IPGRI

Annual Report 2003

International Plant Genetic Resources Institute

Contents

Annual Report 2003

IPGRI's vision...

"Through the collective, concerted action of farmers, forest dwellers, pastoralists, scientists, development workers and political leaders, the full potential of the Earth's plant genetic diversity will be harnessed to eradicate poverty, achieve food security and protect the environment for the benefit of present and future generations."

...and how we approach it

IPGRI's *modus operandi* is based firmly on working with others, leveraging our funds and abilities so that we not only achieve results, but also help to build capacity in those we work with and for. So strong and plentiful are these links, however, that to list them all in every case would make for a very long and dry document. In the following stories some of our partners have been mentioned by name while others have not, but we would like to take this opportunity to thank them all. IPGRI depends on partnerships and partners to get the job done. We also acknowledge the support of all our donors, especially those that contribute unrestricted funds.

FUTURE HARVEST
<www.futureharvest.org>

IPGRI is a Future Harvest Centre supported by the Consultative Group on International Agricultural Research (CGIAR)

Foreword

In 2004, it will be 30 years since IPGRI began as the International Board for Plant Genetic Resources. While we are not planning any grandiose celebrations, we are taking the opportunity to re-examine IPGRI's strategy and to ensure that our approach to the use and conservation of agricultural biodiversity meets the needs of our stakeholders. We have conducted extensive stakeholder consultations and held several meetings to tap the collective insights and experience of IPGRI staff and board members. While this is still a work in progress, it is clear that a key goal will be to improve the lives of poor people by deploying agricultural biodiversity more effectively. The new strategy will be launched in 2004 and will guide IPGRI's work from 2005.

The new strategy coincides with a change at the top. Geoffrey Hawtin leaves IPGRI after 12 years, having built the organization into the global centre of excellence it has become. It is difficult to express how much we, and the whole world of plant genetic resources, owe him. He will continue to play a pivotal role in the *ex situ* conservation of plant genetic resources through his efforts for the Global Crop Diversity Trust.

The Trust moved forward in 2003 as the Interim Panel of Eminent Experts approved the principles for determining the eligibility of collections for Trust support and the Trust's governance and structure. That structure includes the appointment of Geoffrey Hawtin as Interim Executive Secretary. We wish him every success and anticipate even closer collaboration with the Trust in future. We also look forward to providing the technical expertise that will enable the Trust to fulfil its ambition of being a crucial element in the rational, global genebank system that has long been seen as an essential tool for the effective conservation and use of agricultural biodiversity.

Other milestones during the year include the approval of a new Material Transfer Agreement for the genebanks of the Future Harvest Centres. This agreement reflects new provisions on access and benefit sharing in the International Treaty on Plant Genetic Resources for Food and Agriculture, and was drafted with the help of the System-wide Genetic Resources Programme (SGRP), hosted by IPGRI. SGRP and IPGRI also organized an international meeting on Managing Agricultural Biodiversity for Sustainable Development, which succeeded in bringing this important topic before a very wide audience.

Helping human development through the improved use of agricultural biodiversity will be the foundation of IPGRI's future. We are encouraged in this by the results of an External Programme and Management Review that reported early in 2003. The panel found IPGRI "strong and effective", and made several valuable recommendations that have influenced the development of the new strategy. The panel also identified the "charisma and fine leadership" of Geoffrey Hawtin as a key reason for IPGRI's current good health. We can only concur and thank him for his many contributions.

The International Treaty on Plant Genetic Resources for Food and Agriculture will come into force in 2004, confirming the vital importance of plant genetic resources for the future improvement of agriculture and sustainable development. Building on 30 years of experience, and with a forward-looking strategy to guide its own future, IPGRI is determined to play a leadership role to ensure that genetic resources and agricultural biodiversity contribute to a better future for all.

Emile Frison
Director General

Benchaphun Shinawatra Ekasingh
Board Chair

Decoding diversity with molecular methods

Laboratory technologies are giving scientists an insight into plant genetic resources and bringing benefits for use and conservation.

Home gardens are small plots, usually around the house, where people tend the plants that mean most to them. They are often repositories of enormous diversity and an IPGRI project not only recognized this but also called firmly for home gardens to be included in conservation plans (see Annual Report 1999, p. 22). Nevertheless, questions remain. While home gardens are undoubtedly useful to the people who tend them, supplying them with the particular species and varieties they need most, to what extent do they also contribute to the larger goals of conservation? Do they add to the diversity conserved *ex situ* in genebanks?

In an effort to address these issues IPGRI scientists, with colleagues at the University of San Carlos in Guatemala and at IPGRI's sister Future Harvest Centre CIAT (International Center for Tropical Agriculture), recently completed a study of capsicums (chilli peppers) in Guatemala, comparing the diversity in home gardens with that represented in the national genebank collection. They found that the genetic diversity of the peppers collected from home gardens in just one administrative Department of Guatemala was representative of the total genetic diversity of the national collection, which includes peppers from 12 other departments. This suggests that home gardens in the Department of Alta Verapaz are indeed an important component of the conservation strategy for Guatemala, and also that concentrating efforts on that department will likely discover further diversity.

Most of the chilli peppers grown in Guatemala are classified as *Capsicum annuum*, both cultivated and semi-wild. A few belong to other species: *C. chinense*, *C. frutescens* and *C. pubescens*. The scientists compared 34 samples collected from home gardens in Alta Verapaz with 40 accessions in the national collection, drawn from 12 other departments.

The technique used is known as amplified fragment length polymorphism, AFLP, and this study represents the first time that it has been used to assess diversity in home gardens. AFLP is a standard technique in molecular biology, used to look for differences in the DNA between individuals. It detects the presence of differences in particular short target sequences and scores how many of these differences are present in any given individual's DNA. With the right choice of target sequence it is usually possible to discriminate among any collection of individuals, and this proved to be the case. Only two of the 74 samples could not be separated from one another on the basis of their different DNA patterns.

The samples from the home gardens were no different in their overall diversity from the genebank samples, even after excluding accessions collected in Alta Verapaz. There was also no overall difference in diversity between samples from low altitudes and samples from high altitudes. A more detailed analysis of which samples shared which DNA patterns revealed the presence of six distinct clusters, each containing plants from the home gardens and from the genebank. One cluster contained only plants classified as *C. pubescens*. The other clusters contained all the other species, indicating that although botanists distinguish the species on the basis of what they look like there is still considerable interbreeding among them.

One conclusion of the study is that, given the similarity in overall diversity, it makes sense to conserve chilli peppers in the home gardens of Alta Verapaz, with the added benefit that these plants are still subject to evolution and adaptation. But, the very fact that the home garden chillies could be distinguished from the genebank chillies indicates that there are differences between them, and that the chillies of Alta Verapaz may include some with rather rare alleles. In recent years, the Department has also received many immigrants,

who in all likelihood brought their own pepper varieties with them. That makes Alta Verapaz a good place to search for new accessions for the genebank, which would have the additional benefit of making these genetic resources available to breeders.

The right tool for the job

A vital point to emerge from this study is that the scientists chose AFLPs because of their demonstrated success in evaluating diversity in other crop species. This was an effective choice, even though it failed to distinguish two accessions. The two look very different, and one was collected from a hot and humid environment while the other came from a more temperate, dry area. “We could probably tell them apart using different AFLP targets,” said Carmen de Vicente, the IPGRI scientist who led the project, “or by using a different molecular marker, for example microsatellites. But most plant genetic resources scientists and genebank managers in developing countries don’t have access to the kinds of up-to-date information on molecular methods to make good choices about which techniques to use to solve which problems.” That is why de Vicente, with colleague Theresa Fulton of Cornell University in the USA, has compiled a learning module called ‘Using Molecular Marker Technology in Studies on Plant Genetic Diversity’.

P. Eyzaguirre/IPGRI

Farmers in Alta Verapaz maintain massive amounts of diversity in their home gardens, not just chilli peppers. This couple holds a root of chayote (Sechium edule) which is used as medicine.

Molecular markers can make the use and conservation of plant genetic resources easier and more efficient, for example by identifying the relationships between accessions, or finding new genes, or detecting duplicate accessions in genebanks. But these techniques are expensive and resources are limited. The learning module, released in 2003, aims to give users the knowledge they need to make the right decisions about using scarce resources for molecular investigations.

de Vicente points out that “it is of critical importance that scientists do not use this technology simply because

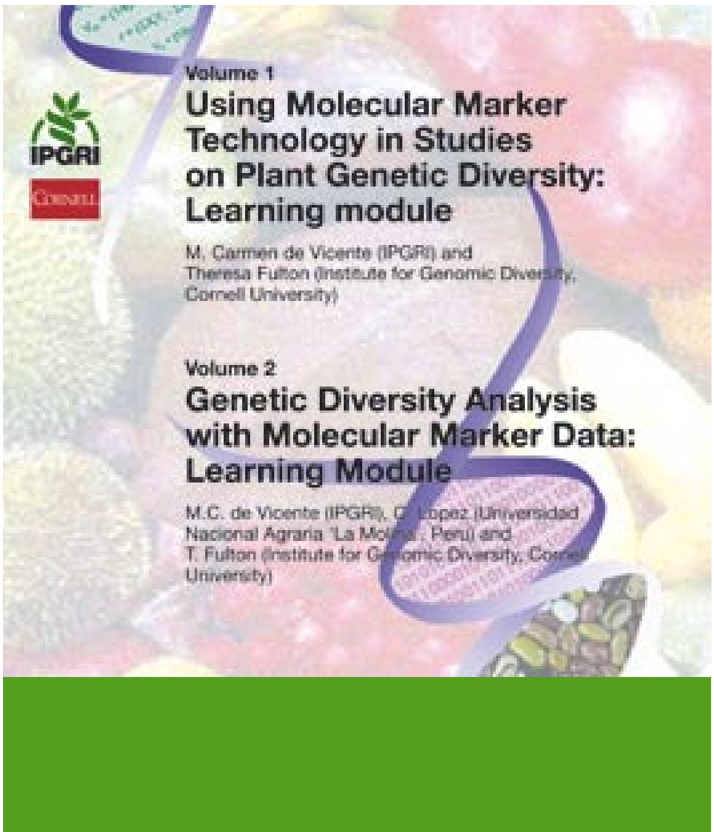
they can or because it is the latest technology, but because they thoughtfully chose the most appropriate technology for the biological questions they are tackling." Her hope is that the learning module will give users the context, knowledge and tools to make the right decisions.

The module introduces readers to the latest techniques and has been carefully constructed to give real world examples of each, selected specifically because they will be of interest to people working in plant genetic resources. There are lists of key references and of equipment that will be particularly useful to scientists in developing countries. The authors hope to keep the module up to date, and encourage users to send them feedback. A companion module, 'Genetic Diversity Analysis with Molecular Data', will be ready in 2004, and will help scientists to make better use of the data they gather.

Molecular descriptors

Mushrooming molecular technologies raise a particular problem for genetic resources: how to standardize descriptions of molecular data so that they can be shared among different researchers and for different plant species. IPGRI is an international leader in the field of descriptors—precise standards that allow scientists to describe plants accurately and repeatably and thus to exchange their data. Now IPGRI has developed a preliminary set of descriptors for molecular data, the first such tool. At the moment, 'Descriptors for Genetic Markers Technologies' defines only a minimum set of information needed to describe results derived from a genetic marker technology, as well as a coding scheme that allows for computerized exchange of data. But the molecular descriptor list also recognizes that individual users will want to implement their own modifications and additions, and establishes a structure that will permit this kind of customization. The standard is also designed to be extended in future, to bring on board the results of new analytical techniques and new formats for data exchange.

"The standardization of molecular information will help scientists to create a global registry of species-specific molecular markers," said Adriana Alercia, who helped develop the descriptors. This kind of information will be vital to breeders seeking to make use of genetic diversity to improve productivity. To assist this effort, IPGRI is a partner in the CGIAR Challenge Program known as Generation, whose aim is "cultivating plant diversity for the resource poor". IPGRI contributed the molecular descriptors to the Challenge Program and de Vicente is managing its sub-programme on capacity development, which will clearly make use of the learning module.



A CD-ROM of the two modules —'Using Molecular Marker Technology in Studies on Plant Genetic Diversity' and 'Genetic Diversity Analysis with Molecular Data'—is available from www.earthprint.com/go.htm?to=IPGRI912. It and 'Descriptors for Genetic Markers Technologies' are also available for download from the IPGRI Web site.

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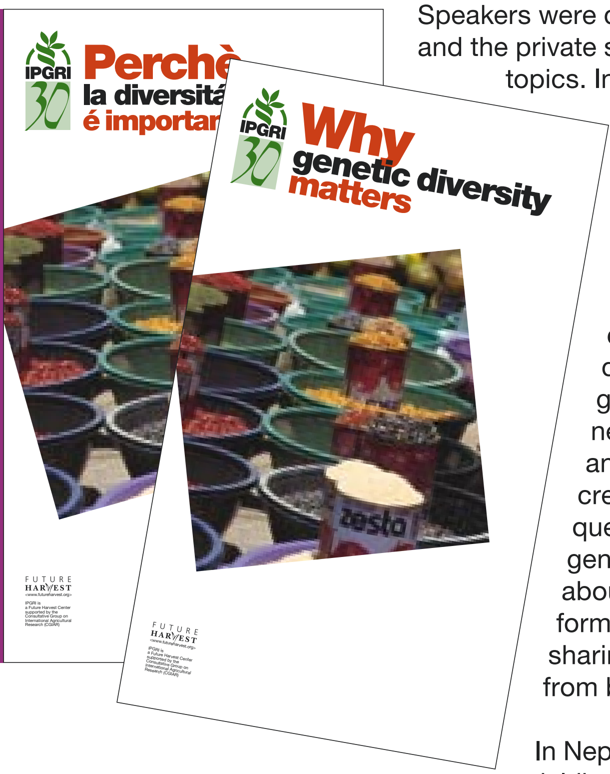
Why genetic diversity matters

The joint annual meeting of the American Society of Agronomy, the Soil Science Society of America, and the Crop Science Society of America offered an ideal opportunity to promote the benefits of agricultural biodiversity.

A single variety of corn as far as the eye can see. Or a home garden in which more than 350 different plant species all play a part? For IPGRI's scientists and partners the two are not mutually exclusive, each being appropriate under the right circumstances. But many mainstream agricultural scientists are not aware that agricultural biodiversity is a powerful force not only for higher yields but also to give millions of poor people around the world a more secure food supply. As they gathered at one of the largest conferences of the year in November 2003, IPGRI, in collaboration with the Plant Genetic Resources Division of the Crop Science Society of America, organized a symposium to explain 'Why Genetic Diversity Matters'.



Speakers were drawn from Future Harvest Centres and the private sector, and addressed a variety of topics. In the developed world, for example, agricultural biodiversity is seen as the raw material from which breeders craft more productive varieties. By unlocking the genetic riches of old, traditional landraces and the wild relatives of crops, breeders can find the qualities needed to respond to changing growing conditions and market demands. So they need access to genetic resources, and genetic resources need to be conserved, characterized and made available for the breeders to create better varieties. But that raises questions of who should benefit from genetic resources. The meeting heard about IPGRI's initiatives to grapple with the formidable policy challenges to achieve fair sharing of the access to and the benefits from biodiversity (see p. 16).

In Nepal, farmers are keen to adopt new high-yielding rice varieties to grow on good land. But they also hang on to their traditional rice types, because they realize that these older varieties give them a dependable harvest in marginal conditions, such as water-logging, that modern varieties simply cannot cope with. And farmers take the diversity contained in modern varieties and breed with it to enhance the performance of their own traditional varieties.

Beyond breeding, however, diversity is proving its worth in farmers' fields around the world. Breeders and farmers have always known that they can protect themselves from pests and diseases by the astute use of crop diversity. Crop rotation makes use of diversity in time. Planting mixtures or variable varieties makes use of diversity in space. And both have a place on even the most modern farms.

The symposium was well attended and much appreciated. For those who could not be there, IPGRI has published a booklet, copies of which are available on request.

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Why genetic diversity matters

Big projects to protect wild relatives and farmers' yields

The Global Environment Facility of the United Nations Environment Programme (UNEP-GEF) is supporting projects that look at the use of agricultural biodiversity to fight pests and diseases and to conserve the wild relatives of crops.

In the 1970s an outbreak of grassy stunt virus devastated the rice fields of millions of farmers in South and Southeast Asia. A relative of rice, *Oryza nivara*, growing in the wild in Uttar Pradesh in India was found to have one single gene for resistance to the virus. Rice varieties containing the disease resistant gene are now grown across 110 000 km^2 of Asian rice fields.

Wild relatives of crops possess characteristics that can be used to enhance the productivity, resilience and nutritional value of cultivated crops, making them an indispensable resource for food security. IPGRI and its partners in five countries have embarked on a project that will work to safeguard these precious resources and make information on them available.

The new project—*In Situ* Conservation of Crop Wild Relatives Through Enhanced Information Management and Field Application—brings together Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan, all of which have rich plant resources that face threats to their survival. The national partners have joined with IPGRI and five other international agencies (BGCI, FAO, IUCN, UNEP-WCMC and ZADI, Germany) to develop and implement rational, cost-effective approaches to conserving their crop wild relatives.

All of the countries involved in the project have already made some efforts to conserve their crop wild relatives, but lack of resources means that there is more to be done. The project will share the experiences of the partner countries, which will develop national information systems and decision-making processes to help them set priorities and carry out some of the most urgently needed conservation actions. Each country will also develop a national strategy for long-term conservation of crop wild relatives and work on increasing public awareness of the importance of these resources. An integrated information system, to be developed with the international partners, will bring several kinds of data under a single umbrella for ease of access. Better information, and better access to it, will make it easier for researchers and plant breeders to make use of crop wild relatives, which will add to their value and thus to the desirability of their conservation. Of course, increased use will raise issues of access and benefit sharing, and the project will address those too.

The project on crop wild relatives has been granted US$6 million by UNEP-GEF, which will be matched by an equal amount from the partners. UNEP-GEF is also funding the detailed development of another project, exploring how agricultural biodiversity can help farmers fight pests and diseases.

The Erebuni Reserve in Armenia was created specifically to protect wild relatives of wheat.

Pests and diseases

Roughly a third of the world's global harvest is lost to pests and diseases, a loss that falls disproportionately on resource-poor farmers in developing countries. Chemical sprays and improved varieties can help farmers to protect their crops, but they are costly and may be difficult to obtain. Some pesticides may also have serious consequences for the environment and the health of agricultural workers.

E. Frison/IPGRI

Cigar-end disease is one of the threats to banana harvests that might be controlled by the use of crop diversity.

Crop diversity could offer a more sustainable and cost effective solution to pests and diseases. Crop mixtures in space and time can reduce damage attributable to pests and diseases and there is plenty of evidence that many farmers already use crop diversity to limit losses caused by pests and diseases.

IPGRI is collaborating with national partners in China, Ecuador, Morocco and Uganda and with FAO, the University of Kassel, Germany and the International Centre of Insect Physiology and Ecology (ICIPE), Kenya, to create a project that will synthesize farmer knowledge with the latest scientific research in order to help farmers make better use of crop diversity to fight pests and diseases.

The project will work on six major crops: maize (*Zea mays*), faba bean (*Vicia faba*), rice (*Oryza sativa*), common bean (*Phaseolus vulgaris*), barley (*Hordeum vulgare*) and banana (*Musa* spp.). All are major staples and thus of vital importance to world food security.

Bioresources Management Agency, Armenia

The project is still in its development stage but much progress has been made. An International Steering Committee has been set up, and key activities and research and development issues have been identified. Existing literature on crop diversity for pest and disease management is being compiled, national meetings have taken place, national planning teams are being finalized and project sites identified. A global workshop on participatory planning and diagnostic tools to understand farmers' knowledge, beliefs and practices in relation to pest and disease management is also being organized and will take place in Kunming, China. The hope is that the final project will be approved for funding in 2005.

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Global Strategy for Plant Conservation

A global framework to guide the conservation of the threatened plant species of the world gets under way.

In April 2002, at their meeting in The Hague, the Conference of the Parties to the Convention on Biological Diversity made a major commitment to halt the loss of plant diversity and safeguard it for the future. They unanimously adopted the Global Strategy for Plant Conservation, which provides a framework to facilitate existing initiatives aimed at plant conservation at global, regional, national and local levels. The strategy addresses not only the conservation of plant diversity but also such aspects as sustainable use, benefit sharing and capacity development. IPGRI is one of several organizations supporting the strategy, among them governments, inter-governmental and non-governmental organizations, conservation and research organizations, universities, research institutes and others.

The Global Plant Conservation Strategy identifies 16 targets that must be hit by the year 2010. These targets cover several objectives related to the conservation of plant diversity such as documentation, conservation, sustainable use, public awareness and capacity development. IPGRI is collaborating with Botanic Gardens Conservation International (BGCI) and the Food and Agriculture Organization of the United Nations (FAO) on five of these targets:

C. Boursnell/IPGRI

Even in intensively cultivated areas, like the rice terraces of Nepal, crop diversity and associated indigenous knowledge can be protected.

Global Strategy

- Target vi: Production land is managed sustainably
- Target viii: Threatened plant species are collected and conserved *ex situ*
- Target ix: Crop diversity is conserved and associated indigenous and traditional knowledge is maintained
- Target xii: Sources of plant-based products are sustainably managed
- Target xiii: Decline of plant genetic resources is halted

E. Dulloo/IPGRI

Only three plants of* Hibiscus liliiflorus *remained in the wild, but the species is now conserved in this field genebank in Rodrigues Island, Mauritius.

IPGRI has been involved in the monitoring and implementation of the strategy. In 2003, IPGRI co-organized a stakeholder meeting with BGCI to consult relevant stakeholders on target viii (collecting and *ex situ* conservation) of the strategy and collaborated with FAO in the preparation of background documentation for the meeting. IPGRI also took part in the Liaison Group meeting (an informal group of participants selected by the Convention on Biological Diversity Secretariat for their relevant expertise) to review the recommendations and conclusions of the stakeholder consultations.

E. Dulloo/IPGRI

***A flower of* Hibiscus liliiflorus.**

IPGRI is also contributing to the strategy's objectives through its projects. The UNEP-GEF (the Global Environment Facility of the United Nations Environment Programme) funded project on crop wild relatives, for example, targets threatened species for *in situ* and *ex situ* conservation (see pp. 6-7), meeting many of the strategy's goals. IPGRI is also working on a project to develop new methods for hard-to-conserve species, which will contribute to other strategic targets.

Once lost, plant diversity is impossible to replace. The 16 targets of the Global Strategy for Plant Conservation have set the world a major challenge: to halt the loss of this vital resource and safeguard it for the future.

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A meeting of minds on agricultural biodiversity

A new facilitation unit to coordinate work on agricultural biodiversity was just one of the recommendations to emerge from an international meeting.

The number of people alive on Earth has doubled since 1961. The amount of food produced per person, however, is almost 25% higher now than it was then. By and large this intensification has gone along with decreasing agricultural biodiversity. Farming systems, especially on good land, are simpler. Highly bred, genetically uniform varieties are grown as monocultures, often with irrigation and inputs of energy, fertilizers and protective chemicals. This intensification has produced more food, but it is often accompanied by environmental degradation and can become unsustainable. With populations continuing to grow, however, further intensification is needed. Agricultural biodiversity could help in the next phase of intensification.

That was one of the conclusions of a meeting on Managing Agricultural Biodiversity for Sustainable Development, organized by IPGRI for the System-wide Genetic Resources Programme (SGRP) of the Consultative Group on International Agricultural Research (CGIAR). More than 60 participants from 35 countries gathered at the World Agroforestry Centre in Nairobi, Kenya, in October 2003. Roughly half the participants were from Future Harvest Centres, the rest from outside the CGIAR.

The meeting agreed that "the opportunities for enhancing livelihoods through the improved use of agricultural biodiversity are far more numerous and more powerful than the participants had [previously] recognized."

A. King/IPGRI

Local marketplaces, such as Nairobi's Ngara market, directly reflect the value of agricultural biodiversity to growers and shoppers.

Agricultural biodiversity consists of all the living elements involved in production systems—from genes to ecosystems. It includes crops, trees, fish and livestock, and all interacting and associated species of pollinators, symbionts, pests, parasites, competitors and so on. The Convention on Biological Diversity distinguishes two kinds of agricultural biodiversity: the managed portion, which people manipulate for their own needs, and the unmanaged portion, which is not manipulated directly but which nevertheless supports essential aspects of production, for example the microbes and other organisms that help to keep soil fertile.

J. Cherfas/IPGRI

Bees, whether managed or wild, perform the vital service of pollination.

Participants shared their ideas and experiences of some of the general benefits of agricultural biodiversity with the workshop. For example, diverse ecosystems are more resistant to change and more stable in their outputs. The overall productivity of such an ecosystem (including the few farm systems studied to date) is less affected by sudden perturbations, such as an outbreak of disease or a failure of the rains. Further, after such a shock the productivity of a diverse ecosystem returns to its average level more rapidly. Together, these two properties can mean that a more diverse food production system is more reliable.

Another benefit of agricultural biodiversity is adaptability. The genetic diversity encoded within variable crops or livestock breeds enables them to respond to different selection pressures. If, for example, there is a general trend in an area towards lower rainfall, then a genetically uniform crop does not give the farmer much room to select better-adapted individuals to track the changing environment. Diversity supplies the genetic variability that artificial selection requires.

These qualities are important for all agriculture. For farmers in marginal areas, battling a fluctuating and often unpredictable environment, they are vital. One participant summarized these qualities of ecosystem health and adaptability to changes as 'sustaina**g**ility'. This encapsulates what many people have been saying about diversity, that it gives people and their farming systems the chance to respond nimbly to environmental changes, quickly and over the longer term.

Having heard presentations on these and other specific topics, the meeting participants split into working groups to discuss possible research areas in more detail and to identify opportunities to enhance the usefulness of agricultural biodiversity in securing adequate food supplies. Among these was the recognition that to date much research on agricultural biodiversity has focused on specific components, for example crops, animals, pollinators, pests and pathogens, often ignoring linkages even though these are obvious. One priority is thus to develop an understanding of how the components of agricultural biodiversity link and interact.

Diversity in the colour of cañahua (Chenopodium pallidicaule), growing on a riverbank in the altiplano of Bolivia, hides even more important diversity in the ability to cope with different challenges.

A. King/IPGRI

Another concern is to ensure that diversity is maintained in order to ensure sustainable development, a win–win scenario that combines high private values (for the farm families using diversity) with high public values for decisions by society at large to conserve and make use of agricultural biodiversity. As the meeting suggested, instead of asking how agricultural biodiversity can be maintained as economies develop, we need rather to ask how development can continue without the loss of agricultural biodiversity.

The meeting ended with a call to try to establish a facilitation unit to support research on agricultural biodiversity. Among other activities, such a unit would act as a focal point for research groups worldwide and would build an open-access repository of relevant information, thus helping to prevent duplication of effort. It could also support the development of partnerships to explore common research themes, and share ideas for project proposals and funding. And it would liaise with established groups such as the Secretariat of the Convention on Biological Diversity and the Food and Agriculture Organization of the United Nations.

At the close of the meeting, IPGRI accepted the challenge of developing the facilitation unit, with SGRP's full support. The proposal to establish such a unit was presented at a seminar during the 7th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP VII), early in 2004. There was strong endorsement from the COP for the proposal, formally reflected in Decision VII/3.

The workshop papers are available at http://sgrp.cgiar.org/agrobiodiversity workshop.html as is a full report on the workshop outcomes.

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What's in a name?

A tool that allows rapid checks of long lists of plant names makes life easier for genebank managers and others.

Databases are only as good as the data they contain, and while an experienced human being may realize that *Triticun* ought to be *Triticum*, computers cannot make the same judgement. So if a researcher is searching for a particular wheat, and a genebank database has erroneously labelled a sample as *Triticun*, that sample may as well not exist. Checking each of the thousands of names in a database is a soul-destroying and error-prone task for a human, but it is meat and drink to a computer. A tool developed by Thomas Metz of IPGRI simplifies the entire process.

The Taxonomic Nomenclature Checker takes a Latin name and compares it against either of two standard dictionaries, one maintained by the Germplasm Resources Information Network (GRIN) of the United States Department of Agriculture (USDA), the other the Mansfeld World Database of Agricultural and Horticultural Crops at the Institute of Plant Genetics and Crop Plant Research (IPK) in Germany. The two reflect different approaches to taxonomy, with the GRIN database being more of a 'lumper' and the Mansfeld Index more of a 'splitter'. Giving users access to both—which between them cover almost all plants of economic importance—enables them to check the two largest dictionaries available.

The Checker operates at three different levels: genus (e.g. *Triticum*), species (e.g. *Triticum aestivum*), and taxon (which adds hybrids and trinomials to the binomials of species, e.g. *Triticum aestivum* var. *lutescens*). It does so in three steps. First, does the name exist? Then, is it spelled correctly? Finally, is it an accepted name or is it a synonym, in which case, what is its accepted name? Such checks are not easy for a computer. Simply matching some of the letters in the candidate name is fraught with difficulties. If too few letters are chosen, then too many names in the dictionary will match, giving an impossibly long list of potentially correct matches. If, instead, one chooses too many letters, the error (if there is one) could lie within that part of the candidate name and so the comparison will not reveal any correct matches. The secret is to use a technique called fuzzy matching, developed from genomic databases. One 'fuzzy' approach compares the whole candidate name with the dictionary and asks how many edits—insertions, deletions and changes—are needed to get from one to the other. *Triticun* is then one edit from *Triticum*, which is probably its correct name.

The real strength of the Checker lies in its speed. It will zip through a list of 8000 names in less than a minute. Of course, because the Checker is looking up words in a dictionary it cannot promise to be exhaustive; for one reason or another the word may not be there. But having flagged up words that aren't present in a list the user is in a good position to submit those to the dictionary. An IPGRI scientist tested the Checker to clean up IPGRI's database of seed-storage behaviour. Quite apart from identifying spelling mistakes, duplicates and synonyms among the 7000 names, the lookup also revealed 16 genera that were not in the GRIN database. IPGRI's partner at GRIN, having confirmed their identity, added them right away. Within a week, they were available to all the other users of the Checker.

Accepted and correctly spelled names are vital for all sorts of communications, because only if people know they are talking about the same plant can they exchange information about it. Many of IPGRI's partners have found the Taxonomic Nomenclature Checker a useful tool in maintaining their databases. Theo van Hintum, of the Centre for Genetic Resources in The Netherlands (CGN), said: "We used it at CGN and were amazed by the number of errors we traced by simply uploading the list of names from our database."

The Taxonomic Nomenclature Checker can be found at
http://pgrdoc.ipgri.cgiar.org/taxcheck/grin/index.html
http://pgrdoc.ipgri.cgiar.org/taxcheck/mansfeld/index.html

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Uncorking grapevine diversity in the Caucasus

One of the ancestral homes of the grapevine is the focus of a new project to capture, document and protect the riches of this culturally and economically important plant.

The grapevine was probably domesticated in several places in Europe, one of the centres being the area between the Black Sea and the Caspian, often referred to as the Caucasus. The region is rich in grapevine diversity and home to the ancestor of the cultivated grapevine, the wild species *Vitis vinifera* ssp. *silvestris*. However, despite this richness and the grape's importance to the region's culture and economy, few resources have gone into collecting, characterizing and conserving grapevine diversity. This is why IPGRI's Regional Office for Europe is helping countries there to strengthen national capacity in the use and conservation of grapevine genetic resources.

A history of winemaking

The Caucasus region comprises Armenia, Azerbaijan and Georgia as well as the southern tip of the Russian Federation. Differences in climate and soil have made the region especially rich in plant genetic diversity. Local communities appreciate and make use of these precious resources, and wine is particularly important to the local culture and economy. Georgia, for example, has won 180 awards for 44 different types of wine and cultivates 34 varieties of grapevine, 30 of which are endemic and found nowhere else.

Uncorking grapevine diversity

J. Cherfas/IPGRI

The future of grape harvests depends on conserving wild varieties.

Civil unrest and economic difficulties mean that money and labour that used to go into the conservation of the region's grapevine diversity have been allocated elsewhere. Fortunately, several scientists and policy-makers in the region are aware of the importance of conserving these resources. In collaboration with the European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR), IPGRI is working with six countries in the region—Azerbaijan, Armenia, Georgia, Moldova, Russia and Ukraine—to strengthen the use and conservation of grapevine genetic resources. Collections are being set up throughout the region and training is being provided to develop scientific capacity.

The project is important for several reasons. By improving local viticulture and strengthening the winemaking industry, the project will help local people to increase their incomes, leaving them better equipped to face the challenges of socioeconomic transition. In addition, identifying and characterizing wild relatives of the grapevine can offer solutions to pests and diseases. This is vital for the entire grape-growing world. In the late 1800s, phylloxera, an insect pest, almost destroyed the European wine industry, which was saved by grafting susceptible varieties onto rootstocks derived from resistant wild relatives. Studying the ancestor of the grapevine could help protect the European wine industry from future pests and diseases.

The project started in 2003, and has already established one collection of 230 varieties in Vashlidjvari, Georgia. In addition, 400 local varieties of grapevine have been identified, documented and multiplied.

Superchilled vines

Grapevine generally has to be conserved in field genebanks because the varieties do not breed true-to-type from seed and so are vegetatively propagated.

Cryopreservation—the preservation of plants at ultra low temperatures, usually in liquid nitrogen—is a less expensive alternative to field genebanks. It is often used for the long-term conservation of vegetatively propagated material and for so-called recalcitrant seeds, which do not tolerate drying for storage. However, many globally important crop plants cannot yet be conserved in this way. IPGRI is one of seven partners in six countries collaborating in CRYMCEPT (Cryopreservation Methods For Conserving European Plant Germplasm Collections), a project funded by the European Union. The project aims to develop new and improved methods for cryopreservation, with a particular emphasis on species that are currently difficult to preserve. A large part of this will involve examining the effects of freezing, desiccation and dehydration on plant tissues. Hence the project will not only help to improve conservation methods but will also shed light on two of the most important stresses that impact plants: freezing and desiccation.

Developing capacity

To improve regional capacity, the project has set up a fellowship programme. Nine fellowships are being awarded to scientists from the region, over a three-year period. In Georgia, for example, a fellowship has helped research into the diversity of endemic varieties using modern techniques of molecular genetics to improve the science of identifying grape varieties by their appearance. Research on wild relatives of grapevine is also underway to evaluate the degree of genetic difference among species and varieties of grapevine.

The project will now work to identify, collect and conserve grapevine diversity in the other countries involved in the project and to establish national collections.

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Making headway: the Genetic Resources Policy Initiative

Two years ago, IPGRI and IDRC (International Development Research Centre), with the support of other donors, launched the Genetic Resources Policy Initiative (GRPI). Two years into the project and GRPI has made significant progress.

IPGRI and IDRC launched the Genetic Resources Policy Initiative (GRPI) to help countries to understand their policy options so that they can develop appropriate regulations and legal frameworks for the conservation and use of genetic resources (see Annual Report 2002, p. 6). The project takes place in two phases. The first phase involves a so-called 'Southern Country Demand Analysis', to identify relevant stakeholders and country needs and priorities in the area of genetic resources policy. The demand analysis looks at who is doing what, identifies the most pressing concerns and gaps in research and assesses the country's capacity to analyze, use and establish policy. The process culminates in national and sub-regional meetings in which participants confirm the findings of the demand analysis and create multi-stakeholder task forces to develop work plans and budgets for the second phase of the project. This report covers progress in the first phase in two countries, Nepal and Zambia.

Nepal

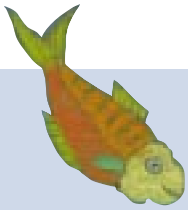
As part of the first phase of the project, Nepal carried out a survey to identify priority issues in genetic resources policy and relevant stakeholders. A workshop in Dhulikhel, Nepal, confirmed and refined the results of the survey and raised awareness among stakeholders. For the first time ever, representatives of relevant stakeholders from the Ministry of Agriculture and Cooperatives, the Ministry of the Environment, the Ministry of Industry and Commerce, the Ministry of Law, Justice and Parliamentary Affairs, the National Agricultural Research Council, non-governmental and farmers' organizations and the private sector came together to focus on policy issues relating to genetic resources. Together they worked to identify needs and priorities and to propose activities to address them.

Collaborating institutions (hosting task forces)

- Desert Research Center, Egypt
- Institute for Biodiversity Conservation, Ethiopia
- National Agriculture Research Council, Ministry of Agriculture, Nepal
- Sociedad Peruana de Derecho Ambiental, Peru
- Ministry of Agriculture and Cooperatives, Zambia
- Conference of Directors of Agronomic Research in West and Central Africa (CORAF)
- East African Plant Genetic Resources Network (EAPGREN)

All illustrations by Guida Joseph

Financial support and collaboration



GRPI is financially supported by the Netherlands Ministry of Foreign Affairs, BMZ/GTZ (Germany), IDRC (Canada), Rockefeller Foundation (USA) and CIDA (Canada).

The highest priority identified by the survey and the workshop was the need to empower farming communities in the management of genetic resources. This requires a two-pronged approach. First, Farmers' Rights are not well defined. The workshop proposed a research programme to establish a scientific basis for supporting Farmers' Rights, drawing on social, economic and biological sciences. Secondly, many communities lack the training and skills to manage their genetic resources. But several pilot communities have become adept at using community biodiversity registers to record both their resources and the traditional knowledge associated with the use and conservation of those resources. The workshop suggested that existing techniques be evaluated and extended to more communities.

The workshop attracted several high-level participants, including three vice-ministers. Shortly after the meeting, the Ministry of Agriculture and Cooperatives asked the project working group to lead the development of the country's first national conservation strategy for agricultural biodiversity. Future GRPI work in Nepal will focus on providing inputs to this process and helping the participants to refine the draft so that it meets their national needs.

Zambia

As in Nepal, the first step for Zambian partners was to conduct the policy and stakeholder appraisal, followed by a highly inclusive workshop to further identify needs and priorities and to confirm the results of the appraisal. The task force identified several priorities to address. For example, planting material of several so-called unconventional crops, such as cassava, is simply not available through the formal sector. The workshop suggested a survey of the availability of these crops together with an analysis of the data and recommendations for how to remedy the situation. Farmers also feel that they do not have adequate access to material currently stored in genebanks, which they could use to improve the productivity of their farm systems. Accordingly, the group will study ways to improve access and the use that farmers can make of agricultural biodiversity. There is also widespread unease about the spread of genetically modified organisms in Zambia, and the workshop suggested it make contributions to the final form and implementation of the Zambia Biosafety Regulations. One suggestion is to monitor the spread of GMOs that may already have arrived in Zambia without the government's approval.

As a result of taking part in the workshop the GRPI task force was able to identify experts in areas in which it lacked capacity. The task force recruited four experts from among the participants of the workshop and is now drafting a proposal for the second phase of the GRPI project.

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Squeezing information from a stone

New techniques for identifying olive varieties based on the visual characteristics of their stones will improve their use and conservation.

For most people, the most complex thought an olive stone prompts is where to discard it once one has enjoyed the flesh surrounding it. But, armed with an image analyzer and a computer program, the stone alone can reveal exactly which variety one has been eating. That information promises to make it easier to improve, use and conserve the huge genetic diversity of the olive (*Olea europea*).

Olives were probably domesticated somewhere in the Near East and spread, largely westward, around the Mediterranean basin. But everywhere that olives found a supportive environment people subjected them to deliberate cross-breeding and selection. The result is that almost all olive-growing regions are home to hundreds of distinct varieties. That means hundreds of distinct names for varieties and, as ever, the problem of identity arises. The same name may refer to different varieties in different places, or the same variety may have different names. That makes life difficult for scientists and others interested in making use of the genetic diversity of the olive to improve productivity.

Descriptors for olives exist, based on what the olives and the trees look like, and in expert hands these can be used to distinguish almost all varieties from one another. The problem is that such expertise takes years to acquire. Further, some traits are inherently difficult to measure and are subject to bias. The surface of a stone, for example, can be smooth, rugose or scabrous, depending on how many grooves there are and how deep they are. But what exactly is the difference between ‘very rugose’ and ‘a bit scabrous’? Or the shape of the stone may vary from almost round to extremely elongated. The descriptors say that if the stone’s length is less than 1.4 times its breadth, then the stone is round, while if the length is between 1.8 and 2.2 times the length it is elliptical. A continuous variable is thus being forced into discrete categories, which is difficult and can introduce uncertainty.

A simple digital photograph of a rugose olive stone is converted into black and white images. The images are then examined by seeing how the ridges fit into boxes of different sizes at different angles. The size and angle of the box gives a measurement that can then be plugged into a program that will identify the olive variety.

A. Bari/IPGRI

identifying olive varieties

To overcome these problems, IPGRI scientists, working with colleagues at the Institut National de la Recherche Agronomique (INRA) in Morocco and at the Instituto de Agricultura Sostenibile (IAS-CSIC) and the University of Cordoba in Spain, adopted a new approach. They created digital images of olive stones and derived certain measurements from the images, finally training a special type of computer program called a neural network to discriminate olive varieties based on the measurements.

The measurements themselves are complex to explain but simple (for a computer) to do. The fractal dimension, for example, captures information about the pattern of grooves on the stone surface. Fractals are particular types of mathematical functions, often found in nature. A fractal dimension is in some sense a measure of the 'wiggliness' of a line. Classic examples are the outline of a fern frond or the coastline of a country. A small leaflet of a fern frond often duplicates in miniature the outline of the frond as a whole. The 'coast'

IPGRI and Morocco

The olive is an extremely important crop for Morocco. There are thousands of producers, more than three-quarters of them smallholders with less than 5 hectares of land. Work on the olive contributes about 11 million person days a year to the Moroccan economy, one reason IPGRI has focused on this crop. But research on olives is only one part of IPGRI's long-standing collaboration with Morocco. Since 1995, IPGRI has been working to help Morocco use and conserve its plant diversity. In 2003 IPGRI renewed its commitment to Morocco, which for the first time agreed to directly fund a programme of work, thus becoming one of IPGRI's newest donors.

IPGRI signed a new Letter of Agreement with the Institut National de la Recherche Agronomique (INRA), the country's national agronomy research institute. Together IPGRI and INRA will work to strengthen the capacity of Morocco and its people to make use of the country's plant genetic diversity. The agreement covers the following main outputs:

- INRA develops a strategy for plant genetic resources and drafts a policy framework.
- Olive genetic resources in the south of Morocco are collected and characterized.
- Morocco's medicinal and aromatic plants, including cumin, fenugreek, caraway, coriander and others, are collected and conserved in genebanks.
- Morocco's collection of stone fruit trees (almond, peach, plum and apricot) is characterized. Rootstocks tolerant to drought and to capnodes (an insect pest that attacks the leaves of young trees) are selected.
- Morocco's pomegranate collection is characterized and samples from the global collection in Turkmenistan are introduced.
- A tissue culture laboratory is established for vegetatively propagated plants.
- A documentation and information system is developed.
- INRA staff are trained in genebank techniques and management.

J. Cherfas/IPGRI

Ancient olive trees too can yield their identity to modern technologies.

made by the edge of still water on a pebbly beach is often indistinguishable from the outline of the entire coast.

For olive stones, the scientists converted the image of the surface into a grid of black and white pixels and then asked how many boxes, all black or all white, could be fitted into the pattern. A simple pattern, with not many lines or grooves, would need just a few boxes, while a more complex pattern would need many more. The number of boxes translates into the fractal dimension of the groove pattern. Another measure is the 'eccentricity' of the stone, which is essentially a measure of the difference between its length and breadth, but also takes into account its outline (does the stone have a pointy tip, or a round one?) and how symmetrical it is.

To begin with, the scientists looked at stones from nine different varieties grown at an assessment site near Marrakech in Morocco. Each variety was being grown in 10 different environments, which offered the opportunity to see how much of the variability in each measure might be genetic and how much caused by the environment in which the trees were growing. Each of eight mathematical measurements proved able to discriminate the varieties. The fractal dimension and the eccentricity were the two most useful, the first because it differed most from variety to variety, the second because it differed least across different environments.

The second stage was to use these two measurements and compare their ability to identify varieties accurately with the standard physical descriptors developed by the International Olive Oil Council. The team classified the stone shape and surface of five known varieties and also measured the fractal dimension and eccentricity. Rather than simply taking the average of the derived measurements, however, the results were fed into a neural network. This is a computer program that takes several different kinds of information, such as the length, breadth and surface of an olive stone, and combines them into a single measurement: its identity. The beauty of a neural network is that it can be taught. You give it the measurements from a whole lot of stones of known varieties, and tell it which measurements are from which varieties. That tunes the ability of the program to discriminate varieties. Then you give it the measurements from an unknown stone and ask it to identify the variety.

The conventional descriptors were, as expected, reasonably good at identifying varieties; they were correct roughly 70% of the time. The new measures, however, were much better. Analyzed by the neural network they correctly identified 96% of the samples. And after training, the neural network's accuracy improved to 98%. The network, using the new measurements, identified 44 out of 45 stones correctly.

These two studies show that computer analysis of the visible features of an olive stone, combined with a trained neural network, is much more accurate than conventional methods. It is also fast and cost effective, and could therefore be an extremely useful approach for managing the genetic resources of the olive. The hope is to allow rapid preliminary screening of varieties to select cultivars that are both high yielding and water efficient.

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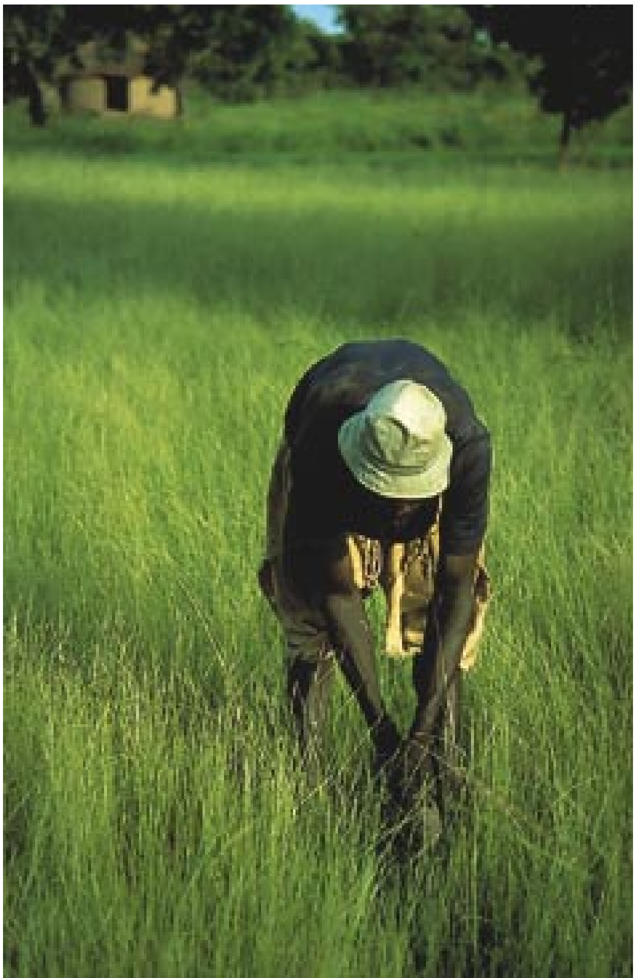
Fonio: West Africa's treasure

A project in West Africa sheds light on the cultural richness and economic potential of fonio, the so–called 'hungry rice'.

West Africans have cultivated fonio (*Digitaria* spp.) for thousands of years and the cereal forms an integral part of the local diet and culture. The Dogon people of Mali say that the entire universe stemmed from a fonio seed. Elsewhere, fonio was considered a luxury that could be served solely to chiefs, royalty and on special occasions. It is highly nutritious, it matures earlier than most cereal crops and it grows easily on sandy, infertile soils, making it indispensable for food security. Yet, despite its importance to the region, it has been neglected by the scientific community. IPGRI is working with four countries—Benin, Guinea, Mali and Nigeria—to promote the production of fonio and to improve the quality of the products derived from it. The work involves strengthening farmers' seed systems, enhancing processing techniques and improving fonio conservation. The ultimate goal is to increase the income of farmers who grow fonio.



G. Hawtin/IPGRI

A farmer tends his field of fonio.

Understanding fonio

Also known as findo, findi, acha or 'hungry rice', fonio was among the first crops to be domesticated in Africa and remains vital to the food security of millions of African farmers who use it in several ways. It is made into porridge and couscous and mixed with other flours to make bread. It is also brewed for beer. The grain, straw and chaff are used for animal fodder and the straw is sometimes chopped and mixed with clay to make bricks.

Despite its economic and cultural importance, however, knowledge of the distribution and genetic diversity of fonio remains limited. This is because scientific research has generally been directed towards the better-known crops—sorghum, pearl millet and maize.

The first phase of the project involved studying the amount and distribution of fonio diversity. In Mali, for example, the project used agro-morphological methods to classify samples of fonio and to determine the degree of genetic diversity among them. Twenty-four samples of fonio were collected from different villages and studied to determine the degree of diversity present. The crucial discovery,

which is being made in several other similar projects, is that “the name is not a criterion for distinction”, according to project scientist Raymond Vodouhé. Two visibly distinct varieties might have the same name in different villages. And farmers from different ethnic groups might give different names to the same variety.

This was borne out by a detailed look at 62 fonio accessions in the genebank of the National Cereals Research Institute in Badeggi, Nigeria. Some accessions were all but impossible to distinguish on the basis of morphology, even though they had been collected under different names. The analysis also revealed two main clusters of fonio types, corresponding to the two main species, *D. exilis* and *D. iburua*. Project scientists are working with molecular biologists at the Institute of Plant Genetics and Crop Plant Research in Gatersleben, Germany, to get a better understanding of how the name, appearance and molecular details of a variety are linked.

Community seed systems

Another part of the project looked at community seed systems—how farmers obtain and conserve fonio seeds. In the four countries studied, farmers like to exchange seed among themselves and only rarely buy seeds from the market. Farmers also like to use seeds that they have saved from previous harvests, which they store in clay granaries.

Seed supply and storage from season to season, however, are only part of the rich cultural milieu in which fonio is embedded. In Benin, ceremonies ensure the good storage, production and commercialization of fonio. During these ceremonies, the people sacrifice chickens, goats or cows to their gods with a bale of fonio and a drink of tchoukoutou, a sorghum-based beer. Farmers are not allowed to sell fonio products before harvest or before the sacrificial ceremony.

In Nigeria most farmers grow fonio mainly for household consumption and not for sale. Those who do choose to sell fonio products say that diabetics are their most important customers. Doctors too are recommending fonio to diabetic patients and a private-sector women’s group is exporting fonio to France and the USA. At present the group is not able to meet the demand for its products, which suggests that there could be important markets to tap.

Processing fonio

Fonio plants shatter easily when they are mature, so much of the grain is lost between harvesting and processing the crop. Also, threshing and husking fonio take a great deal of time, and current methods often contaminate the final product with sand. The project therefore looked at ways to improve postharvest technology, both to enhance the quality of the final product and to minimize grain loss.

To do this, the project tested a variety of threshing and husking methods. In Benin, threshing on a canvas sheet and husking with a machine significantly reduced the time and effort involved and improved the final product. The only problem that remains is the cost: buying a threshing machine is expensive for the community. In Benin, the National Institute for Agricultural Research and the Regional Extension Service, in the Department of Atacora, convinced the private sector to buy such a machine for the farmers in Boukombé. This successful experiment is being considered as a model.

These are still preliminary results, yet there is a clear indication that farmers do value fonio and that, working together, the partners can increase that value. In particular, work on postharvest processing could yield relatively quick returns.

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Assessing the impact of better bananas

Dissemination of improved banana varieties to farmers in East Africa should have a great impact on farmers' lives.

Banana is a basic staple food for hundreds of millions of people in the developing world and nowhere more so than in East Africa, where people eat more bananas than anywhere else. Ugandans produce 10.5 million tonnes of banana each year, around 450 kg per person, and the word for bananas, 'matooke', also means 'food'. But the livelihood and food security of the farmers who depend on the crop is threatened by declining soil fertility and an increase in virulent pests and diseases.

The majority of bananas grown worldwide are the result of farmers' selections rather than breeding programmes. However, in recent years, IPGRI's INIBAP (International Network for the Improvement of Banana and Plantain) programme has been working with national agricultural research systems, non-governmental organizations and community programmes to disseminate new, improved varieties to smallholder farmers, in an effort to improve their incomes. One group, the Kagera Community Development Project, for example, has estimated that since 1997 it has disseminated nearly 500 000 banana suckers to farmers. A further 2 million may have been diffused indirectly in the Kagera District in Tanzania. But what is the impact of these efforts, and how can they guide future activities? A new project has started to find out.

A challenging crop

Assessing the impact of improved banana varieties on the livelihood of farmers is no easy task. Because roughly half the crop is eaten on the farm, simply examining volumes and prices in the market cannot assess the impact of improved varieties on farmers' livelihoods. And because banana is a perennial, grown with other annual and perennial crops as just one contribution to food and income, the effects on a household's well-being are hard to quantify.

C. Boursnell/IPGRI

New banana varieties, along with advice on how to look after them, have contributed to doubled yields in some parts of East Africa.

C. Boursnell/IPGRI

Banana samples from around the world, kept at the INIBAP Transit Centre in Belgium, are part of the search for improved varieties.

To overcome these difficulties, the project is adopting an inter-disciplinary approach that combines social, economic and biological sciences and depends on multiple partners, including the National Agricultural Research Organization and Makerere University in Uganda, the Agricultural Research and Development Institute and Sokoine University in Tanzania, and three Future Harvest Centres: IPGRI, IITA (International Institute of Tropical Agriculture) and IFPRI (International Food Policy Research Institute). Financial support has come from the US Agency for International Development (USAID), the Rockefeller Foundation, the International Fund for Agricultural Development (IFAD) and the participating organizations themselves.

Institutional Learning and Change

Institutional Learning and Change (ILAC) has been defined as “the process of reflection and reframing of knowledge that results in changed behaviour and improved performance.” IPGRI is playing a leading role in a CGIAR ILAC initiative that aims to improve the effectiveness of agricultural research programmes in their contribution to poverty alleviation. ILAC encourages organizations to learn from their development activities and to incorporate the lessons learnt into future initiatives. Accordingly, the project partners have been gradually preparing their institutions to internalize the results so that these results can guide future efforts. This will ensure that the study’s findings will be used to inform future banana research and development, and thus improve their impact. The ultimate aim is to learn to target development efforts more effectively.

The project has already surveyed 800 households in Tanzania and Uganda and documented the banana varieties they grow. The survey identified 95 distinct varieties, almost all of them endemic to the East African Highlands and found nowhere else. Households grow an average of nine varieties, but some have as many as 27. Researchers will use the data to analyze the traits that farmers consider to be most important and predict the likely adoption of improved banana varieties and the factors that influence farmers’ choices.

For example, a farmer may not perceive pests and diseases in the same way as a pathologist, and may even fail to notice the damage they cause. This might affect the farmer’s decision to adopt disease or pest resistant varieties.

To examine the different dimensions that contribute to poverty and its alleviation, the project is employing a sustainable livelihoods approach. It is important, for

example, to consider the different impacts on men and women, or richer and poorer households. A new banana variety may be particularly suited for brewing beer, but will this benefit the rich and the poor equally? And will it help women more than men? Answers to these questions will influence banana improvement and how NARS respond to the needs of farmers.

Capacity development is another key element of the project. The partners are supervising six doctorate students and four students working towards Master's degrees. All except one are from East Africa.

By assessing the impact of improved banana varieties on the livelihood of smallholder farmers, the organizations involved in the project will be able to target their work more effectively. On this level, the ultimate output of the project will be an action plan, which will help enhance the impact of improved varieties on the livelihoods of farmers in East Africa.

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Uganda opens banana lab

President Yoweri Museveni of Uganda cut the ribbon to open his country's newly equipped biotechnology laboratory in August 2003. He used the occasion to tell the world that Uganda is now "fully mobilized to accept biotechnology". The focus for this new chapter in agricultural history is matooke, the cooking banana and daily meal for Ugandans and many other East Africans.

A tissue-culture laboratory has been refurbished and another laboratory for molecular and genetic transformation work has been built in what is now known as the National Agricultural Biotechnology Centre at the National Agricultural Research Organization at Kawanda near Kampala. A team of Ugandan scientists runs the laboratories and has already succeeded in producing the starting materials for genetic work on matooke and other East African banana varieties. Ugandan researchers are training at the Katholieke Universiteit Leuven, Belgium, and the Forestry and Agricultural Biotechnology Institute in Pretoria, South Africa, where they are developing the transgenes and techniques for transferring them into the banana.

Once all the pieces are in place, the project will deliver a matooke-type banana with resistance to black Sigatoka, a disease caused by a fungus, and to nematode worms and weevils. The potential flexibility of biotechnology should allow the NABC to insert the useful genes into any one of a number of popular banana varieties.

The project is supported by the governments of Uganda and Belgium, the Rockefeller Foundation and the US Agency for International Development.

Sesame: threats and opportunities

IPGRI is working to safeguard one of India's oldest and most precious crops: sesame.

People in India have been growing sesame for more than 5000 years and the country now accounts for about a quarter of sesame production worldwide. Despite its economic importance for food, oil and medicine, however, production of sesame has been falling. To help improve the incomes of sesame farmers and safeguard the country's precious sesame diversity, Indian researchers and IPGRI have undertaken several activities over the past few years.

Core collection

There are two main reasons why sesame production has fallen in India. First is a lack of high-yielding varieties. Secondly, much of the harvest is lost to pests and diseases. The Indian National Bureau of Plant Genetic Resources holds a large collection of sesame with more than 3000 accessions. This could be used to develop new and improved sesame varieties but its very size makes it difficult to use. IPGRI and India's national programme collaborated to develop a core collection of Indian landraces, which contains most of the genetic diversity of the entire collection in a smaller number of accessions. This has made the genebank more manageable and therefore more useful to breeders and farmers.

Promoting use and conservation through market incentives

Nevertheless, sesame production in India is continuing to fall. Farmers will not grow sesame if it is low yielding and not worth much on local and world markets. Developing improved varieties that yield more is one way to promote sesame production, and some

P. Mathur/IPGRI

Sesame makes an important contribution to the lives of rural Indian families.

Sesame: threats and opportunities

Sesame opens up opportunities in Sudan

Sesame may provide farmers in Sudan with the resources they need to start rebuilding their lives. Catholic Relief Services (CRS) identified sesame as a valuable cash crop for smallholder farmers across the Sahel zone. Sudan has an ideal climate for growing sesame and northern Sudan is already the largest exporter of sesame seed and oil in Africa. IPGRI and CRS are now working with farmers in Sudan to find the most suitable varieties for their conditions.

The National Genebank of Kenya, another partner in the effort, holds about 2000 accessions of sesame, a subset of the global collection. Assessing all of these samples would be an impossible task. To make the assessment easier, IPGRI helped the genebank to select a representative core collection. The genebank's samples were, however, too small to supply Sudanese farmers with seeds for the trials. So a round of seed multiplication was planted in Kiboko in Kenya, on a research site operated by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

About 10 of the best accessions will be taken to Sudan for trials at different locations with different conditions. The participation of farmers is key to the project's success. "We have to get their views", says Robbert van der Steeg, an IPGRI scientist. "It is important that farmers accept the varieties." Once farmers have identified the most useful varieties for them, CRS will help promote them and make seed available.

Reports of the project created interest among sesame traders worldwide, which bodes well for its future if peace can be secured in the region.

R. van der Steeg/IPGRI

Growers in Sudan admire their sesame harvest.

progress is being made. Another is to provide farmers with market incentives. IPGRI has been conducting a case study in the state of Rajasthan to assess the potential for market-based incentives for conserving sesame landraces in farmers' fields.

So far the project has surveyed 400 farmers. Alarmingly, one of the first things the study discovered was that in the past decade about 40% of sesame farmers have stopped growing the crop entirely. Neither traditional landraces nor older improved varieties are being grown. According to the survey, this is not only because of low yields and the crop's high susceptibility to diseases, but also because of climate change. Sesame is generally

R. van der Steeg/IPGRI

Sesame with a light seed coat is preferred in many markets.

grown as a rain-fed crop, because other more important crops take up irrigated land. But rainfall in the major sesame growing areas of Rajasthan has not only been declining but is also irregular, making the harvest unreliable.

Another important finding was that farmers chose to grow varieties depending on their market value. White sesame is roughly twice as popular on the international market as black sesame. But traditional sesame varieties often have black or brown seed coats, so farmers are less likely to grow them. Much of India's sesame diversity is thus being lost because farmers opt to grow white-coated varieties that are more valuable on the market.

The project will now look at ways of promoting the production of these traditional varieties by promoting links between sesame traders and sesame growers and by raising awareness of the properties of traditional sesame varieties and their market possibilities.

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Models for better forest management

A dynamic approach is enabling scientists to understand how a complex forest ecosystem operates and is offering local people a rich choice of management options to improve their lives.

The *Araucaria araucana* forests of Argentina are the heart of a complex social and biological system that supports in large measure the local Mapuche people. The seeds of the araucaria trees are a key resource for the Mapuche, who gather them for their own use, to sell in the market, and to feed to their livestock. Wildlife, indigenous and exotic, also eat the seeds. The forests, however, are fragmented and endangered, and in many places a combination of soil erosion and lack of regeneration poses an additional threat to the future of these forests and thus of the Mapuche.

A project, funded by the Bundesministerium für Zusammenarbeit (BMZ), Germany, had already shown how a more flexible and integrated approach to managing the seed harvest could improve the well-being of the Mapuche (see Annual Report 2001, p. 28). But, during the final project workshop, held in San Carlos de Bariloche in Argentina, the project partners realized that they had collected enough data to begin to think about building a more complex dynamic model of the many different factors that link the communities, with their social and economic needs, to the biology of the araucaria forests and their associated ecosystems. Such a model, the project partners hoped, would give greater insights into how the system operated and so would enable the Mapuche to exploit their natural assets more effectively.

IPGRI therefore convened an international workshop (also funded by BMZ) in October 2003, inviting specialists in modelling and veterans of the araucaria project. The purpose was to share information on the different kinds of modelling tools available and to assess the araucaria data, with a view to developing a new multidisciplinary project that would capitalize on the earlier work and move the management of the forests forward.

After spending a couple of days exploring the araucaria data and hearing from invited experts about specific models in different disciplines, the participants brainstormed the design of a workable model structure to represent the araucaria system. Crucially,

B. Vinceti/IPGRI

J. Cherfas/IPGRI

Rojelio Quilaleo is a community leader in Chiuquilihuin, where* Araucaria araucana *is a vital component of livelihoods.

the model needs to incorporate social and economic parameters, such as the income the Mapuche derive from their livestock and off-farm activities, and connect these factors to biological parameters, such as the seed production of the trees and how that in turn is affected by weather, grazing patterns and so on.

The purpose of the model is to guide management decisions, most of which will be taken by the Mapuche, who are vital partners in the exercise. Ideally it will offer simple, practical recommendations for levels of exploitation of araucaria resources, mainly non-timber forest products, that will be acceptable to the communities in the short term while guaranteeing the survival and even expansion of the resource in the future. But the path from data to recommendations is anything but simple.

Seed production, for example, is determined largely by the amount of rainfall in the preceding two years. Seed production is also a key factor in sexual regeneration, which helps to maintain the genetic diversity of the araucaria forests. The wind carries pollen over considerable distances, so the diversity of the population as a whole is not much affected by local genetic erosion. Diversity in a given forest stand is, however, affected by fragmentation, because seeds are distributed mainly by small rodents, who tend not to move from one fragment of forest to another.

The livestock that the Mapuche raise add yet more complexity. Every year some animals are eaten and some are sold for income; the numbers are governed largely by a community's need to keep the nucleus of breeding females at a sustainable size. But that in turn is affected each year by the amount of forage available. When natural grazing is bountiful, seeds are a small part of the livestock diet, but when grazing is limited seeds may form up to 80% of the diet. Grazing and seed production vary independently, and need to be considered in tandem.

Participants at the workshop considered these and other aspects of the entire system and agreed that the model would have to meet two criteria. First, it needed to capture the structure of the forests in a descriptive, dynamic way that fully identified the linkages and feedback loops among the different factors; genetic, ecological and socioeconomic. Secondly, the model needed to be quantitative, so that it could predict the behaviour of the araucaria system, thus allowing stakeholders not only to guide good use of the forest resources now, but also enabling them to examine alternative management regimes that might be both more productive and more sustainable.

By the end of the workshop such a model had indeed been outlined, with a clear idea of the sorts of variables, criteria and indicators that would need to be measured and studied. The next step is to make the measurements, build the model, and put it to work to help the Mapuche manage their trees and improve their lives. The workshop goal was amply realized, according to Weber Amaral, coordinator of IPGRI's Global Forest Genetic Resources Strategies programme. "We produced a preliminary concept note," he said, "and the workshop participants provided valuable feedback on it. We hope to continue working with the Mapuche and other stakeholders and submit the new project for funding in 2004."

Further information
w.amaral@cgiar.org

Selected IPGRI publications

- 2002 IPGRI Annual Report
- IPGRI Thematic Report 2000–2001
- Annual Report 2002 of the CGIAR System-wide Genetic Resources Programme (*for SGRP*)
- INIBAP Annual Report 2002 (*for INIBAP*)
- A Guide to Effective Management of Germplasm Collections—Handbooks for Genebanks No. 6 (*with Wageningen UR, FAO and SGRP*)
- FAO–IPGRI Plant Genetic Resources Newsletter No. 132–135 (*with FAO*)
- Plant Genetic Resources Abstracts, Volume 12 (*with CABI*)
- Poverty Reduction in Coconut Growing Communities, Volume 1: The Framework and Project Plan (*with COGENT*)
- Forest Genetic Resources—IPGRI's Strategic Action Plan (*in Russian*)
- Programme de ressources génétiques forestières en Afrique au sud du Sahara (programme SAFORGEN)—Réseau "Espéces Ligneuses Alimentaires" (*with SAFORGEN*)
- Neglected and Underutilized Plant Species—Strategic Action Plan of the International Plant Genetic Resources Institute
- Siembra de Soluciones. Tomo 2. Opciones para leyes nacionales de control sobre recursos genéticos e innovaciones biológicas (*with IDRC and DHF*)
- Le Débat des semences. Volume 2. Solutions pour les lois nationals régissant le contrôle des ressources génétiques et des innovations biologiques (*with IDRC and DHF*)
- Plant Genetic Resources In Africa's Renewal: Policy, Legal and Programmatic Issues under the New Partnership for Africa's Development
- Agrobiodiversity Conservation On-farm: Nepal's Contribution to a Scientific Basis for National Policy Recommendations
- Descriptors for Fig (*Figus carica*), Litchi (*Litchi chinensis*), Melon (*Cucumis melo* L.), Ulluco (*Ullucus tuberosus*) (*in Spanish*), Rucola (*Eruca* spp.) (*in Italian*), Pistacio (*in Arabic and Russian*)
- A Training Guide for *In Situ* Conservation On-farm (in Arabic) (*with SDC, IDRC, GTZ, BMZ, FAO and DGIS*)
- What Future for the Crop Genetic Resources of Afghanistan? (*with USAID, FAO and ICARDA*)
- Conservation through sustainable use of fruit genetic resources in Central Asia (*in English and Russian*) (*with FAO and the Uzbek Research Institute for Plant Industry*)
- Conserving and Using Plant Genetic Resources for Food, Agriculture and Income in West and Central Africa
- Ampélographie des vignes autochtones cultivées et spontanées de Tunisie (*with INRAT*)
- Material de apoyo a la capacitación en conservación *in situ* de la diversidad vegetal en areas protegidas y en fincas
- Using Molecular Marker Technology in Studies on Plant Genetic Diversity Studies: Learning Module (*with Cornell University*)
- Análisis estadístico de datos de caracterización morfológica de recursos fitogenéticos. Boletín técnico no. 8
- Memorias del Taller Internacional sobre *Caricaceae* (*with FONTAGRO-IICA*)
- Law and Policy of Relevance to the Management of Plant Genetic Resources. Learning Module (*with SGRP and ISNAR*)
- The International Treaty on Plant Genetic Resources for Food and Agriculture: A Primer for the Future Harvest Centres of the CGIAR (*for SGRP*)
- *Mycosphaerella* Leaf Spot Diseases of Bananas: Present Status and Outlook. Proceedings of the 2nd International Workshop on *Mycosphaerella* Leaf Spot Diseases
- Global Evaluation of *Musa* Germplasm for Resistance to *Fusarium* Wilt, *Mycosphaerella* Leaf Spot Diseases, and Nematodes: Performance Evaluation. INIBAP Technical Guidelines 7 (*in English, French and Spanish*)
- Banana and Plantain Embryogenic Cell Suspensions. INIBAP Technical Guidelines 8 (*in English, French and Spanish*)
- Advancing Banana and Plantain Research and Development in Asia and the Pacific. Vol. 11 (*with BAPNET*)
- Solanaceae Genetic Resources in Europe. Report of two meetings—21 September 2001, Nijmegen, The Netherlands and 22 May 2003, Skierniewice, Poland (*with ECP/GR*)
- Mediterranean Oaks Network. Report of the second meeting, 2–4 May 2002, Gozo, Malta (*with EUFORGEN*)
- INIBAP 2003. *Musa*Doc 2003. (CD-ROM)
- Renforcement de la contribution du fonio à la sécurité alimentaire et aux revenus des paysans en Afrique de l'Ouest. Actes du séminaire régional sur le fonio, 19–22 novembre 2001, Bamako, Mali
- Strengthening Partnerships in Agricultural Research for Development. Proceedings of the GFAR-2000 conference, 21–23 May 2000, Dresden, Germany (*with GFAR*)
- On-Farm Management of Agricultural Biodiversity in Vietnam

These and other IPGRI publications are available in portable document format (PDF) from the IPGRI Web site (http://www.ipgri.cgiar.org/publications/indexpub.htm).

IPGRI's projects

Strengthening national plant genetic resources programmes and networks in the Americas
(*Project Coordinator:* Xavier Scheldeman)
assists countries in Latin America and the Caribbean to build up their capacities to conserve and use plant genetic resources

Strengthening national plant genetic resources programmes and networks in Asia, the Pacific and Oceania
(*Project Coordinator:* Ramanatha Rao)
assists countries in Asia, the Pacific and Oceania to build up their capacities to conserve and use plant genetic resources

Strengthening national plant genetic resources programmes and networks in Europe
(*Project Coordinator:* Lorenzo Maggioni)
assists countries in Western and Eastern Europe to build up their capacities to conserve and use plant genetic resources

Strengthening national plant genetic resources programmes and networks in sub-Saharan Africa
(*Project Coordinator:* Mikkel Grum)
assists countries in sub-Saharan Africa to build up their capacities to conserve and use plant genetic resources

Strengthening national plant genetic resources programmes and networks in Central and West Asia and North Africa
(*Project Coordinator:* Stefano Padulosi)
assists countries in Central and West Asia and North Africa to build up their capacities to conserve and use plant genetic resources

Capacity-building for plant genetic resources conservation and use
(*Project Coordinator:* Issiaka Zoungrana)
develops options and tools for institutional frameworks to strengthen PGR national programmes; facilitates individual and group training and capacity building activities; strengthens structure and coordination mechanisms for carrying out training and capacity building

Global forest genetic resources strategies
(*Project Coordinator:* Weber Amaral)
supports strategic research on the conservation and use of intraspecific diversity of useful forest tree species; it also aims to develop an information system on forest genetic resources

Commodity chains research to promote sustainable livelihoods
(*Project Coordinator:* Pons Batugal)
identifies constraints and opportunities for supporting sustainable livelihoods through IPGRI's projects on cacao, coconut and tropical fruits

Locating, assessing and monitoring plant genetic diversity
(*Project Coordinator:* Devra Jarvis)
develops methods for locating and measuring genetic diversity in cultivated and wild species, combining ethnobotanical with agro-ecological approaches; it also develops methods for monitoring genetic erosion

Plant genetic resources conservation strategies and technologies
(*Project Coordinator:* Ehsan Dulloo)
develops methodologies for complementary conservation strategies for plant genetic resources; improves conservation and management of *ex situ* germplasm collections; develops *in situ* and on-farm conservation methodologies; improves conservation strategies for crop wild relatives

Laws and policies affecting the conservation, use and exchange of genetic resources for food and agriculture
(*Project Coordinator:* Michael Halewood)
supports the development of national and international policies, laws and administrative procedures, and legal instruments, procedures and policies for the CGIAR

Agricultural biodiversity management and production systems
(*Project Coordinator:* Toby Hodgkin)
develops and implements strategies that support the maintenance and use of diversity in agricultural production, and that support conservation and use of neglected and underutilized species

Livelihoods and institutions: social, cultural and economic aspects of agricultural biodiversity
(*Project Coordinator:* Pablo Eyzaguirre)
applies social science research to enhance the contribution of plant genetic resources to the livelihoods and well-being of the rural poor; develops methods for the use and conservation of diversity, particularly in microenvironments and marginal areas

Plant genetic resources information management and knowledge sharing
(*Project Coordinator:* Paul Neate)
seeks to provide global access to the knowledge required for sustainable management and use of genetic resources; offers information services to support the research activities of IPGRI staff and their partners

Understanding and communicating the value and impact of plant genetic resources
(*Project Coordinator:* Jamie Watts)
builds financial and institutional support for plant genetic resources activities worldwide by raising awareness among key target audiences of the role of these resources in sustainable development and food security; assesses IPGRI's impact on the conservation and use of plant genetic resources

***Musa* genetic resources management**
(*Project Coordinator:* Nicolas Roux)
collects the germplasm of *Musa* and its wild relatives; promotes its safe storage, movement and use; develops standardized tools for retrieving and exchanging information on *Musa* germplasm

Genetic improvement of *Musa*
(*Project Coordinator:* Jean-Vincent Escalant)
identifies disease- and pest-resistant *Musa* genotypes, researches *Musa* pathogen diversity, screening methods and molecular genetics and develops improved *Musa* genotypes; provides *Musa* germplasm

***Musa* information management and sharing**
(*Project Coordinator:* Claudine Picq)
supports the production, collection and exchange of information on banana and plantain; publicizes *Musa* issues and the work of INIBAP to scientific and non-technical audiences

Regional support to *Musa* research
(*Project Coordinator:* Richard Markham)
supports INIBAP's global, regional and national networks and other partnerships in Latin America and the Caribbean, in Asia, the Pacific and Oceania, and in sub-Saharan Africa

Supporting global genetic resources conservation and use through the System-wide Genetic Resources Programme
(*Project Coordinator:* Jane Toll)
provides support to the CGIAR system in two areas: (1) genetic resources policy, (2) in IPGRI's capacity as convening centre of the CGIAR's System-wide Genetic Resources Programme (SGRP)

Establishment agreement

The international status of IPGRI is conferred under an Establishment Agreement which, by January 2003, had been signed by the Governments of:

Algeria, Australia, Belgium, Benin, Bolivia, Brazil, Burkina Faso, Cameroon, Chile, China, Congo, Costa Rica, Côte d'Ivoire, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Greece, Guinea, Hungary, India, Indonesia, Iran, Israel, Italy, Jordan, Kenya, Malaysia, Mauritania, Morocco, Norway, Pakistan, Panama, Peru, Poland, Portugal, Romania, Russia, Senegal, Slovakia, Sudan, Switzerland, Syria, Tunisia, Turkey, Uganda and Ukraine.

Financial report

For the year ended 31 December 2003, in US dollars (000s)

Unrestricted	
Australia	162
Austria	207
Belgium	335
Canada	1085
China	120
Denmark	444
France	202
Germany	241
India	75
Italy	1640
Japan	498
Korea, Republic of	50
Mexico	10
Netherlands	1662
Norway	485
Philippines	14
South Africa	50
Sweden	440
Switzerland	702
Thailand	9
USA	500
World Bank	1809
Subtotal	**10 740**

Restricted and Attributed	
ACIAR	273
ADB	826
Belgium	1103
Brazil	10
CABI	10
CAPRi	113
CATIE	26
CDC/World Bank	365
CENICAFE	26
CFC	658
CGIAR Gender and Diversity Program	3
CIDA	28
CIMMYT	82
CIRAD	29
COL	14
CORAF/WECARD	24
CTA	89
DANIDA	13
DFID	1091
DFSC	3
DSE	6
European Commission	1948
European Countries	909
FAO	257
FFTC	7
Finland	59
FONTAGRO	62
France	17
Gatsby Foundation	264
GTZ/BMZ	508
IAO	15
ICARDA	59
ICIPE	17
ICRAF	1
IDRC	305
IFAD	409
IFPRI	3
ISF	25
Italy	162
Japan	435
Korea, Republic of	195
KUL	16
Luxembourg	206
Mexico	3
Multi-donors to Cocoa Project Phase II Preparation Meetings	25
Multi-donors to Genetic Resources Policy Initiative	595
Multi-donors to Global Crop Diversity Trust Campaign	943
Multi-donors to World Summit on Sustainable Development	5
Netherlands	262
Norway	51
NZODA	87
OAS/CICAD	798
Philippines	46
Pioneer	6
Quebec	47
Rockefeller Foundation	101
SDC	607
SEARCA	1
SIDA	111
Spain	18
SPC	8
TBRI	1
Uganda	473
UNDP-GEF	866
UNEP-GEF	499
USAID	237
USDA	15
VVOB	242
World Bank	6
Subtotal	**16 724**
Total Grants	**27 464**

Financial report

Continued

Restricted projects

ACIAR	
Technical support for regional plant genetic resources development in the Pacific	98
Development of advanced technologies for germplasm conservation of tropical fruit species	171
Germplasm health management manual	4
Subtotal	273
ADB	
Conservation and use of native tropical fruit species biodiversity in Asia	482
Developing sustainable coconut-based income-generating technologies in poor rural communities	344
Subtotal	826
Belgium	
Collaborative *Musa* research—KUL	236
INIBAP *Musa* conservation research	370
INIBAP Transit Centre—KUL	149
Musa coordination in Africa	329
Studies on breeding systems (*Phaseolus lunatus*) Phase II	10
Study of diversity (*Colletotrichum* and *Stylosanthes*) Phase II	9
Subtotal	1103
Brazil	
Shipment of coconuts to Brazil	10
CABI	
Plant genetic resources compendium: expert consultation	10
CAPRi	
Strengthening community institutions to support the conservation and use of plant genetic resources in Uzbekistan and Turkmenistan	86
International conference on property rights	27
Subtotal	113
CATIE	
Training in black Sigatoka management	7
Development of resistant plantain	19
Subtotal	26
CDC (proposal to World Bank)	
CGIAR genebank upgrades—*Musa*	207
CGIAR genebank upgrades—SGRP/SINGER	143
CGIAR genebank upgrades for SGRP monitoring	15
Subtotal	365
CENICAFE	
Study on genetic diversity of *Passiflora* and Caricaceae	26
CFC	
Cocoa germplasm utilisation and conservation	116
Coconut germplasm utilisation and conservation	129
Farmer participatory evaluation and dissemination of improved *Musa* germplasm	413
Subtotal	658
CGIAR Gender and Diversity Program	
Gender and diversity project	3
CIDA	
Dietary diversity: a challenge linking human health with plant genetic resources	28
CIMMYT [1]	
Challenge programs—Unlocking genetic diversity in crops for the resource poor	82
CIRAD	
Musa publications	29
COL	
Distance learning intern	8
Distance learning intern	6
Subtotal	14
CORAF/WECARD	
Promoting fonio production in West and Central Africa through germplasm management and improvement of post harvest technology	24
CTA	
Information services/publications	69
Meeting—Plant genetic resources information networking, Benin	9
Plant genetic resources compendium: expert consultation	11
Subtotal	89
Danida	
Effective conservation and use of intermediate and recalcitrant tropical forest tree seed Phase II	13
DFID	
Coconut genetic resources	60
Conservation strategies and technologies	277
Farmer participatory testing of banana IPM options in Eastern Africa	41
Laws and policies affecting the conservation, use and exchange of genetic resources for food and agriculture	124
Livelihoods and institutions: social, cultural and economic aspects of agro biodiversity	186
Regional support to *Musa* research in Latin America and the Caribbean, and in Asia and the Pacific	126
Support to national plant genetic resources programmes in Sub-Saharan Africa	277
Subtotal	1091
DFSC	
Proceedings from the IPGRI/DFSC project on handling and storage of recalcitrant and intermediate tropical forest tree seeds	3
DSE	
Home Gardens publication	1
Publication of the Zschortau seminar	5
Subtotal	6
European Countries [2]	
ECP/GR—Phase VI	599
EUFORGEN—Phase II	310
Subtotal	909
European Commission	
BIOdiversity and Economics for CONservation (BioECON)	45
EPGRIS, European plant genetic resources information infra-structure	20
Establishing cryopreservation methods (CRYMCEPT)	5
EuroCat	1
European crop wild relative diversity assessment and conservation forum	5
Gene-Mine	1
Genetic resources policy and law—ACP	269
Genetic resources policy and law—Asia	171
Support to BARNESA network of ASARECA	15
Support to plant genetic resources programmes in Sub-Saharan Africa—ACP	243
Support to plant genetic resources programmes in the Central and West Asia and North Africa Region—CAC	501
Support to regional *Musa* programmes—ACP	238
Support to regional *Musa* programmes—Asia	336
Support to regional *Musa* programmes—Latin America	98
Subtotal	1948
FAO	
An initiative of the EAPGREN, ECP/GR and GRENEWECA networks	20
Conservation and management of forest genetic resources—a practical guide	2

[1] The funds for the CGIAR Challenge Program 'Unlocking genetic diversity in crops for the resource poor' (now the 'Generation Challenge Program) provided by the EC and the World Bank are channelled through CIMMYT.

[2] These countries supported both ECP/GR and EUFORGEN: Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Macedonia (FYR), Malta, Netherlands, Norway, Poland, Portugal, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom. These countries supported ECP/GR: Armenia, Greece, Iceland, Israel, Latvia, Romania. Luxembourg supported EUFORGEN.

Enhancing plant genetic resources information management and exchange in Latin America and the Caribbean	22
FAO–IPGRI Activities for the consultation with stakeholders and development of a mechanism to facilitate the implementation of the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources	36
International training course on fruit tree genetic resource conservation and use for Central Asia	4
Meeting on 'The evolving role of genebanks in the light of developments in molecular genetics'	2
National programme strategies and *in vitro* conservation manual	2
Pilot testing of GPA national information sharing mechanism in Kenya and Ghana	25
Technical paper for international technical workshop on *in situ* conservation of agricultural biodiversity in Peru	10
Initiative to strengthen activities related to sustainable utilisation of plant genetic resources for food and agriculture	25
Plant Genetic Resources Newsletter	28
Publications for Dresden conference 2000	5
Joint donor/informal panel of eminent expert meeting, Global Crop Diversity Trust	50
Fundraising counselling activities and donor meeting, Global Crop Diversity Trust	26
Subtotal	257
Finland	
Associate expert—Malaysia	6
Associate expert—Malaysia	53
Subtotal	59
FFTC	
Support to germplasm multiplication training workshops	7
FONTAGRO	
Utilization of papaya genetic resources for their improvement and promotion	62
France	
The Montpellier Biotech Platform	17
Gatsby Foundation	
Improving the management of banana and plantain genetic resources for Africa	264
GTZ/BMZ	
Access and benefit sharing: exploring options to implement the International Treaty on Plant Genetic Resources for Food and Agriculture	20
Baseline survey on neglected and underutilised crops in East and Central Africa	9
Forest genetic resources in Brazil and Argentina	83
Home gardens and *in situ* conservation	9
In situ conservation (Morocco component) Phase II	218
Patterns of genetic diversity and genetic erosion of traditional crops in Peru	126
An initiative of the EAPGREN, ECP/GR and GRENEWECA networks	13
Promotion of neglected and indigenous vegetable crops for nutritional health in Eastern and Southern Africa	12
International workshop: managing agricultural biodiversity for sustainable development	18
Subtotal	508
IAO	
An Initiative of the ECP/GR, GRENEWECA and EAPGREN workshop 'Interregional networking for plant genetic resources'	15
ICARDA	
Rebuilding Agriculture in Afghanistan	59
ICIPE	
Conservation of biodiversity of Gramineae and Arthropods	17
ICRAF	
Conservation and use of the mountain agro-biodiversity in the East African highlands	1
IDRC	
Crucible meetings—publications in French and Spanish	23
Musa in situ conservation	32
Regional roundtable on contribution of plant genetic resources in Africa's economic renewal	6
Scientific basis of *in situ* conservation of agricultural biodiversity—Mexico Phase II	8
Strengthening the scientific basis of *in situ* conservation of agricultural biodiversity on-farm—Nepal	191
Symposium on managing biodiversity	6
Utilization of banana (*Musa* sp.) based biodiversity to improve livelihoods in East Africa	39
Subtotal	305
IFAD	
Assessing the impact of improved banana on livelihoods in East Africa	15
Enhancing the contribution of neglected and underutilised species to food security and to incomes of the rural poor	347
Enhancing farmer livelihoods through improved on-farm management of plant genetic resources: developing an innovative conceptual, methodological and operational framework	43
Agro-biodiversity for development in North Africa: role of plant genetic resources in people's livelihoods	4
Subtotal	409
IFPRI	
MSc student—Diversity analysis of finger millet in India	3
ISF	
SINGER—System-wide Information Network for Genetic Resources	25
Italy	
Associate expert—Socioeconomic studies on neglected and underutilised species in Central and West Asia and North Africa	72
Associate expert—Forest genetic resources research	90
Subtotal	162
Japan	
CGIAR genetic resources support program policy research and coordination of the System-wide Genetic Resources Programme	100
Global forestry genetic resources strategies—Research on the genetic resources of bamboo and rattan	110
Plant genetic program in Asia, the Pacific and Oceania	80
Global forestry genetic resources strategies—Research on the genetic resources of bamboo and rattan	123
Plant genetic program in Asia, the Pacific and Oceania	22
Subtotal	435
Korea, Republic of	
Associate scientist	90
Associate scientist—Medicinal plants	45
Associate scientist research grant	17
Medicinal plants in 16 countries in Asia–Pacific	24
Conducting an Asia Pacific medicinal plants research meeting	19
Subtotal	195
KUL	
VLIR projects in Asia	16
Luxembourg	
Genetic resources of broad-leaved forest tree species in South-Eastern Europe Phase II	206

[3] The following provided support for the Cocoa Phase II Preparation Meetings: Masterfoods, USDA, WCF.
[4] The following provided support for the Genetic Resources Policy Initiative, GRPI: Germany, IDRC, Netherlands, Rockefeller Foundation.
[5] The following provided support for the Global Crop Diversity Trust Campaign Phase II: AusAID, CIDA, SDC, Rockefeller Foundation, Syngenta, USAID.
[6] The following provided support for the World Summit on Sustainable Development: CDC, CGIAR Secretariat, IDRC, PARC.

Financial report

Continued

Mexico	
Policy workshop—support to national genetic resources programme	3
Multi-Donors to Cocoa Phase II Preparation Meetings[3]	
Cocoa Phase II preparation meetings expenditure	25
Multi-Donors to Genetic Resource Policy Initiative, GRPI[4]	
Genetic resource policy initiative expenditure	595
Multi-Donors to Global Crop Diversity Trust Campaign Phase II[5]	
Global Trust Campaign Expenditure Phase II	943
Multi-Donors to World Summit on Sustainable Development[6]	
World Summit on Sustainable Development Expenditure	5
Netherlands	
Associate expert—Forest genetic resources research—CWANA	15
Associate expert—Fruit and nut tree complementary conservation strategies	68
Associate expert—Information management, networking and capacity building in conservation and use of forest genetic resources in sub-Saharan Africa	95
Associate expert—Restoration of plant genetic diversity	67
Associate expert—Geographic information systems for plant biodiversity	8
Associate expert—Agricultural economist	9
Subtotal	262
Norway	
Policy unit	51
NZODA	
Pacific plant genetic resources	87
OAS/CICAD	
Rehabilitation and modernization of organic banana production in Alto Beni, Bolivia	798
Philippines	
Introduction, evaluation and adoption of new banana materials in the Philippines	46
Pioneer	
Advisory committee meeting on public domain/public goods	6
Quebec	
Internship on genetic resources policy issues	2
Internship on impact assessment in Uganda	15
Internship on integrating print and electronic publishing	4
Internship on *Musa* germplasm information system	15
Internship on policy and legal issues	11
Subtotal	47
Rockefeller	
Banana weevil resistance mechanisms—PhD student	43
Institutional Learning and Change (ILAC)	2
Musa baseline information project	19
Strategies for genetic transformation of bananas in Africa—workshop	37
Subtotal	101
SDC	
Access and benefit-sharing: SADEC regional workshop	20
Systemwide PGR Policy Research Unit CGIAR and SGRP	123
Enhancing contribution of home gardens to on-farm management of plant genetic resources and to improve livelihood of Nepalese farmers	75
In situ conservation of agricultural biodiversity Phase III	19
In situ conservation of agricultural biodiversity Phase IV	370
Subtotal	607
SEARCA	
Publication of the Myanmar workshop proceedings—2002	1
SIDA	
Genetic resources policy	22
Genetic resources policy	70
Regional roundtable on contribution of plant genetic resources in Africa's economic renewal	2
Seedling solutions publications volume II	5
Advisory committee meeting on public domain/public goods	2
ASARECA EAPGREN baseline survey—8 countries	10
Subtotal	111

Spain	
Training programme	18
SPC	
Taro genetic resources conservation and utilisation	8
TBRI	
Regional information system for banana and plantain for Asia and the Pacific	1
UNDP-GEF	
Participatory management of date palm plant genetic resources in oases of the Maghreb	861
Formulation mission leading to the development of a GEF biodiversity project brief	5
Subtotal	866
UNEP-GEF	
Community-based management of on-farm plant genetic resources in arid and semiarid areas of Sub-Saharan Africa	239
In situ/On farm conservation of agricultural biodiversity (horticultural crops and wild relatives species) in Central Asia	260
Subtotal	499
Uganda	
Novel approaches to the improvement of banana production in Eastern Africa	473
USAID	
Meeting on 'The evolving role of genebanks in the light of developments in molecular genetics'	2
Support to FHIA breeding programme	75
Target project—Increasing productivity and market opportunities for banana in Africa	160
Subtotal	237
USDA	
Collection of germplasm in Bolivia and Guyana	9
Collection of germplasm of *Phaseolus* spp. and *Arachis hypogaea* L. in Venezuela	1
Documentation and management of plant genetic resources in developing countries	2
In situ conservation of wild crop relatives in Paraguay	3
Subtotal	15
VVOB	
Nematology in Latin America and the Caribbean	52
Technology transfer in Eastern and Southern Africa	67
Nematology in West and Central Africa	59
Nematology in Asia	64
Subtotal	242
World Bank	
CGIAR genetic resources policy committee	6
Total Restricted Grants	**16 724**

Professional staff

OFFICE OF THE DIRECTOR GENERAL

FRISON, Dr Emile*	Director General (from 1/8/03)
HAWTIN, Dr Geoffrey**	Director General (to 31/7/03)
FOWLER, Dr Cary	Honorary Research Fellow, Senior Advisor
MACLEAN, Ms Sheryl*	Personal Assistant to Director General
MALGRAND, Ms Karine	Fund Raising Assistant
WATANABE, Dr Kazuo	Honorary Research Fellow
WATTS, Ms Jamie	Scientist, Impact Assessment and Evaluation
WITHERS, Dr Lyndsey	Assistant Director General

SECRETARIAT OF THE CGIAR SYSTEM-WIDE GENETIC RESOURCES PROGRAMME

TOLL, Ms Jane	Senior Scientist, SGRP Coordinator
DAOUD, Ms Layla	Communications and Information Assistant
GAIJI, Mr Samy	Senior Scientist, SINGER Project Leader
SKOFIC, Mr Milko	Database and Programmer Analyst
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The cover shows a market in Khota Baru, Malaysia. Illustration by Greg Morgan, based on an original photograph by Anne Vézina.

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- the Plant Genetic Resources Programme
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