal
France	Spain
Germany, Democratic Republic	Sweden
Germany, Federal Republic	Switzerland
Greece	Turkey
Hungary	United Kingdom
Iceland	Yugoslavia

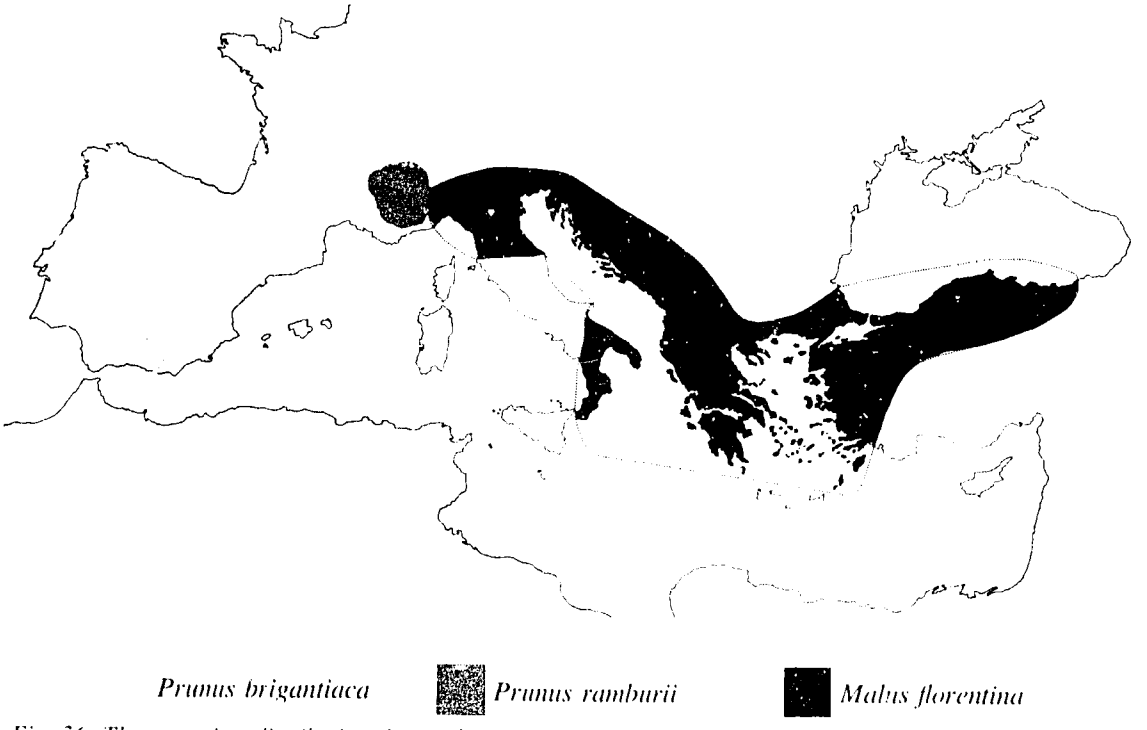


Fig. 26. These species (distribution shown above) in the Mediterranean are under threat. Many species of Prunus *show varying degrees of genetic erosion and Governments have been asked to initiate field surveys and develop* in situ *reserves as soon as possible*

AVENA

A second edition of a catalogue of *Avena* accessions in genebanks in Europe was published by the genebank at FAL, Braunschweig, Federal Republic of Germany, February 1986; it is apparent from the catalogue that 36% of all accessions are nominal duplicates.

The second meeting of the Working Group on *Avena* was held at FAL, 18-20 March. As a result of this meeting, much of the emphasis in work with the data base in 1986 was devoted to the identification of duplicates in collections. The European *Avena* data base will register characterization data of all European accessions, whereas 12 evaluation descriptors were selected for priority documentation of the unique material and further registration at the genebank at Braunschweig.

ALLIUM

A first edition of the *Allium* European list was published in December 1985 and distributed in 1986.

The second meeting of the Working Group on *Allium* was held at the Research Institute for Vegetable Growing and Breeding, Olomouc, Czechoslovakia, 7-9 January. The Working Group established guidelines for an operational European network of active collections, and proposed that the Research Institute of Vegetable Growing and Breeding of Czechoslovakia act as a field genebank for long-day accessions, complementing that already established for short-day accessions at the Israeli Genebank.

Sets of characterization and evaluation data for different groups of *Allium* species were selected for priority documentation by active collections and registration in the European *Allium* data base at the Institute of Horticultural Research (National Vegetable Research Station), Wellesbourne, UK. Efforts of the *Allium* Working Group programme in 1986 were especially directed towards the extension of the network.

BARLEY

The European barley data base was established by ZIGuK, German Democratic Republic, and in March 1986 contained 37 478 accessions from 24

institutions. ZIGuK is now compiling a new edition including 54 000 accessions from 32 institutions; this will be widely distributed in printed copy or magnetic tape form early in 1987.

ZIGuK is continuing its effort to identify duplicates and the most unique accessions within sets of duplicates. Final lists of such accessions will be distributed by late 1987.

The second meeting of the Working Group on Barley met at ZIGuK, 27-29 May. One of its recommendations was that each national genebank should select five descriptors of particular importance to barley breeders. These will be documented for the unique material (as identified in the barley data base) and then registered in it.

FORAGE GRASSES AND LEGUMES

Updated lists of forage germplasm accessions were circulated in 1986 from information in the forage data bases assembled to date. The need for standardization of the lay-out of these lists, as well as the use of descriptor states, was felt necessary; a standard format for further publications of the European forage list was drafted by the end of 1986 and circulated and should be agreed upon by early 1987. The Institut de Biocénotique Experimentale des Agrosystèmes, Université de Pau, France, agreed to act as a data base for *Lathyrus latifolius*, *L. sylvestris*, *L. heterophyllus* and *L. tuberosus*, while the Biology Department, University of Southampton, UK, agreed to cover other *Lathyrus* species; the Hebrew University of Jerusalem, Israel started work with European accessions of *Trifolium alexandrinum*, *T. resupinatum* and related wild taxa, and the Research Station of Grasses, Roznov, Czechoslovakia will act as a data base for *Trisetum flavescens* and *Arrhenatherum elatius*. The Istituto del Germoplasma, Bari, Italy added *Hedysarum* to the genera for which it is responsible.

A training course on forage genetic resources was organized jointly by the ECP/GR Programme and SIA, Spain (p. 55).

Fig. 27. Field workers at ZIGuK, Gatersleben, German Democratic Republic, harvesting plots of barley

Table 11. Number and type of accessions registered in European data bases

	Named accessions	Unnamed accessions	Number of named duplicates [1]	Total
Allium	1 553	1 413		2 966
Avena	7 915	1 591	2 831	9 506
Barley	22 018	28 336	8 900	50 354
Prunus	9 036	309	1 739	9 345
Sunflower (wild)		1 463		1 463
Sunflower (cultivated)	972	366		1 338
Forages [2]				>20 000
Festuca	415	1 806	101	2 221
Lolium perenne	491	2 279		2 770
Trifolium pratense	996	177	233	1 173

[1] Duplicates identified only by similar names

[2] Species of the following genera are registered in different European data bases: *Bromus, Dactylis, Festuca, Hedysarum, Lathyrus, Lolium, Phalaris, Phleum, Poa, Medicago, Trifolium* and *Vicia*

PRUNUS

The second stage of data registration into the European *Prunus* data base at the NGB was started in early 1986. This involves compiling the documentation of some characterization and evaluation data for each *Prunus* species together with the additional passport descriptors as requested by the second meeting of the Working Group; a complete catalogue is expected in 1987. In July 1986 the European data base for *Prunus* published a list of apricot accessions in Europe, extracted from the first edition of the European list and sorted by institute.

SUNFLOWER

A second edition of the European list of wild sunflower (Part 1—Accession Data) was published in November 1986, and the European list for cultivated sunflower was widely circulated. The Working Group on Sunflower held its second meeting at the Cereal Research Institute, Szeged, Hungary, 15-17 April.

Of the characterization evaluation descriptors for this crop, nine were selected for priority documentation and further registration in the European data base for cultivated sunflower (Cereal Research Institute, Szeged, Hungary) and 14 for the data base for wild sunflower (Institute of Field and Vegetable Crops, Novi Sad, Yugoslavia). Rationalization of collecting work will occur only after registration and comparison of these data. A list of open-pollinated cultivars which represent the main variation patterns and which are ancestral to nearly all existing modern cultivars is being prepared. These open-pollinated cultivars will serve as reference cultivars and will be maintained by the active collections with very high regeneration standards.

TRAINING

The IBPGR has been instrumental in the training of scientists and technicians involved with genetic conservation since its establishment. Over the years, the IBPGR's training programme has made major contributions to building up the knowledge and skills of personnel for national, regional and international organizations. A shortage of skilled personnel still exists in many of the developing countries and IBPGR continues to give high priority to training.

The IBPGR recognizes the need for a range of theoretical and practical training activities to accelerate the transfer of technologies in different aspects of genetic conservation. These include, for example, field collection techniques for different crops and their wild and weedy relatives, handling of seeds in the field during collecting missions and after their deposition in genebanks, seed physiology, genebank management, documentation and information management, characterization and evaluation and *in vitro* conservation of germplasm.

The training programme of IBPGR has four subprogrammes:

—Post-graduate courses;
—Specialized short technical courses;
—Individual training programmes and study tours; and
—IBPGR Intern fellowships.

POST-GRADUATE TRAINING COURSES

University of Birmingham, UK

The international training programme leading to the M.Sc. degree in *Conservation and Utilisation of Plant Genetic Resources* at the University of Birmingham, UK has been supported by IBPGR since 1976 to enable more participants from developing countries to attend. The course was reviewed by a panel of IBPGR Board Members in 1985 which agreed that IBPGR should continue to support it for the next few years because of the continuing need for the unique service it provides. A large part of the cost is borne by the UK authorities and the Board recognizes this input-in-kind to its Programme.

During the 1985-86 session, 11 participants attended the M.Sc. course of which six received IBPGR fellowships. These were from Costa Rica (2), Sri Lanka, PDR Yemen and Zambia (2). Out of nine students attending the 1986-87 session, IBPGR provided fellowships to candidates from China (2), Ecuador, Honduras, Mexico, Somalia and Tanzania.

In addition to the M.Sc. course, the University of Birmingham offers two short courses of three-month duration on *Conservation of Plant Genetic Resources* (from September to December) and *Evaluation and Utilisation of Plant Genetic Resources* (from January to March). In 1986 trainees from Egypt, Ethiopia, India, Iran (3), Somalia and Tanzania (2) received IBPGR support for participation in these courses.

The University of Birmingham also initiated a new short specialized training course on *In Situ Conservation of Plant Genetic Resources* for six weeks during November-December. In 1986 IBPGR fellowships were awarded to four students, two each from Chile and Morocco. (Although IBPGR does not provide funds for *in situ* work, where this activity impinges on its Programme, e.g. for forages, it makes a special case in the allocation of fellowships.)

Faculté des Sciences Agronomiques de l'Etat, Gembloux, Belgium

The IBPGR initiated a new one-year training programme in French on genetic resources in 1985 at the Faculté des Sciences Agronomiques de l'Etat, Gembloux, Belgium. During the first year (1985-86) four students from Benin, Burundi, Côte d'Ivoire and Rwanda attended the course, with IBPGR support. For the academic year 1986-87, three students, one each from Guinea-Conakry, Morocco and Togo received IBPGR fellowships.

The Faculty at Gembloux also organized a two-month short course on genetic resources conservation, evaluation and documentation, which was attended in 1986 by five students—from Morocco, Senegal (2), Tunisia and Viet Nam with grants from IBPGR.

International Rice Research Institute

IRRI organized a one-year training course on Genetic Resources Conservation and Management, October 1985-September 1986. The course was funded by the Italian Government and the University of the Philippines at Los Baños; IRRI provided the lecturers. Scientists from the Nordic Gene Bank (Sweden), the Istituto del Germoplasma (Italy) and IBPGR were also involved. Trainees did some field collecting in their own countries, and there was also practical work on genebank operation and management, field planting, characterization, documentation and seed storage. There were 12 participants from Bangladesh, Burma, China (2), Ethiopia, Ghana, India, Indonesia, Malaysia, Sri Lanka (2) and Viet Nam. Fellowships for the two African students were provided by IBPGR.

IBPGR Training Course on Exploration of Wild Genetic Resources, Hebrew University of Jerusalem, Rehovot, Israel, 7-17 April

This was the third course organized by the Faculty of Agriculture, the Hebrew University of Jerusalem with major financial support from IBPGR. Some local expenses were funded by GIFRID. A total of 18 participants attended from Argentina, Bulgaria, Costa Rica (2), Dominican Republic, Ethiopia (2), India, Israel (4), Nepal, Sri Lanka, UK (2) and Zambia (2). These included some of the students of the M.Sc. course on conservation and utilization of plant genetic resources at the University of Birmingham, UK to provide field experience.

IBPGR Training Course on Forage Legume Genetic Resources for the Mediterranean, SIA, Badajoz, Spain, 19-24 May

This course was jointly organized by IBPGR under its ECP/GR programme and SIA. The participants were from Algeria, Bulgaria, Cyprus, Egypt, Greece, Morocco, Portugal (2), Spain and Tunisia (2).

IBPGR Training Course on Seed Physiology and Handling, RBG, Kew, Wakehurst Place, UK, 26 July-16 August

A total of 19 trainees from 17 countries attended. The major emphasis of the course was on principles of seed physiology and practical training in seed handling in genebanks. The participants were from Bangladesh, Benin, Brazil, China (2), Costa Rica, Ethiopia, Hungary, India, Iran, Kenya, Democratic Republic of Korea, Malawi, Nigeria, Philippines, Romania, Sri Lanka and Zambia.

IBPGR Training Course on Documentation and Information Management, USDA-ARS, Beltsville, USA, 11-19 August

This was the third course organized by IBPGR to meet the needs for training on practical aspects of documentation of genetic resources and data base management using computers. A total of nine par-

Fig. 28. In addition to classroom studies, training entails practical collecting experience in the field and other aspects such as seed-handling, -storage and data management

ticipants from China, Colombia, India (2), Egypt, Morocco, Poland, Tunisia and Yugoslavia attended the course.

IBPGR Training Course on Techniques for Forage Genebanks, ILCA, Addis Ababa, Ethiopia, 30 November-13 December

ILCA in collaboration with the IBPGR Regional Office for Eastern Africa organized this training course on practical aspects of seed handling, especially of forage crops. Participants from Botswana, Ethiopia (2), Kenya, Lesotho, Madagascar, Mozambique, Sudan, Swaziland and Zambia attended the course.

Training Course on Recursos Fitogenéticos, ETSIA, Madrid, Spain, 15 January-15 June

ETSIA of the Universidad Politecnic, Madrid, organizes a five-month training course on genetic resources, in Spanish, annually. IBPGR provided travel grants to participants from Argentina (2), Bolivia, Mexico, Peru and Venezuela in 1986.

OTHER TRAINING COURSES

IBPGR also encourages the initiation of relevant courses by other organizations and may also participate in them. In 1986 the Japanese International Cooperation Agency, in collaboration with NIAR continued a four-month training course on plant genetic resources and participants from several Asian countries and a few Latin American countries attended.

CIHEAM, France, and Instituto Agronómico Mediterráneo de Zaragoza, Spain, started a 12-month post-graduate course which includes plant genetic resources course units for participants from Mediterranean countries.

INDIVIDUAL TRAINING PROGRAMMES

IBPGR provides some fellowships and travel grants to scientists from developing countries to undertake study tours and for on-the-job training at genetic resources centres and other institutions, and also to enable them to participate in relevant international workshops and symposia. During 1986 such travel funds were provided to scientists from China (2), Czechoslovakia, Egypt, Ethiopia, Iran, Democratic Republic of Korea and Pakistan.

INTERNSHIPS

In 1985 IBPGR initiated an Internship Programme to give supervised research experience to young scientists at pre- or post-doctoral levels in genetic resources centres associated with the IBPGR global network. The training which these scientists receive will help to upgrade the work of genetic resources centres. The fellowships are usually for one year, but may be extended for a further year.

During 1986, some Internships were combined with Collector posts (see IBPGR Staff in 1986, p. 61) and others were working on various research projects. In the future most Interns will be attached directly to the Research Division of IBPGR, but this will await completion of the internal restructuring of IBPGR.

In 1986 Interns were posted at CIAT, Colombia (studies on the wild *Phaseolus* genepool); Department of Primary Industry, Aiyura, Papua New Guinea (characterization of sweet potato); ILCA, Ethiopia (research on African forages); Department of Medicinal Plants, Kathmandu, Nepal (assistance to the national programme with emphasis on fruit crops); Cocoa Research Unit, University of the West Indies, Trinidad (research on biochemical characterization of cocoa); Dodo Creek Research Station, Solomon Islands (research on root and tuber crops); National Herbarium and Botanic Gardens, Harare, Zimbabwe (research on wild crop germplasm of southern Africa, especially *Vigna* spp.); IUCN/WWF, Bogor, Indonesia (research on the primary genepool of *Mangifera*); and USDA-ARS Southern Crops Research Laboratory, College Station, Texas, USA (studies on wild African species of *Gossypium*). During the year the Interns working in Papua New Guinea and CIAT completed their assignments; both took up further international employment (by AVRDC and CIAT respectively).

ADMINISTRATION

MEMBERSHIP AND BOARD MEETINGS

At the request of the CGIAR, the members of the Board of Trustees of IBPGR had remained the same in 1986 as in 1985. In 1985 CGIAR enforced a freeze not only on Board membership but also on Staff changes pending the outcome of deliberations of a CGIAR Committee which advised on the changes in structure recommended by an external review and negotiations between CGIAR and FAO which hosts IBPGR on space allocations and staffing.

The freeze on changes in Board membership was lifted at the CGIAR mid-term meeting in Ottawa, 19-23 May 1986 and as a result membership of the Board will change on 1 January 1987.

At the end of 1986 a total of eight Trustees had completed their terms of membership: Dr. C.J. Bishop, Prof. J.P. Cooper, Dr. Q. Jones, Dr. H.K. Jain (whose place had been filled on an *ad hoc* basis by Dr. A.B. Joshi, former Board member since Dr. Jain had taken up a post with ISNAR), Prof. S.A. Qureshi, Prof. G.T. Scarascia-Mugnozza, Dr. Djibril Sène and Dr. Xu Yun-tian.

The IBPGR and the CGIAR had agreed at the mid-term CGIAR meeting in Tokyo in 1985 that in future up to four Trustees would be elected directly by the CGIAR, and the remainder would be elected by the IBPGR, thereby bringing IBPGR more into line with other CGIAR centres.

On the recommendation of the CGIAR Committee on IBPGR it was agreed by the CGIAR at its annual meeting in Washington, DC 31 October-7 November 1986 that the new mechanism would be phased in gradually and for 1987 all new Trustees would be approved by CGIAR. The following were approved: Two members appointed by the CGIAR: Dr. A. Papasolomontos (Cyprus) and Prof. W.M. Tossell (Canada). The new Trustees elected by IBPGR and approved by the CGIAR are: Prof. H.F. Chin (Malaysia), Dr. V.L. Chopra (India), Dr. J.H.W. Holden (UK), Prof. D.R. Marshall (Australia) and Dr. C.F. Murphy (USA).

The Nominations Committee of IBPGR met on three occasions in conjunction with the meetings of the Board and its Executive Committee to make recommendations on candidates nominated.

During 1986 the Board met 19-21 February 1986 in Rome and the Executive Committee met 18 February in Rome, 27-28 May in Ottawa, Canada and 29 October in Washington, DC.

It is accepted practice that donors may attend any of the open parts of the Board or Committee meetings and in 1986 observers from Australia, Canada, France, India, Netherlands, Switzerland and the USA attended meetings.

CHAIRMAN

Since the Chairman of the Board, Prof. E.L.J. Kährc, retired at the end of 1986, the Board recommended suitable replacements and delegated authority to the Executive Committee to determine their availability to serve. Accordingly, the Executive Committee ratified the recommendation of the Board that Dr. W.J. Peacock serve as Chairman for 1987-88 at its 35th meeting in May 1986.

REPRESENTATION AT INTERNATIONAL MEETINGS

Apart from a relatively large number of IBPGR meetings itemized in other sections of this report and the regularly scheduled meetings of TAC, Center Directors, Center Board Chairpersons and the CGIAR, IBPGR participated in the following international or regional events during 1986:

—IJO Coordination Committee Meeting on Jute and Kenaf, Dhaka, Bangladesh, 18-21 January

—International Symposium on Tropical and Sub-Tropical Fruit Breeding, Brasilia, Brazil, 27-31 January

—Regional Meeting on Genetic Resources in

Meso-America, CATIE, Turrialba, Costa Rica, 11-14 February
—FAO/UNEP/Unesco/IUCN Ecosystem Conservation Group, Working Group on *In Situ* Conservation, Paris, France, 26-27 February
—Fifth Congress on Andean Agriculture, Puno, Peru, 11-14 March
—CGIAR Inter-Center Workshop on Agro-ecological Characterization, FAO, Rome, Italy, 14-18 April
—Working Group of FAO Commission on Plant Genetic Resources, Rome, Italy, 2-3 June
—EUCARPIA Genebank Committee Meeting, Radzikow, Poland, 18 June
—EUCARPIA Symposium on Methods of Biochemical Evaluation of Germplasm Collections, Radzikow, Poland, 19-20 June
—Symposium on Conservation and Management of Endangered Plants and Animals, Bogor, Indonesia, 18-20 June
—ILDIS Board Meeting, St. Louis, Missouri, USA, 21 June
—International Food Legume Research Conference, Spokane, Washington, USA, 6-11 July
—Twenty-first ISTA Congress, Brisbane, Australia, 11-18 July
—Smithsonian International Symposium on Grass Systematics and Evolution, Washington, DC., USA, 23-27 July
—Sixth International Congress on Plant Tissue and Cell Culture, Minneapolis, USA, 3-8 August
—22nd International Horticultural Congress, Davis, California, USA, 11-20 August
—ACIAR Workshop on Food Legume Improvement, Khon Kaen, Thailand, 1-3 September
—Smithsonian/NAS-NSF Forum on Bio-Diversity, Washington, DC., USA, 22-24 September
—Fifth International Barley Genetics Symposium, Okayama, Japan, 6-11 October
—10th Anniversary of the Plant Genetic Resources Center, Addis Ababa, Ethiopia, 13-16 October
—Commonwealth Secretariat CSC Workshop on Underexploited Plants, London, UK, 21-24 October
—INIBAP/ACIAR/QDPI Workshop on Banana Improvement, Cairns, Australia, 13-17 October

CGIAR SERVICE

Prof. Williams, Director, IBPGR, served part-time as Chairman *ad interim* of the Directors General of the CGIAR up to June 1986 and Prof. Kåhre, IBPGR Chairman, served as Chairman of the CGIAR Center Board Chairpersons during 1986.

COMMITTEES

The Programme Committee, which was established in 1985 to advise the Board on all aspects of programme planning and execution, held three meetings in 1986 in conjunction with meetings of the Executive Committee (17 February, 26-27 May and 27-28 October). The Programme Committee agreed to the new structure in line with the recommendations of the external review (1985) and subsequent discussions by TAC and donors. In particular they addressed the reorganization of the staffing structure and liaised closely with staff on programme structure. An outline of these changes was provided in *Annual Report 1985*.

The IBPGR Advisory Committee on *In Vitro* Storage (Appendix II) held its third meeting in Valencia, Spain, 4-6 June 1986. Further details are given on p. 35. During the year Prof. de Langhe resigned as Chairman due to pressure of work as Director of the new organization INIBAP. Dr. L.A. Withers, who has acted as honorary technical secretary since the Committee's inception, was asked to take over as Chairman. Committee members give freely of their time and provide a major input to the Director's planning and operation of the IBPGR Programme. Over the years many scientists, from all parts of the world, have participated in Committees and Working Groups and they continue to provide advice and help at no cost.

A Working Group on Barley was held in association with the 5th International Barley Genetics Symposium (13-14 October) to assess action which has occurred since a previous Working Group made recommendations in 1981. A number of Working Groups were convened in the context of the Special Project ECP/GR (see Appendix IV).

In Southeast Asia Working Groups met on the genetic resources of sugarcane (5-7 March, Indonesia), tropical fruits (24-26 June, Malaysia) and forages (23-25 September, Khon Kaen, Thailand) (see Appendix IV).

STAFF

Due to the CGIAR freeze in 1986 there were no major staff changes during the year although plans were far advanced for restructuring. This will be implemented as from early 1987.

There are several categories of staff administered in two ways. The Headquarters and senior Field Staff are administered through FAO, whereas more temporary field staff such as Collectors are now administered through IIE, as is the Intern Pro-

gramme which provides junior fellowships. A list of senior Staff is shown in Appendix I.

In 1987 the Field Programme will see changes in staffing in both Africa and Asia. The areas that will be covered in Africa will be the Sahel with an IBPGR Officer hosted by the ICRISAT Sahelian Center near Niamey, Niger (replacing the IBPGR office in Burkina Faso) and the Eastern Africa office will remain in Nairobi. The Collector in Burundi, Rwanda and Zaire completed her assignment at the end of 1986 and another Collector was appointed late in 1986 at the National Herbarium and Botanic Garden, Harare, Zimbabwe to work in southern Africa. The Collector for forages in Southeast Asia also finalized his assignment during the year.

In Asia the office for Southeast Asia is to be merged and moved so that the programme provides better assistance to a much wider area.

No changes are envisaged in Latin America nor the Mediterranean, North Africa, Southwest Asia although there will be more coordination between the latter area and the Special Project ECP/GR.

An in-house staff review was held in December to assess the practicalities and constraints in collecting wild species since this is a major thrust of IBPGR. A report was produced for the Programme Committee and in 1987 the Committee will make proposals to the Board and the Director on any aspects which will enhance this essential work of IBPGR.

The Director serves also as Chief of the FAO Crop Genetic Resources Centre and as Executive Secretary of the ECP/GR. Despite the lack of implementation of an expanded management structure due to the CGIAR freeze in 1986 the Director was greatly assisted by a Senior Adviser, Dr. J.H.W. Holden, although much of his efforts related to policy issues of the Programme and Executive Committee. Dr. J.L. Creech and Prof. M. Iizuka, both former Board members, also acted as Senior Advisers to the Director on specific issues. The Director wishes to pay particular tribute to these scientists and also to the new Chairman of the *In Vitro* Committee, Dr. L.A. Withers who voluntarily gave of her time helping the programme development.

PUBLICATIONS

IBPGR publications fall under a number of categories. Apart from *Annual Reports*, pamphlets and general information, they include those dealing with scientific standards, proposals for further practical research or the results of research, practical guides, e.g. for documentation and those which inform the genetic resources community, e.g. Newsletters.

In 1986 the number of IBPGR publications was less than in 1985 largely because the latter year saw the issuance of numerous descriptor lists.

The mailing list of IPBGR now exceeds 4500. Conscious attempts were made in 1986 to see that publications, as far as possible, are provided to libraries as well as key workers such as genebank curators, coordinators and other national programme staff.

INTERNATIONAL AGRICULTURAL RESEARCH CENTERS OF THE CGIAR

The Consultative Group on International Agricultural Research (CGIAR) was set up in 1971 to help coordinate the efforts of countries, public and private institutions, international and regional organizations and representatives from developing countries to support a network of 13 international agricultural centers.

The CGIAR provides a mechanism for mobilizing financial support for the centers. Its overall goal is, through international agricultural research and related activities, to develop technology and to cooperate with national research systems in developing countries with the aim of alleviating hunger and poverty, improving the management of natural resources and increasing employment and income, particularly of the lower income groups.

Each centre of the CGIAR is autonomous with its own Board of Trustees or governing body. Each develops its own budget for core funds mobilized by CGIAR.

CGIAR is co-sponsored by FAO, UNDP and the World Bank. The World Bank provides the CGIAR with its chairman and secretariat, while FAO provides a secretariat for the group's Technical Advisory Committee (TAC). The TAC regularly reviews the scientific and technical aspects of all the centers.

An overview of the work of the CGIAR carried out by the centers listed below may be found in the *CGIAR Annual Reports*.

CIAT
Centro Internacional de Agricultura Tropical
Cali, Colombia

CIMMYT
Centro Internacional de Mejoramiento de Maiz y Trigo
Mexico City, Mexico

CIP
Centro Internacional de la Papa
Lima, Peru

IBPGR
International Board for Plant Genetic Resources
Rome, Italy

ICARDA
International Center for Agricultural Research in the Dry Areas
Aleppo, Syria

ICRISAT
International Crops Research Institute for the Semi-Arid Tropics
Hyderabad, India

IFPRI
International Food Policy Research Institute
Washington D.C., USA

IITA
International Institute of Tropical Agriculture
Ibadan, Nigeria

ILCA
International Livestock Centre for Africa
Addis Ababa, Ethiopia

ILRAD
International Laboratory for Research on Animal Diseases
Nairobi, Kenya

IRRI
International Rice Research Institute
Manila, Philippines

ISNAR
International Service for National Agricultural Research
The Hague, Netherlands

WARDA
West African Rice Development Association
Monrovia, Liberia

APPENDIX I

IBPGR STAFF IN 1986

Prof. J.T. Williams[1]
Director

Headquarters Staff

Officers

Dr. N. M. Anishetty
(Board Secretary)

Dr. C.G.D. Chapman[2]
(Evaluation and Regeneration)

Dr. J.T. Esquinas Alcazar[3]
(Training, *a.i.*)

Mr. J. Konopka
(Documentation)

Ir. D.H. van Sloten
(In-charge, Field Programme)

Dr. Kar-Ling Tao
(Conservation)

Mr. J.M. Watts
(Publications)

Support Staff

Ms. C. Gorelli
(Programme Assistant)

Mr. G. Sayour
(Research Assistant)

Secretaries

Miss R. Andarias
Mrs. L. Dalton[4]
Ms. F. Farzad[2,3]
Mrs. G. El Belghami Sijelmassi[2,4]
Mrs. M. Hansel
Mrs. M. McArthur-Giannini
Miss L. Parry-Bruton[3]
Miss D.E. Quaye
Miss A.M. Ruffini
Mr. A. Vaid

Clerks

Ms. M. Bonami
Ms. C. Buttafuoco
Ms. A. Vittorini[3]

Field Programme (Professionals)

Eastern Africa Programme

Mr. A.F.Y. Attere
Field Officer
c/o ILRAD
Nairobi, Kenya

Dr. R. Mithen[4]
IBPGR Collector
c/o National Herbarium and Botanic Gardens
Harare, Zimbabwe

Central Africa Programme

Miss Jane Toll
IBPGR Collector
c/o FAO Representative, Burundi
B.P. 1250
Bujumbura, Burundi

Western Africa Programme

Mr. M. Horn
Field Officer
c/o FAO
B.P. 575
Ouagadougou, Burkina Faso

Mr. G. Mergeai[3]
Assistant (Togo)

Latin America Programme

Dr. D. Debouck[3]
IBPGR/CIAT Collector (*Phaseolus*)
c/o CIAT
Cali, Colombia

Dr. Fermin de la Puente
IBPGR/CIP Collector (sweet potato)
c/o CIP
Apartado 5669
Lima, Peru

Dr. M. Holle
Field Officer
c/o CIAT
Cali, Colombia

Dr. S. Salazar
Collector for Meso-America
c/o CATIE
Turrialba, Costa Rica

Mediterranean and Southwest Asia Programme

Dr. W.G. Ayad
Field Officer
c/o ARI
Nicosia, Cyprus

Europe (ECP/GR)

Dipl. Ing. P.M. Perret
Officer for Europe
c/o Headquarters

Southeast Asia Programme

Dr. N. Chomchalow
Field Officer
c/o FAO Regional Office
Bangkok, Thailand

Dr. H. Takagi[3]
Assistant (Papua New Guinea)

Dr. K.L. Mehra[3]
IBPGR Collector for Forages
c/o LBN
Bogor, Indonesia

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[1] Also Chief, FAO Crop Genetic Resources Centre and Executive Secretary, UNDP-IBPGR ECP/GR

[2] Outposted c/o LNOR, 1001 22nd Street, N.W., Suite 300, Washington, DC 20437, USA

[3] Left during the year

[4] Joined during the year

APPENDIX II

CONSERVATION ADVISORY COMMITTEES

ADVISORY COMMITTEE ON SEED STORAGE

Chairman:

Prof. E.H. Roberts
Dept. of Agriculture and Horticulture
University of Reading
Earley Gate
Reading RG6 2AT
UK

Members:

Prof. J.D. Bewley
Department of Botany
University of Guelph
Guelph
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Canada

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Faculty of Agriculture
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Serdang, Selangor
Malaysia

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Seed Quality Control Services
Ministry of Agriculture
Bureau of Plant Industry
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Italy

Prof. J.T. Williams
IBPGR
Food and Agriculture Organization
of the United Nations
Via delle Terme di Caracalla
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Italy

ADVISORY COMMITTEE ON *IN VITRO* STORAGE

Chairman:

Prof. E.A.L. De Langhe
Laboratory of Tropical Crop Husbandry
Catholic University of Leuven
Kardinaal Mercierlaan 92
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Belgium
(Currently: Director, INIBAP, Montpellier, France)

Members:

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North Carolina State University
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Colombia

Prof. Y. Yamada
Research Centre for Cell
and Tissue Culture
Faculty of Agriculture
Kyoto University
Sakyo-ku, Kyoto 060
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Dr. W.R. Scowcroft
Division of Plant Industry
Commonwealth Scientific and
Industrial Research Organization
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(and Biotechnica international Inc.,
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Department of Agriculture
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Sutton Bonington
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Leicestershire LE12 5RD
UK

[1]Chairman of the Committee since September 1986

APPENDIX III

MEMBERSHIP OF THE IBPGR REGIONAL COMMITTEE FOR SOUTHEAST ASIA

Member:	Alternate:
INDONESIA	
Dr. Achmad Soedarsan Bogor Research Institute for Estate Crops Taman Kencana 1 Bogor	**Dr. Made Sri Prana** Bogor Botanic Gardens Jalan Juanda No. 18 Bogor
MALAYSIA	
Dr. Abdul Wahab bin Ngah Malaysian Agricultural Research and Development Institute P.O. Box 12301 General Post Office Kuala Lumpur	**Dr. Ahmad Zamzam bin Mohamad** Malaysian Agricultural Research and Development Institute P.O. Box 12301 General Post Office Kuala Lumpur
PAPUA NEW GUINEA	
Mrs. Rosa Kambuou Bubia Agricultural Research Centre P.O. Box 1639 Lae	**Mr. Fred Dori** Crop Research Department of Primary Industry P.O. Box 417 Konedobu
PHILIPPINES	
Prof. Ricardo M. Lantican (Chairman) University of the Philippines at Los Baños College, Laguna 3720	**Mr. Nestor C. Altoveros**[1] National Plant Genetic Resources Laboratories Institute of Plant Breeding University of the Philippines at Los Baños College, Laguna 3720
THAILAND	
Dr. Ampol Senanarong Department of Agriculture Bangkhen, Bangkok 10900	**Dr. Praphas Weerapat** Pathum Thani Rice Research Centre Rice Research Institute Department of Agriculture Rangsit, Pathum Thani

[1]Official notification not yet received

APPENDIX IV

MEMBERSHIP OF CROP WORKING GROUPS IN 1986

IBPGR *AD HOC* WORKING GROUP ON BARLEY

Chairman:

Prof. G. Fischbeck
Technische Universitat München
Lehrstuhl für Pflanzenbau and Pflanzenzüchtung
8050 Freising-Weihenstephan
Federal Republic of Germany

Members:

Dr. S. Ceccarelli
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Research in the Dry Areas (IC ARDA)
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and Breeding
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Prof. B.L. Harvey
Department of Crop Science
and Plant Ecology
University of Saskatchewan
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Canada

Mr. L. Jestin
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France

Prof. F. Kikuchi
Institute of Agriculture and Forestry
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Niiharigun 305
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Prof. T. Konishi
Institute for Agricultural
and Biological Sciences
Okayama University
Kurashiki 710
Japan

Dr. F. Scholtz
Zemntralinstitut für Genetik und
Kulturpflanzenforschung (ZIGuK)
Akademie de Wissenschaften der DDR
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German Democratic Republic

Prof. Shao Qiquan
Institute of Genetics
Academia Sinica
Beijing
China

Observers

Prof. R. von Bothmer
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Dr. B.H. Somaroo
International Center for Agricultural
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Aleppo
Syria

IBPGR/SEAP WORKING GROUP ON FORAGES

Members:

Dr. Anake Topark-ngam
(Convener)
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Khon Kaen University
Khon Kaen
Thailand

Mr. M.E. Seregar
Animal Husbandry Research Institute
Jalan Raya Pajajaran
Bogor
Indonesia

Mr. Ahmad Tajuddin Zainuddin
Livestock Research Director
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University of Philippines at Los Baños
College, Laguna
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Dr. R.J. Williams
Division of Tropical Crops and Pastures
Commonwealth Scientific and Industrial
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Dr. Rainer Schultze-Kraft
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Centro Internacional de Agricultura
Tropical (CIAT)
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Cali
Colombia

IBPGR/SEAP WORKING GROUP ON TROPICAL FRUITS

Members:

Dr. Abdul Wahab bin Ngah
(Convener)
Fruit Research Division
Malaysian Agriculture Research and
Development Institute
Serdang, Selangor
Malaysia

Dr. R.R.C. Espino
Institute of Plant Breeding
University of Philippines at Los Baños
College of Agriculture
College, Laguna
Philippines

Dr. D.C. Giacometti
Centro Nacional de
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Dr. Usep Soetisna
National Biological Institute
Bogor
Indonesia

IBPGR/SEAP WORKING GROUP ON SUGARCANE

Members:

Dr. Ir. H. Boedijono Wirioatmodjo
(Convener)
Associate Director for Agriculture
Sugar Research Institute
Pasuruan
East Java
Indonesia

Dr. D.J. Heinz
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Mr. M. Krishnamurthi
The Fiji Sugar Corporation Ltd.
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Dr. K. Mohan Naidu
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Mr. Jaray Sadakorn
Botany and Weed Science Division
Department of Agriculture
Bangkhen
Bangkok 10900
Thailand

Mr. D.I.T. Walker
West Indies Central
Sugarcane Breeding Station
Groves
St. George
Barbados

Fig. 29. Field visit of IBPGR/SEAP Working Group on Tropical Fruits to MARDI field genebank, Malaysia

ECP/GR *AVENA* WORKING GROUP (SECOND MEETING)

Chairman:

Dr. H. Thomas
Welsh Plant Breeding Station
Plas Gogerddan, Near Aberystwyth
Dyfed, Wales SY23 3EB
UK

Members:

Ir. G. Clamot
Station d'Amélioration des Plantes
Centre de Recherches Agronomiques
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Dr. M. Gullord
State Agricultural Research
Station Apelsvoll
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Norway

Dipl.-Biol. J. Hetzler
Institut für Pflanzenbau und
Pflanzenzüchtung (FAL)
Bundesallee 50
3300 Braunschweig
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Dr. G. Ladizinsky
School of Agriculture
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P.O. Box 12
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Israel

Dr. P. Mikoska
Cereal Research and Breeding
Institute
Havlickova 2787
Kromeriz CS-767 41
Czechoslovakia

Dr. W. Podyma
Plant Breeding and Acclimatization
Institute
05-870 Blonie
Radzikow near Warsaw
Poland

Dr. L. Seidewitz
Institut für Pflanzenbau und
Pflanzenzüchtung (FAL)
Bundesallee 50
3300 Braunschweig
Federal Republic of Germany

Members unable to attend

Dr. C. Tüten
Aegean Regional Agricultural
Research Institute
P.O. Box 9
Menemen-Izmir
Turkey

Dr. A. Popovic
Institute for Small Grains
Save Kovscevica 31
3400 Kragujevac
Yugoslavia

ECP/GR SUNFLOWER WORKING GROUP (SECOND MEETING)

Chairman:

Dr. F. Vear
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APPENDIX V

CONTRIBUTIONS TO IBPGR (1986)

US$ equivalents

Donor	Core	Special Projects
Australia	158 878	
Austria	49 985	5 922[1]
Belgium	105 395	
Canada	323 980	
China	[3]	
Denmark	103 593	
Finland		
France	148 133	1 832[1]
Germany, Fed. Rep.	156 993	9 892[1]
India	[3]	
Italy	173 838	
Japan	788 899	
Netherlands	297 910	344 800[2]
Norway	110 248	
Spain	149 945	
Sweden	272 021	
Switzerland	[4]	11 447[1]
United Kingdom	659 550	5 922[1]
USA	1 025 000[5]	
	4 524 368	379 815

[1] European Cooperative Programme for Conservation and Exchange of Crop Genetic Resources (Phase II): 26 European Governments are members

[2] Work in Papua New Guinea: East Asia and Pacific Seminar in 1987 (Government of Japan)

[3] To be received in 1987

[4] 1986 pledge received in 1985

[5] Overpayment of US $50 000 to be returned to USAID in 1987

APPENDIX VI

STATEMENT OF ACCOUNTS FOR 1986

US$ equivalents

RECEIPTS		
Balance as at 1 January 1986		1 197 996[1]
Various Governments contributions		4 524 368
Special projects		379 815[2]
Interest credited in 1986		93 028
		6 195 207
DEDUCT		
Cash expenditure		
Core Programme		
Personnel services	1 163 195	
Official duty travel	548 756	
Contractual services	1 458 975	
General operating expenses	188 622	
Supplies and materials	187 616	
Furniture and equipment	26 [illegible]	
Fellowships	287 886	
	3 861 547	
Special projects	218 922	
Payment of obligations carried forward from previous years	300 142	
	4 380 611	
Commitments		
Incurred in 1986	905 906	
Working capital fund	150 000	
Unliquidated obligations carried forward from previous years	286 279	
1987 Seminar in Japan	218 400	
	5 941 196	5 941 196
BALANCE AT 31 DECEMBER 1986		254 011

[1] Unobligated cash balance and unliquidated obligations (1985 and previous years)

[2] European Cooperative Programme for Conservation and Exchange of Crop Genetic Resources (Phase II) and collection of plant genetic resources in Papua New Guinea (Government of Japan)

1986 EXPENDITURE BY FUNCTIONS

US$ equivalents

Administration [1]	560 265
Technical Services [1]	219 460
Global Genetic Resources Network [2]	1 011 093
Germplasm Acquisition	627 829
Characterization and Evaluation	580 023
Training	638 330
In Vitro Culture Research	445 679
Genetic Diversity Research	478 676
Seed Conservation Research	206 098
Special Projects	263 240
Working Capital Fund	150 000
1987 Seminar in Japan	218 400

[1] Includes programme coordination

[2] Includes regional coordination

HIGHLIGHTS OF 1986 ACTIVITIES

Germplasm acquisition: Emphasis by IBPGR on increasing the number of wild species in collections in 1986 resulted in a greater number of collecting missions where these species were targeted. Of the 72 collecting and survey projects in 1986 in 56 countries, 17 dealt exclusively with wild genepools, and 16 in addition were for potential forage species. IBPGR organized, or assisted in the organization of, 39 projects for the collecting of landraces and/or primitive cultivars. In addition, more attention was given to taxonomic and ecogeographic studies.

A lack of basic knowledge on wild genepools has made it essential that systematic studies are undertaken either prior to or at the same time as major collecting missions. Such studies continued on *Mangifera* and similar projects were initiated on *Abelmoschus*, *Beta*, *Brassica*, *Citrus* and *Vigna*.

Conservation: IBPGR has developed scientific and operational standards for seed storage in order to assist genebanks. The 37 IBPGR designated base collections have been invited to participate in this programme (called a Register for Genebanks) and several were visited. In 1986, the evaluation of 18 genebanks was complete.

IBPGR support to conservation research was increased considerably during the year.

Its support for conservation facilities went to institutes in China, Egypt, Ghana, India, Iran, Mexico, Paraguay, Peru, Portugal, Syria and Tanzania.

In 1986 IBPGR established a model *in vitro* active genebank at CIAT to test operational details and to identify and resolve problems.

In vitro research during the year included: *in vitro* collecting techniques, techniques for the initiation and maintenance in slow growth of cultures of *Musa*, sweet potato, *Colocasia* and *Xanthosoma*, and techniques for the *in vitro* propagation and culture of *Citrus*, cacao and sugarcane.

Attempts to cryopreserve germplasm has met with varying success, but most progress to date has been made with cassava and a limited amount of work was carried out on disease indexing especially of sweet potato and potato. Major new research was initiated on genetic stability.

Documentation: Computer facilities at IBPGR Headquarters and Field Offices were upgraded.

A cashew descriptor list was published and those for Bambara groundnut, *Citrus*, Chinese cabbage, eggplant, mango, papaya, several cultivated *Brassica* species, wild *Brassica* species and *Xanthosoma* were prepared.

Descriptors for barley and wheat published by IBPGR and other organizations were recorded in a single file and cross referenced.

Directories for soyabean and a revised edition of root and tuber crops (aroids, cassava, potato, sweet potato and yam) were published. Work continued on directories for industrial crops, a revision of food legumes (excluding soyabean), temperate fruits and tree nuts, and a revision of wheat.

IBPGR provided either hardware or software to centres in Ecuador, India, Morocco and Tunisia. Both hardware and a data base management system were provided to China to upgrade an existing microcomputer system.

Projects on documentation of crops in 1986 included cooperation with or assistance to: CSIRO, Australia (perennial *Glycine*), CIAT (global data base for *Phaseolus vulgaris*), UNA, Peru (Andean crops), ETSIA, Spain (*Cucumis* data base), the Greek Gene Bank (an information system) and CAAS, China (compilation of a catalogue of Chinese crop genetic resources available for exchange).

Further progress was made in the development of IBPGR data bases at the Hebrew University of Jerusalem, Israel (information on the wild relatives of cultivated plants and related environmental data) and the University of Nottingham, UK, (ongoing *in vitro* research pertinent to conservation).

IBPGR initiated a survey of the distribution of the major forage species in the Mediterranean.

Characterization and evaluation: Projects involving characterization (many of which include multiplication and deposition of samples in base collections) took place in Argentina, Barbados, Bolivia, Burkina Faso, China, Colombia, Costa Rica, Côte d'Ivoire, Ecuador, Egypt, Greece, Guatemala, Indonesia, Japan, Jordan, Madagascar, Morocco, Nigeria, Peru, Seychelles, Spain, Sudan, Sweden, Thailand, Trinidad, USA and UK.

An IBPGR Workshop "Genetic Resources and the Plant Breeder" was attended by 30 scientists and 22 papers were presented; the proceedings will be published.

A research project was started on comparisons of chloroplast DNA restriction fragment length polymorphisms (RFLP) to determine how the technique can elucidate species origins and genetic diversity in sweet potato. Additional projects were initiated on genetic diversity of *Phaseolus lunatus* using electrophoretic analysis and phaseolin and on transferring techniques already developed for cocoa to identify genotypes and cocoa group types for international collections.

A guide to the literature on characterization using isozyme electrophoresis was published.

IBPGR support to research on patterns of diversity included: cytology, taxonomy and characterization of wild oat samples from the Mediterranean, variation patterns of the genepools of *Abelmoschus*, *Arachis*, wild perennial *Glycine*, *Ipomoea*, wild *Phaseolus*, wild and cultivated *Solanum* (African eggplant), cytology and variation patterns of wild *Pennisetum* collected in the Sahel, distribution patterns of wild *Mangifera* and taxonomy of wild *Capsicum*.

A new study was initiated with FAO and RGB, Kew, UK on taxonomy and distribution of wild *Allium* species. IBPGR became more involved with work on relationships within the wild genepool of *Hordeum* and with the study of variation in the African wild genepool of *Gossypium*.

Training: In 1985-86, 17 scientists were awarded post graduate fellowships and in 1986-87 12 were supported at both the University of Birmingham, UK and Faculté des Sciences Agronomiques de l'Etat, Belgium. They came from Benin, Burundi, Chile, China, Costa Rica, Côte d'Ivoire, Ecuador, Guinea Conakry, Honduras, Mexico, Morocco, Rwanda, Senegal, Somalia, Sri Lanka, Tanzania, Togo, Tunisia, Viet Nam, PDR Yemen and Zambia. Ten specialized training courses were supported in various parts of the world and for 71 trainees.

IBPGR initiated an Internship Programme at pre- or post-doctoral levels in genetic resources centres associated with the IBPGR global network. During 1986, some Internships were combined with IBPGR Collector posts.

To give supervised research experience to young scientists, IBPGR Interns were posted at CIAT, ILCA, IUCN/WWF (in Indonesia), Papua New Guinea, Nepal, Trinidad, Solomon Islands, Zimbabwe, and USA.

ACONTECIMIENTOS DEL AÑO 1986

Adquisición de germoplasma: El empeño del IBPGR en incrementar el número de las especies silvestres en colecciones durante 1986 tuvo como resultado un mayor número de misiones de recolección donde dichas especies fueron el objetivo. De las 72 misiones de recolección y proyectos de inspección llevados a cabo durante 1986 en 56 países, 17 fueron dedicados exclusivamente a acervos genéticos, y 16 además a forrajeras de potencial agrícola. El IBPGR organizó o ayudó en la organización de 39 proyectos para la recolección de cultivares locales y/o primitivos. Además se prestó más atención a los estudios taxonómicos y ecogeográficos.

La falta de un conocimiento básico de los acervos genéticos silvestres ha hecho esencial que los estudios sistemáticos sean considerados prioritarios, en la mayor parte de los casos, que las misiones de recolección. Dichos estudios continuaron para *Mangifera* y otros proyectos similares se iniciaron con *Abelmoschus*, *Beta*, *Brassica*, *Citrus* y *Vigna*.

Conservación: El IBPGR ha desarrollado "standards" científicos y operativos para el almacenaje de semillas con el fin de ayudar a los bancos de germoplasma. Las 3 colecciones de base designadas por el IBPGR, fueron invitadas a participar en este programa (llamado "Registro para Bancos de Germoplasma") y varias fueron visitadas. En 1986, la evaluación de 18 bancos de germoplasma había sido ya completada.

El apoyo del IBPGR a la investigación en el campo de la conservación fue incrementado considerablemente durante el año.

Apoyó decisivamente a institutos en China, Egipto, Ghana, India, Irán, México, Paraguay, Perú, Portugal, Siria y Tanzania, con el fin de facilitar la conservación.

En 1986 estableció un modelo de banco de germoplasma de colecciones activas *in vitro* en el CIAT para la conservación *in vitro*, destinado a analizar los detalles operativos y a identificar y resolver diversos problemas.

La investigación *in vitro* durante el año incluyó: técnicas de recolección *in vitro*, técnicas para el comienzo y el mantenimiento en lento crecimiento de cultivos de *Musa*, batata, *Colocasia* y *Xanthosoma* y técnicas para la propagación y cultivo *in vitro* de *Citrus*, cacao y caña de azúcar.

Los intentos para la criopreservación de germoplasma han dado como resultado variados éxitos, pero hasta la fecha se ha observado un mayor progreso con yuca y una cierta cantidad de trabajo fue llevada a cabo sobre la catalogación de enfermedades, especialmente en batata y patata. Una mayor investigación fue iniciada en la estabilidad genética.

Documentación: Se ampliaron las facilidades con los computadores tanto en la sede central del IBPGR como en las oficinas en el campo.

Una lista de descripción de castaña del Brasil fue publicada y las de Bambarra, *Citrus*, col de China, berenjena, mango, papaya, varias especies cultivadas de *Brassica* y especies silvestres de *Brassica* y *Xanthosoma* se prepararon.

Descriptores de cebada y trigo publicados por el IBPGR y otras organizaciones, fueron reunidos en un único archivo y puestos en relación entre sí.

Directorios de soja y una edición revisada de cultivos de raíces y tubérculos (aroideas, yuca, patata, batata y yame) fueron publicados. Se continuó el trabajo en los directorios para cultivos industriales, una revisión de leguminosas (excluyendo soja), árboles frutales de clima templado y de fruto duro y una revisión de trigo.

IBPGR suministró "hardware" y "software" a centros en Ecuador, India, Marruecos y Túnez. Se proveyó "hardware" y un sistema de manejo de bases de datos a China para mejorar el sistema de microcomputador ya existente.

Los proyectos en la documentación de cultivos en 1986 incluyeron la cooperación y la asistencia a: CSIRO, Australia (*Glycine* perenne); CIAT (una base de datos global para *Phaseolus vulgaris*); UNA, Perú (cultivos andinos); ETSIA, España (base de datos para *Cucumis*), el Banco de Germoplasma de Grecia (un sistema de información) y CAAS, China (para la compilación de un catálogo de recursos fitogenéticos chinos disponibles en intercambio).

Se realizó un mayor progreso en el desarrollo de las bases de datos del IBPGR situadas en la Universidad Hebrea de Jerusalén, Israel (información en las familias silvestres de las plantas cultivadas y los datos del entorno relativos a los mismos) y en la Universidad de Nottingham, Gran Bretaña, (trabajos de investigación *in vitro* actualmente en curso, destinados a la conservación).

El IBPGR inición una investigación de la distribución de las especies forrajeras más relevantes en el Mediterráneo.

Caracterización y evaluación: Proyectos que incluían caracterización (muchos de los cuales incluyen multiplicación y el depósito de muestras en las bases de colección), tuvieron lugar en Argentina, Barbados, Bolivia, Burkina Faso, China, Colombia, Costa Rica, Costa de Marfil, Ecuador, Egipto, España, Grecia, Guatemala, Indonesia, Japón, Jordania, Madagascar, Marruecos, Nigeria, Perú, Seychelles, Sudán, Suecia, Tailandia, Trinidad, Estados Unidos y Gran Bretaña.

A una reunión de trabajo organizada por el IBPGR sobre "Los Recursos Genéticos y el Mejorador de Plantas" acudieron 30 científicos y 22 trabajos fueron presentados: las actas vendrán publicadas próximamente.

Un proyecto de investigación se inició sobre las comparaciones en los polimorfismos de la longitud restrictiva de los fragmentos de DNA, que no forman parte del núcleo de la célula y que tienen una función precisa en los cloroplastos (RFLP) para determinar cómo la técnica puede sacar a la luz los orígenes y la diversidad genética de la batata. Se iniciaron otros proyectos adicionales sobre la diversidad genética de *Phaseolus lunatus* usando análisis de electroforesis y phaseolina y sobre las técnicas de transferimiento ya desarrolladas para cacao con el fin de identificar genotipos y tipos de grupos de cacao para colecciones internacionales.

Se publicó una bibliografía sobre la caracterización de germoplasma mediante el uso de isoenzimas determinadas por electroforesis.

El apoyo del IBPGR a la investigación en modelos de diversidad incluyó: citología, taxonomía y caracterización de especies silvestres de Avena originarias del Mediterráneo, modelos de variación de acervos genéticos de *Abelmoschus*, *Solanum* silvestre y cultivado (berenjena africana), citología y modelos de variación de *Pennisetum* silvestre recolectado en el Sahel, modelos de distribución de *Mangifera* silvestre y taxonomía de *Capsicum* silvestre.

El IBPGR inició un nuevo estudio, conjuntamente con la FAO y el RGB, Kew, Gran Bretaña, sobre la taxonomía y la distribución de especies silvestres de *Allium*. El IBPGR incrementó su contribución con el trabajo sobre las relaciones entre el acervo genético silvestre de *Hordeum* y con el estudio de la variación en el acervo genético silvestre africano de *Gossypium*.

Adiestramiento: En 1985-86, se concedieron becas de postgraduado a 17 científicos y en 1986-87 fueron concedidas a 12, tanto en la Universidad de Birmingham, Gran Bretaña, como en la Facultad de Ciencias Agronómicas del Estado, Bélgica. Estos becados procedían de Benin, Burundi, Chile, China, Costa Rica, Costa de Marfil, Ecuador, Guinea-Conakry, Honduras, México, Marruecos, Rwanda, Senegal, Somalia, Sri Lanka, Tanzania, Togo, Túnez, Viet-Nam, República Popular del Yemen y Zambia. Igualmente se apoyó a 10 cursillos especializados de adiestramiento en varias partes del mundo para un total de 71 personas.

El IBPGR inició un Programa de Becas a niveles pre y postdoctorales en los centros de recursos genéticos, que se asoció a su nivel global de actividades. Durante 1986, se combinaron algunas becas con trabajos como colector del IBPGR.

Para supervisar la experiencia en la investigación de jóvenes científicos, becados por el IBPGR fueron destinados a CIAT, ILCA, IUCN WWF (en Indonesia), Papua Nueva Guinea, Nepal, Trinidad, Islas Salomón, Zimbabwe y Estados Unidos.

LE POINT DES ACTIVITES EN 1986

Acquisition de souches génétiques: Les efforts de l'IBPGR pour augmenter la représentation des espèces sauvages dans les collections sont reflétés par le plus grand nombre de missions de collectes organisées pour ces espèces. Ainsi, de 72 projets de collectes et d'explorations effectués en 1986 dans 56 pays, 17 concernent les pools géniques sauvages exclusivement, tandis que 16 traitent des espèces fourragères. L'IBPGR a organisé, ou aidé à l'organisation de, 39 projets pour la collecte de variétés de pays et cultivars primitifs. Plus d'attention a été donnée à la taxonomie et aux études écogéographiques.

Des lacunes dans la connaissance des espèces sauvages ont rendu necéssaire la mise en oeuvre d'études systématiques soit avant soit en même temps que les missions de collectes les plus importantes. De telles études ont continué pour *Mangifera*, et ont été commencées pour *Abelmoschus*, *Beta*, *Brassica*, *Citrus* et *Vigna*.

Conservation: L'IBPGR a developpé des standards scientifiques et opérationnelles pour la conservation des semences au service des banques de gènes. Les 37 collections de base designées par l'IBPGR on été invitées à participer à ce programme (denommé 'Registre des Banques de Gènes') et plusieurs ont été visitées. En 1986 l'évaluation de 18 banques de gènes était achevée.

L'appui de l'IBPGR à la recherche sur la conservation s'est considérablement augmenté cette année.

Des instituts en Chine, Egypte, Ghana, Inde, Iraq, Mexique, Paraguay, Pérou, Portugal, Syrie et Tanzanie beneficièrent de son aide sous forme d'équipements pour la conservation.

En 1986, l'IBPGR a établi un projet pilote pour une banque de gènes *in vitro* au CIAT afin de tester les détails opérationnels, d'identifier et de résoudre les contraintes.

La recherche sur les techniques *in vitro* au cours de cette année inclut les techniques de collecte *in vitro*, des techniques pour l'établissement et la maintenance de cultures de tissus à croissance lente de *Musa*, de patates douces, de *Colocasia* et de *Xanthosoma* et des techniques pour la propagation *in vitro* des cultures de *Citrus*, cacao et canne à sucre.

Les essais pour la cryopréservation des souches génétiques ont donné des résultats variables: les progrès les plus significatifs à ce jour concernent le manioc. Quelques travaux furent menés sur l'indexage des maladies spécialement pour les patates douces et la pomme de terre. Des recherches importantes, ont été commencées au sujet de la stabilité génétique.

Documentation: Les équipements en ordinateurs du siège de l'IBPGR ainsi que des bureaux de terrain ont été améliorés.

Une liste de descripteurs pour le cajou fut publiée, et ceux pour le pois de terre, *Citrus*, le chou chinois, les aubergines, le manguier, le papayer, plusieur espèces cultivées de *Brassica*, les espèces sauvages de *Brassica*, et de *Xanthosoma* sont en préparation.

Les descripteurs pour l'orge et le blé publiés par l'IBPGR et par d'autres organisations ont été rassemblés sur ordinateur pour référence croisée.

Le répertoire pour le soja ainsi qu'une édition revisée du répertoire pour les racines et tubercules (aroides, manioc, pomme de terre, patate douce et igname) furent publiés. La préparation des répertoires plantes industrielles, fruits des régions tempérées et noix, et la révision du repértoire des blés ainsi que celui des légumes à graines (soja exclu) fut continué.

L'IBPGR a pourvu en équipements ou en logiciels des centres en Ecuador, Inde, Maroc et Tunisie. La Chine a reçu une assistance composée de matériel et de logiciels pour améliorer un système de micro-ordinateur en place.

Les projets pour la documentation des cultures incluent en 1986 l'assistance à ou la coopération avec: CSIRO, Australie (*Glycine* perénnes), CIAT (base de données pour *Phaseolus vulgaris*), UNA, Pérou (cultures andéenes), ETSIA, Espagne (base de données *Cucumis*), la Banque grèceque de gènes (un système d'information) et CAAS, Chine (compilation d'un catalogue des ressources phytogénétiques chinoises disponibles pour échange).

Des progrès sont à noter dans le développement des bases de données IBPGR à l'Université Hébraique de Jérusalem, Israel (information sur les espèces sauvages par-

entes des cultivées et données relatives à l'environnement) et à l'Université de Nottingham, UK (recherches *in vitro* en cours pour la conservation).

L'IBPGR a commencé une étude au sujet de la distribution des espèces fourragères majeures dans la région Mediterranéenne.

Caracterisation et evaluation: Des projets relatifs à la caractérisation (beaucoup d'entre eux incluant la multiplication et le dépôt d'échantillons dans des collections de base) furent menés à bien en Argentine, Barbade, Bolivie, Burkina Faso, Chine, Colombie, Costa Rica, Côte d'Ivoire, Equateur, Egypte, Grèce, Guatemala, Indonesie, Japon, Jordanie, Madagascar, Maroc, Niger, Pérou, Seychelles, Espagne, Sudan, Suède, Thailande, USA et Grande-Bretagne.

30 scientifiques participèrent à un atelier de l'IBPGR intitulé "Les Ressources Génétiques et le Sélectionneur" et 22 papiers furent presentés, ceux-ci seront publiés.

Un programme de recherche a été commencé au sujet de la comparaison du polymorphisme de longueur des fragments de restriction (PLFR) de l'ADN chloroplastique pour examiner comment cette technique peut aider à la détermination des origines de la patate douce et de sa diversité génétique. D'autres projets ont été mis en route pour l'étude de la diversité génétique de Phaseolus lunatus à l'aide d'analyse électrophorétiques de la phaseolin et pour le transfert de techniques déjà mises au point pour le cacao afin d'identifier les génotypes et de différencier des groupes types de cacao dans les collections internationales.

Un guide de la littérature traitant de la caractérisation à l'aide de l'électrophorèse d'isozymes fut publié.

L'appui de l'IBPGR à la recherche sur les schèmes de diversité a inclus: cytologie, taxonomie et caractérisation des échantillons d'avoines sauvages en Mediterranée, variation dans le pool génique d'Abelmoschus, Arachis, Glycine sauvages et perénnes, Ipomea, Phaseolus sauvages, Solanum sauvages et cultivés (aubergines africaines), cytologie et schèmes de variation des Pennisetum sauvages collectés au Sahel, distribution des Mangifera sauvages et taxonomie des Capsicum non cultivés.

Une nouvelle étude fut commencée, en collaboration avec la FAO et le RGB, Kew, UK, au sujet de la taxonomie et de la distribution des espèces sauvages d'Allium. L'IBPGR s'est également interessé aux relations de parenté dans le pool génique de l'orge et à l'étude des variations dans le pool génique africain du Gossypium.

Formation: 17 étudiants reçurent une bourse pour études universitaires en 1985-86 et en 1986-87, 12 étudiants, soit à l'Université de Birmingham soit à la Faculté des Sciences Agronomiques de l'Etat, Belgique. Ces étudiants venaient du Benin, Burundi, Chili, Chine, Costa Rica, Côte d'Ivoire, Equateur, Guinee-Conakry, Honduras, Mexique, Maroc, Rwanda, Sénegal, Somalie, Sri Lanka, Tanzanie, Togo, Tunisie, Viet Nam, PDR Yemen et Zambie. Dix cours de formation spécialisés furent financés dans différentes parties du monde pour un total de 71 étudiants.

L'IBPGR a commencé un Programme d'Internat à un niveau pré ou post doctoral auprès des centres de ressources génétiques associé à son réseau. En 1986 certains postes d'internes furent combinés avec des postes de collecteurs de l'IBPGR.

Les internes de l'IBPGR furent placés au CIAT, à l'ILCA, à l'IUCN/WWF (Indonesie), en Papua-Nouvelle Guinée, au Népal, à Trinidad, aux Iles Salomon, au Zimbabwe et aux USA afin de recevoir une expérience de recherche sous la supervision d'experts confirmés.

أهم أحداث العالم

* الحصول على الموارد الوراثية :

أدى تركيز المجلس الدولى للموارد الوراثية النباتية على زيادة عدد الأنواع البرية فى المجموعات المحفوظة أثناء ١٩٨٦ الى ازدياد عدد بعثات الجمع حيث استهدفت تلك الأنواع. ركز ١٧ مشروعا – من مجموع ٧٢ مشروعا جمع وحصر تم القيام بهم خلال ١٩٨٦ فى ٥٦ بلدا – على المجموع الجينى للأنواع البرية. اضافة الى ذلك، اضطلع ١٦ مشروعا آخر من هذه المشروعات بالأنواع التى يمكن الاستفادة منها كأعلاف. قام المجلس الدولى للموارد الوراثية النباتية بتنظيم أو المساعدة فى تنظيم ٣٩ مشروعا لجمع الأصناف البدائية (الغير محسنة) والأجناس الأرضية للمحاصيل. بالاضافة الى ذلك تم توجيه اهتمام أكبر الى دراسات التصنيف النباتى والدراسات البيئية الجغرافية.

لقد كان من شأن انعدام المعرفة الأساسية للمجموعات الجينية للأنواع البرية أن جعل الاضطلاع بالدراسات التصنيفية قبل أو أثناء القيام بمهمات الجمع الرئيسية عملية ضرورية. واستمرت دراسات من هذا النوع على Mangifera وبدئ فى مشروعات مماثلة على أنواع Abelmoschus , Beta, Brassica, Citrus and Vigna.

* برامج الحفظ:

توصل المجلس الدولى للموارد الوراثية النباتية الى تحديد معايير علمية وعملية لحفظ البذور بغرض معاونة بنوك الجينات. وقد دعيت ٣٧ مجموعة أساسية معينة من قبل المجلس الى المساهمة فى هذا البرنامج المسمى "بسجل بنوك الجينات" والتى تم زيارة عدد منها. فى عام ١٩٨٦، استكمل تقييم ١٨ من بنوك الجينات. وازداد بدرجة ملموسة دعم المجلس الدولى لبحوث الحفظ أثناء

العام. كما قدمت المساعدات لمرافق الحفظ فى معاهد البلدان الآتية: الصين، مصر، غانا، الهند، ايران، المكسيك، باراغواى، بيرو، البرتغال، سورية وتنزانيا.

وفى ١٩٨٦ أنشأ المجلس الدولى للموارد الوراثية النباتية بنك جينات نموذجى للحفظ فى المختبر للمجموعات العاملة وذلك فى المركز الدولى للزراعة الاستوائية بكولومبيا بغرض اختبار التفصيلات العملية وللتعرف على حل المشاكل المحتملة.

وتضمنت بحوث الحفظ فى المختبرات، أثناء العام، على: تقنيات الجمع فى المختبر، تقنيات تكوين وصيانة الأنسجة المزروعة فى وسط بطىء النمو لكل من الموز والبطاطا وأنواع Xanthosoma, Colocasia، وكذلك تقنيات تكوين واكثار الأنسجة المزروعة فى المختبر لمحاصيل قصب السكر والكاكاو والحمضيات (الموالح).

من ناحية أخرى، قوبلت محاولات "حفظ المواد الوراثية بالتجميد" بدرجات متفاوتة من النجاح. ولكن معظم التقدم الذى تم التوصل اليه حتى الآن كان على محصول Cassava. كذلك تم القيام بعمل محدود على تحديد الأمراض باستخدام زراعة الأنسجة لمحاصيل البطاطس والبطاطا.

تم البدء فى بحوث رئيسية جديدة خاصة "بالثبات الوراثى" فى زراعة الأنسجة.

* التوثيق:

تم تطوير مرافق التوثيق فى المركز الرئيسى للمجلس الدولى للموارد الوراثية النباتية وبعض مكاتبه الحقلية.

صدرت القائمة الوصفية لمحصول فاكهة Cashew وأعدت قوائم أخرى لأنواع الحمضيات، الملفوف، الباذنجان، المانجو وعدة أنواع برية ومزروعة من Brassica ومحصول Xanthosoma, Papaya.

سجلت القوائم الوصفية لمحصولى القمح والشعير التى أصدرها المجلس الدولى وبعض المنظمات الأخرى فى سجل واحد بالحاسب الآلى متضمنا اشارات للمراجع الأصلية لكل منها.

صدرت مطبوعات دليل المجموعات لفول الصويا والطبعة المعدلة لمحاصيل الجذور والدرنات (البطاطس والبطاطا والكسافا وأنواع Aroids ومحصول Yam). استمر العمل على اصدار دليل مجموعات المحاصيل الصناعية، الطبعة المعدلة للبقوليات الغذائية (باستثناء فول الصويا)، فواكه المناطق المعتدلة وأشجار اللوز والجوز والبندق والبكان بالاضافة الى الطبعة المعدلة للقمح.

قدم المجلس الدولى للموارد الوراثية النباتية أنظمة آلية أو برامج للحاسب الآلى لعدة مراكز فى اكوادور، الهند، المغرب وتونس. زودت الصين بجهاز حاسب آلى ونظام لادارة قواعد البيانات وذلك بغرض تطوير أداء النظام الحالى للحاسب الآلى الصغير (الميكروكمبيوتر).

اشتملت مشاريع توثيق المحاصيل فى ١٩٨٦ على التعاون مع أو تقديم المعونة الى: CSIRO، استراليا (الأنواع المعمرة لـ Glycine)، CIAT (قاعدة البيانات العالمية لمحصول الفاصوليا)، UNA - بيرو (محاصيل منطقة الانديز)، ETSIA - اسبانيا (قاعدة بيانات أنواع Cucumis)، بنك الجينات اليونانى (نظم معلومات) وأكاديمية العلوم الزراعية بالصين لتجميع قائمة بالموارد الوراثية للمحاصيل الصينية المتاحة للتبادل الدولى.

حدث تقدم أكبر فى اعداد قواعد بيانات المجلس الدولى للموارد الوراثية النباتية فى الجامعة العبرية بالقدس - اسرائيل (معلومات عن الأقارب البرية للنباتات الزراعية والبيانات البيئية المتعلقة بها) وجامعة نوتنجهام بالمملكة المتحدة (بحوث مستمرة للحفظ بالمختبر).

بدأ المجلس الدولى بحصر توزيع أنواع الأعلاف الرئيسية فى منطقة حوض البحر الأبيض المتوسط.

* التوصيف والتقييم :

أجريت مشاريع توصيف (كثير منها يتضمن على أكثار العينات وايداعها فى المجموعات الأساسية) فى بلدان الأرجنتين، باربادوس، بوليفيا، بوركينافاسو، الصين، كولومبيا، كوستاريكا، كوت ديفوار، اكوادور، مصر، اليونان، غواتيمالا، اندونيسيا، اليابان، الأردن، مدغشقر، المغرب، نيجيريا، بيرو، جزر سيشيل، اسبانيا، السودان، السويد، تايلند، ترينيداد، الولايات المتحدة الأمريكية والمملكة المتحدة.

حضر ٣٠ عالما حلقة عمل خاصة عقدها المجلس الدولى للموارد الوراثية النباتية لمناقشة موضوع "الموارد الوراثية ومربى النبات" حيث قدم ٢٢ بحثا سيتم اصدارها قريبا فى كتاب مفصل.

بدىء العمل فى مشروع أبحاث خاص "بمقارنات تعدد الأشكال الطولية لأجزاء الحامض النووى د.ن.أ التى تقوم بوظائف محددة فى الجزىء الخلوى اللانووى المسمى بكلوروبلاست" وذلك لتحديد مدى قدرة هذه التقنية العلمية على تفسير أصل الأنواع والتباين الوراثى لمحصول البطاطا.

كذلك بدأت مشاريع بحثية اضافية على التنوع الوراثى لنوع Phaseolus lunatus باستخدام التحليل الالكتروفوريس لبروتين الفاصوليا وعلى تقنيات النقل التى تم التوصل اليها فى الكاكاو للتعرف على التركيبات الوراثية وأنماط مجاميع الكاكاو للمجموعات الدولية.

صدر دليل مراجع لدراسات التوصيف باستخدام التحليل الالكتروفوريس للانزيمات المتماثلة.

تضمن دعم المجلس الدولى للموارد الوراثية النباتية للأبحاث على: سيتولوجيا (علم الخلية) وتصنيف وتوصيف أنواع الشوفان البرية من منطقة البحر الأبيض المتوسط، أنماط التباين فى المجاميع الجينية لأنواع Abelmoschus, Arachis أنواع Glycine البرية المعمرة، Ipomea، الأنواع البرية لـ Phaseolus، سيتولوجيا وأنماط التباين فى الأنواع البرية Pennisetum والتى جمعت من منطقة الساحل بأفريقيا، أنماط التوزيع لأنواع Manqifera وتصنيف الأنواع البرية Capsicum.

تم بالاشتراك مع منظمة الأغذية والزراعة الدولية (الفاو) والحدائق الملكية النباتية بكيو - المملكة المتحدة البدء فى دراسة جديدة لتصنيف وتوزيع الأنواع البرية Allium. كذلك ساهم المجلس الدولى بصورة أكبر فى الدراسات الخاصة بالعلاقات بين الأنواع فى المجموع الجينى لـ Hordeum وكذلك دراسة التباين فى المجموع الجينى للأنواع الأفريقية من القطن.

* التدريب:

حصل ١٧ عالما فى عام ١٩٨٥-١٩٨٦ و ١٢ باحثا فى عام ١٩٨٦-١٩٨٧ على منح للدراسات العليا بكل من جامعتى برمنجهام - المملكة المتحدة وكلية الدولة لعلوم المحاصيل - بلجيكا، على وجه الترتيب. وينتمى هؤلاء المتدربين للبلدان الآتية: بينان، بوروندى، شيلى، الصين، كوستاريكا، كوت ديفوار، اكوادور، غينيا - كوناكرى، هندوراس، المكسيك، المغرب، رواندا، السنغال، الصومال، سرى لانكا، تنزانيا، توغو، تونس، فيتنام، جمهورية اليمن الديمقراطية الشعبية وزامبيا.

تم دعم عشرة حلقات تدريبية قصيرة فى أجزاء مختلفة من العالم وحضرها ٧١ متدربا.

شرع المجلس الدولى للموارد الوراثية النباتية فى برنامج تفرغ كامل للبحوث وذلك لتدريب صغار الباحثين فى مستويات ما

قبل أو ما بعد درجة الدكتوراة فى مراكز موارد وراثية مرتبطة بالشبكة الدولية للمجلس. أثناء ١٩٨٦ أدمجت بعض منح التفرغ مع وظائف جامعى الموارد الوراثية التابعة للمجلس.

حتى يمكن تقديم تجربة بحوث (تحت الاشراف العلمى) لصغار العلماء، أرسل باحثو المجلس الدولى للعمل التفرغى فى المركز الدولى للزراعة الاستوائية والمركز الدولى لبحوث الحيوان الزراعى والاتحاد الدولى لصيانة البيئة/الصندوق الدولى للحياة البرية (اندونيسيا)، جزر غينيا الاستوائية، نيبال، ترينيداد، جزر سليمان، زمبابوى والولايات المتحدة الأمريكية.

本年主要工作

种质资源的获得

国际植物遗传资源委员会强调要在收集品中增加野生品种的数目，因而在1986年，对野生品种的采集有显著增加。1986年在包括56个国家的72项采集和调查项目中，有17项专为野生基因群体而设，还有16项是针对具潜能的牧草品种的。本委员会组织或帮助组织了39项采集土生种和/或原始栽培品种的项目。此外，还特别注意分类学和生态地理学的研究。

由于缺乏对野生基因群体的基本知识，在展开重大的采集活动之前或共同时，进行系统研究迫成为必要。今年，对芒果属继续进行了这样的研究，并开始了对秋葵属、恭莱属、柑桔属和豇豆属进行类似的研究。

保存工作：

为了帮助各基因库，本委员会为种子贮藏制定了科学性及管理性的标准。此外，又邀请共37个特定的基础库参加基因库注册的项目。1986年完成了对18个基因库的审评工作。

本委员会今年大大增加了对资源保存研究的支持。

它向中国、埃及、加纳、印度、伊朗、墨西哥、巴拉圭、秘鲁、葡萄牙、叙利亚和坦桑尼亚的研究所提供了一些资源保存的设备。

1986年本委员会在国际热带农业中心建立了一个离体培养的中期基因库的试样，以试验管理细节，找出和解决问题。

今年的离体研究包括：离体采集技术；芭蕉、甘薯、芋属和盾柱芋属在培养基缓慢生长的起始和维持技术；柑桔、可可和甘蔗的离体繁殖和培养技术。

超低温保存的努力取得了不同程度的成功，但是迄今为止，多数的进展是在木薯方面取得的。此外在病害指数（尤其是甘薯和马铃薯病害指数）方面亦作了若干工作。主要的新研究项目是在遗传稳定性方面。

文 献

提高了本委员会总部和地区办事处的计算机设备的质量。

出版了腰果的描述符。而下列作物的描述符则在草拟中：巴姆巴拉落花生（VOANDZEIA SUBTERRANEA）、柑桔、中国白菜、茄子、苹果、番木瓜、几种栽培芥属品种、野生芥属品种和盾柱芋属。

将本委员会和其他组织出版的大麦和小麦的描述符收集在一个卷宗里，并作了交互索引。

大豆指南和根茎块茎作物（天南星科植物、木薯、马铃薯、甘薯和大薯）指南的修订本出版了。经济作物指南的编制及食用豆科植物（大豆除外），温带水果和坚果指南和小麦指南的修订工作继续在进行中。

国际植物遗传资源委员会向厄瓜多尔、印度、墨洛哥和突尼斯各研究中心提供了硬件或软件。向中国提供了硬件和一个资料库管理系统，以提高现有的微型计算机的能力。

1986年的作物资讯项目包括了对下述机构的帮助或合作：澳大利亚的联邦科学及工业研究组织（多年生大豆）、国际热带农业中心（菜豆全球资料库）、秘鲁的国立农业大学（安第斯山区作物）、西班牙理工学院（西瓜属资料库）、希腊基因库（一个情报系统）和中国农业科学院（编纂一本供交换用的中国作物遗传资源目录）。

在以色列耶路撒冷的希伯来大学（关于栽培植物野生亲缘的资料和有关的环境资料）和英国的诺丁汉大学（正在进行的关于保护的离体研究）在建立本委员会的资料库方面，取得了进一步的进展。

本委员会开始了对地中海区的主要饲草品种分布的调查。

性状描述和评价

性状描述的项目（其中很多包括基础库样品的繁育和保存）分别在阿根廷、巴巴多斯、玻利维亚、布基纳法索、中国、哥伦比亚、哥斯达黎加、科特迪瓦、厄瓜多尔、埃及、希腊、危地马拉、印度尼西亚、日本、约旦、马达加斯加、墨洛哥、尼日利亚、秘鲁、塞舌尔、西班牙、苏丹、瑞典、泰国、特立尼达、美国和英国进行。

国际植物遗传资源委员会举行的"遗传资源和植物育种工作者"讨论会有30位科学家参加，提出了22篇论文，并将出版论文汇编。

下列的研究项目正在开展：比较叶绿体脱氧核糖核酸的限制断片长度的多形性，以确定这项技术与甘薯品种的起源和遗传多样化的相关性；利用电泳分析研究菜豆苷的遗传多样性和英

豆豌的遗传多样性；研究如何将已知的识别可可基因型及可可各种类型的技术转用于其他国际种质资源。

一本关于利用同功酶电泳方法描述性状的文献指南已经出版。

本委员会对性状分化式样研究的支持包括：地中海野生燕麦的细胞学、分类和特性；秋葵属、落花生属、野生多年生大豆、番茄属、野生菜豆、野生和栽培茄属（非洲茄子）的变异形式；在萨其勒收集的野生狼尾草属的细胞学和变异形式；野生苹果属的分布形式和野生诺丽属的分类。

粮农组织北欧地区种质库和英国皇家科伍植物园对野生的葱属品种的分类和分布开始了一项新的研究。本委员会更多地参与了大麦属的野生基因群体间关系的研究和对非洲棉属野生基因群体的变异研究。

培　训

在1985-86年内，有17名科学家得到研究生奖学金，而在1986-87年内，有12名科学家得到资助在美国伯明翰大学和比利时的占布路农业学院进修。这些科学家来自：贝宁、布隆迪、智利、中国、哥斯达黎加、科特迪瓦、厄瓜多尔、几内亚（科纳克里）、洪都拉斯、墨西哥、摩洛哥、卢旺达、塞内加尔、索马里、斯里兰卡、坦桑尼亚、多哥、突尼斯、越南、也门民主人民共和国和赞比亚。此外，在世界各地又举办了10个专门培训班，培训了71名学员。

本委员会在其全球协作网的一些遗传资源中心举办了一个实习员计划。实习员中包括未获博士学位或已获博士学位的人员。1985-86年，一些实习员兼任了本委员会的雇员。

为使年青的科学家得到指导性的研究经验，本委员会的实习员设在国际热带农业中心、非洲国际畜牧中心、国际保护自然及自然资源联盟/世界野生生物基金（在印度尼西亚）、巴布亚新几内亚、尼泊尔、特立尼达、所罗门群岛、津巴布韦和美国。

A LIST OF ABBREVIATIONS USED IN THIS REPORT

AAS	— Academy of Agricultural Sciences (China)
ACIAR	— Australian Center for International Agricultural Research
ARC	— Agricultural Research Center—USDA (USA)
ARC	— Agricultural Research Centre (Egypt)
ARI	— Agricultural Research Institute (Cyprus)
ARS	— Agricultural Research Service—USDA (USA)
AVRDC	— Asian Vegetable Research and Development Center (Taiwan, China)
BGRC	— Braunschweig Genetic Resources Centre (of FAL) (Federal Republic of Germany)
BVRC	— Beijing Vegetable Research Centre (China)
CAC	— Crop Advisory Committee—USDA (USA)
CATIE	— Centro Agronómico Tropical de Investigación y Enseñanza (Costa Rica)
CENARGEN	— Centro Nacional de Recursos Genéticos (Brazil)
CENIAP	— Centro Nacional de Investigaciones Agropecuarias (Venezuela)
CENTA	— Centro Nacional de Tecnología Agropecuaria (El Salvador)
CGIAR	— Consultative Group on International Agricultural Research
CIAT	— Centro Internacional de Agricultura Tropical—CGIAR
CIHEAM	— Centre International de Hautes Etudes Agronomiques Mediterranéennes
CIMMYT	— Centro Internacional de Mejoramiento de Maíz y Trigo—CGIAR
CIP	— Centro Internacional de la Papa—CGIAR
CNR	— Consiglio Nazionale delle Ricerche (Italy)
COMECON	— Council for Mutual Economic Assistance
CRI	— Crops Research Institute (Ghana)
CRI	— Cereal Research Institute (Hungary)
CRU	— Cocoa Research Unit (Trinidad)
CSC	— Commonwealth Science Council
CSIRO	— Commonwealth Scientific and Industrial Research Organization (Australia)
DIEAF	— Dirección de Investigación y Extensión Agropecuaria y Forestal (Paraguay)
DIGESA	— Dirección General de Servicios Agrícolas (Guatemala)
DRA	— Direction de la Recherche Agronomique (Togo)
DSIR	— Department of Scientific and Industrial Research (New Zealand)
EAN	— Estaçao Agronomica Nacional (Portugal)
ECP/GR	— European Cooperative Programme for Conservation and Exchange of Crop Genetic Resources—UNDP/IBPGR
EMBRAPA	— Empresa Brasileira de Pesquisa Agropecuaria (Brazil)
ETSIA	— Escuela Técnica Superior de Ingenieros Agronómos (Spain)
EUCARPIA	— European Association for Research on Plant Breeding
FAL	— Institut für Pflanzenbau und Pflanzenzüchtung der Bundesforschungsanstalt für Landwirtschaft (Federal Republic of Germany)
FAO	— Food and Agriculture Organization of the United Nations
FOFIFA	— National Centre for Applied Research and Rural Development (Madagascar) (Translation of Malagasy language)
FONIAP	— Fondo Nacional de Investigaciones Agropecuarias (Venezuela)
GIFRID	— German-Israel Fund for Research and International Development
GTZ	— Deutsche Gesellschaft für Technische Zusammenarbeit (Federal Republic of Germany)
HAES	— Highlands Agricultural Experiment Station (Papua New Guinea)
IABS	— Institute for Agricultural and Biological Science (Okayama University, Kurashiki, Japan)

IARC	— International Agricultural Research Center
IAVH	— Institut Agronomique et Vétérinaire Hassan II (Morocco)
IBPGR	— International Board for Plant Genetic Resources—CGIAR
IBTA	— Instituto Boliviano de Tecnología Agropecuaria (Bolivia)
ICA	— Instituto Colombiano Agropecuario (Colombia)
ICARDA	— International Center for Agricultural Research in the Dry Areas—CGIAR
ICRISAT	— International Crops Research Institute for the Semi-Arid Tropics—CGIAR
ICTA	— Instituto de Ciencia y Tecnología Agrícola (Guatemala)
IDR	— Institute du Developpement Rural (Burkina Faso)
IFPRI	— International Food Policy Research Institute—CGIAR
IIE	— Institute of International Education (USA)
IIHR	— Indian Institute of Horticultural Research
IIPGR	— Institute of Introduction and Plant Genetic Resources (Bulgaria)
IITA	— International Institute of Tropical Agriculture—CGIAR
IJO	— International Jute Organization (Bangladesh)
ILCA	— International Livestock Center for Africa—CGIAR
ILDIS	— International Legume Database and Information Service
ILRAD	— International Laboratory for Research on Animal Diseases—CGIAR
INERA	— Institut National d'Etude et de Recherche Agronomiques (Zaire)
INIA	— Instituto Nacional de Investigaciones Agrarias (Spain)
INIA	— Instituto Nacional de Investigaciones Agrícolas (Mexico)
INIAP	— Instituto Nacional de Investigaciones Agropecuarias (Ecuador)
INIBAP	— International Network for the Improvement of Banana and Plantain
INRA	— Institut National de la Recherche Agronomique (France)
INRA	— Institut National de la Recherche Agronomique (Morocco)
INTA	— Instituto Nacional de Tecnología Agropecuaria (Argentina)
INTSOY	— International Soybean Program (USA)
IPB	— Institute of Plant Breeding (Philippines)
IRAZ	— Institut de Recherche Agricole et Zootechnique (Burundi, Rwanda, Zaire)
IRCT	— Institut de Recherches du Coton et des Textiles Exotiques (France)
IRFA	— Institut de Recherches sur les Fruits et Agrumes (France)
IRRI	— International Rice Research Institute—IRRI
ISABU	— Institut des Sciences Agronomiques du Burundi
ISAR	— Institut des Sciences Agronomiques du Rwanda
ISP	— Institut Supérieur Polytechnique (Burkino Faso)
ISTA	— International Seed Testing Association
IUCN	— International Union for Conservation of Nature and Natural Resources
IVIA	— Instituto Valenciano de Investigaciones Agrarias (Spain)
IVT	— Institute for Horticultural Plant Breeding (Netherlands)
LBN	— National Biological Institute (Indonesia)
LNOR	— Liaison Office for North America (FAO)
MAB	— Man and Biosphere Programme—Unesco
MARDI	— Malaysian Agricultural Research and Development Institute
NAS-NSF	— National Academy of Sciences—National Science Foundation (USA)
NBPGR	— National Bureau of Plant Genetic Resources (India)
NGB	— Nordic Gene Bank
NIAR	— National Institute of Agricultural Research (Japan)
NPGS	— National Plant Germplasm System—USDA (USA)
NSSL	— National Seed Storage Laboratory (USA)
NVRS	— National Vegetable Research Station (now part of Institute of Horticultural Research) (UK)
ORSTOM	— Institut Francais de Recherche Scientifique pour le Développement en Cooperation (France)
PARC	— Pakistan Agricultural Research Council (Pakistan)
PCARRD	— Philippine Council for Agricultural and Resources Research and Development

PGR	— Plant Gene Resources of Canada (Canada)
PGRC/E	— Plant Genetic Resources Center (Ethiopia)
PORIM	— Palm Oil Research Institute of Malaysia
QDPI	— Queensland Department of Primary Industries (Australia)
RBG	— Royal Botanic Gardens (UK)
RCA	— Institute for Plant Production and Qualification (Hungary)
SADCC	— Southern African Development Coordination Conference
SARD	— Scientific and Agricultural Research Directorate (Syria)
SEAP	— Southeast Asia Programme—IBPGR
SIA	— Servicio de Investigación Agraria (Spain)
SVP	— Foundation for Agricultural Plant Breeding (Netherlands)
TAC	— Technical Advisory Committee—CGIAR
TISTR	— Thailand Institute of Scientific and Technical Research (Thailand)
UNA	— Universidad Nacional Agraria (Peru)
UNDP	— United Nations Development Programme
UNEP	— United Nations Environment Programme
Unesco	— United Nations Educational, Scientific and Cultural Organization
UNET	— Universidad Nacional Experimental del Tachira (Venezuela)
USDA	— United States Department of Agriculture (USA)
VIR	— N.I. Vavilov Institute of Plant Industry (USSR)
WARDA	— West African Rice Development Association—CGIAR
WPBS	— Welsh Plant Breeding Station (UK)
WWF	— World Wildlife Fund
ZIGuK	— Zentralinstitut für Genetik und Kulturpflanzenforschung (German Democratic Republic)

Cover photos (clockwise from top): Wild species of mango, Indonesia (IBPGR). Stipagrostis pungens, *a drought-tolerant forage, Niger (IBPGR). Mountain forest, Mexico (IUCN/WWF). Market where indigenous potatoes are sold, Peru (IBPGR). Collecting Triticeae, Inner Mongolia, China (IBPGR). Other photos: Figs. 1, 2, 4, 7, 9, 10, 11, 12, 14, 16, 17, 18, 19, 21, 24, 25, 27, 29: IBPGR. Fig. 15: AVRDC. Fig. 20: IUCN/WWF. Fig. 28: CGIAR.*