



IPGRI

Annual Report

2002

**International Plant Genetic
Resources Institute**



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Annual Report 2002

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

Foreword

The year was dominated by the World Summit on Sustainable Development (WSSD), held in September in Johannesburg, South Africa. Also billed as Rio Plus 10, the Summit sought to obtain real commitments to meeting the Millennium Development Goals that were set at a conference in New York in September 2000. World leaders agreed there to halve the number of people affected by poverty and those who have no access to clean water by the year 2015.

Agricultural research will play a key role in meeting both goals, and IPGRI was proud to have been asked by the Future Harvest Centres of the Consultative Group on International Agricultural Research to coordinate the participation of the Centres. Thanks to those efforts, and the efforts of others, agriculture was firmly on the agenda and given considerable prominence at the World Summit. IPGRI and FAO also took advantage of the WSSD to launch the campaign for the Global Conservation Trust. This effort to secure the future of genebanks in perpetuity was warmly welcomed in Johannesburg and at the 9th Regular Session of the Commission on Genetic Resources for Food and Agriculture. In part as a result of this support the Trust expects to reach its first goal of US\$100 million in pledges by the end of 2003.

IPGRI is striking out into new areas of work. A large project to study the conservation and use of wild relatives of crops received the go ahead from GEF/UNEP late in 2002. The project will bring together scientists and policy-makers in five countries, which share both mountainous terrain and a wealth of wild relatives, in an effort to ensure that the countries concerned have the capacity to take care of their plant genetic resources. Making use of wild relatives and other species neglected by mainstream science can make a genuine contribution to poverty alleviation, as an IFAD-supported global project on neglected and underutilized species is proving.

As a result of the experience IPGRI and its partners have gained working with minor crops, we feel it is important to address the question of nutrition. To do so, IPGRI staff and consultants are working on a Nutrition Strategy that will enable us to put our understanding of crop and plant diversity to work in the service of dietary diversity. This too will contribute to poverty alleviation, food security and improved human health.

Finally, we should draw attention to some changes in our Board of Trustees. During the year we were saddened by the death of Gene Namkoong, a member of the Board since 1997 and a good friend of IPGRI. We also said farewell to Marcio de Miranda Santos, our Board Chair for the past six years. We are truly grateful for the leadership and advice he provided during challenging times, and wish him well in the future.

The Millennium Development Goals will be hard to meet. They will require all sectors to work together and even then may not succeed. IPGRI remains committed to the basic premise that diversity is the foundation without which we cannot hope to build the improved agricultural systems that the world's poor and hungry need to build themselves better lives.

Geoffrey Hawtin
Director General

Benchaphun Shinawattra Ekasingh
Board Chair

Foreword

Banking on local knowledge

Farmers in Jordan are working with local researchers to document and share the secrets of agricultural survival in a harsh and inhospitable climate.

Walking the baking deserts or stony mountain slopes of Jordan in the summertime, when the temperature can reach 40°C and more, it is hard to believe that come the spring, after winter rains, the land will be carpeted with a wealth of green grass and jewelled flowers. That, however, is the reality in Jordan, and generations of farmers and herders have learned not only to survive but also to thrive there. In doing so the local people have built up a formidable knowledge bank that preserves the most valuable of the lessons learned through their active innovation and experimentation. An IPGRI project, funded in part by the Noor Al-Hussein Foundation, seeks to document that knowledge, preserve it, and make it more widely available.

Nabeel Abu-Shriha and Mahmoud Hadid, working with the Noor Al-Hussein Foundation, set out to discover what farmers and pastoralists from all of Jordan's different regions could tell them. "The diversity of climatic regions in Jordan makes the Jordanian farmer a mobile information encyclopaedia," say the researchers, who sought to understand not only the use of local plants as food and feed for livestock, but also how some are valued as medicines and others for handicrafts. Nor did they neglect associated information, such as the best time of year and place to gather these plants, or the procedures needed to make a particular product.

As in so many parts of the world, genetic diversity is under threat, and for all the usual reasons: intensification of agriculture, changed patterns of land use, physical erosion. Older

landraces and wild varieties, which were widely planted in the past, are in decline. Farmers no longer grow the semi-wild wheat and barley landraces that they used to. Local olive and fig selections are also being abandoned, as are the wild plums and staples of the vegetable garden, such as watermelons and onions. Farmers cite droughts and water scarcity—springs have dried up and flows in some rivers are greatly reduced—as driving the shift away from old and traditional crops. They prefer improved varieties of just a few cash crops, to sell in the markets, and they say that these represent a better use of the available supplies of water.



A farmer in Jordan sows pasture crops. Tapping the traditional knowledge of farmers should help improve livelihoods.
F. Botts/FAO

Local
knowledge



Overgrazing, seen here on the outskirts of Amman, threatens the long-term future of agriculture in much of Jordan.
R. Faidutti/FAO

Farmers are well aware of the root cause of water scarcity. They mention increases in population, which lead to house-building and deforestation, which in turn take both land and water from agriculture. They also shared some of the traditional practices that make better use of land and water. One of these is known as *shigag*, which involves allowing animals to graze narrow strips across the slope of a hillside. Land prepared in this way absorbs more of the winter rain and gives a better harvest the following year. Another technique involves building sand walls along the contours, which again slows down the runoff of rainwater and thus ensures better penetration for the following season's crops.

Low rainfall hits diversity in two ways. First the natural forages that support livestock on the rangelands are less

productive, so the animals may eat into the natural capital of these resources. That damages the land in the long term. Secondly, lack of water stunts the growth of crops planted specifically to provide feed for livestock, which further intensifies grazing pressure on the rangelands.

The surveys also tapped farmers' knowledge about the use of wild plants. In addition to the expected information about sources of food and fodder, and how best to make use of it, the researchers also uncovered some surprises. Wild pistachio, for example, is a source of chewing gum. People deliberately damage the trunk of the tree and collect the thick liquid that bleeds from the wound. This is dried to make a gum that people chew for pleasure and medicinally to treat oral disease and stomach disorders. The use of pistachio resin in this way was once more widespread, but it still survives in a few areas. People also use wild fenugreek flowers, gathered in the winter, to help make a kind of soft cheese known as gee. The flowers, and another additive derived from pine trees, help to coagulate whole milk to make the gee.

Abu-Shriha and Hadid conclude that many of the individual nuggets of knowledge the farmers shared with them could have an impact on the sustainability of farming and livelihoods if copied across the country. And they make a plea for more studies to include participation by farmers. "Not only is it a way of doing better, more relevant research," they say, "it is also a way of empowering communities at the same time." Every development programme, they say, should include an assessment of the impact on agricultural biodiversity and should work with farmers to make use of their experience in building a more sustainable system for making use of the available natural resources.

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Drying without dying: improved options for tropical trees

Studies on 61 tree species in 18 countries have resulted in techniques that give foresters and nurseries access to far greater diversity as they seek to manage forest genetic resources.

The common wisdom about many tropical tree seeds is that they are difficult to store for any length of time. Unlike conventional seeds of, say, wheat, or barley or rice, they do not take kindly to drying and generally fail to germinate unless handled with care and planted quickly after they have matured. Even seeds collected in the forest and taken to nurseries often perish on the journey. Such seeds are called 'recalcitrant', and they have made it difficult for people to manage re-forestation schemes in the tropics: because there is such a narrow range of species from which to produce seedlings, planting schemes suffer a lack of diversity and also may lack species local to the area. But a recently completed project, funded by Danish International Development Assistance (Danida) and coordinated by IPGRI and the Danida Forest Seed Centre (DFSC), discovered that many species are not, in fact, quite as recalcitrant as had been believed. Almost half the species examined can actually be stored for reasonable lengths of time, provided they are treated with care.

The primary goal of the project was to examine in detail the storage biology of economically important tree species, with a view to increasing the diversity of available species. In addition it was vital to improve the abilities of partners to work with these tree seeds. So training and sharing information was an integral component of the project from the start. At an early workshop in 1996 the partners came together to define a screening protocol that would be used to test all the species. The protocol established ground rules for collecting and handling seeds and enumerated the many different pieces of data that researchers needed to collect. It also set out specific methodologies to adhere to when drying seeds and then when testing their germination. By adopting a single protocol the partners ensured that data gathered around the world by different centres, and from different species, would be comparable.

In the end, 22 tree-seed institutions from developing countries participated directly in the seed-testing aspects of the project. Other centres in more developed countries acted as 'replicating partners', offering training in the agreed protocol and confirming the research results where possible.

The project focused especially on valuable species that were also of social importance, because these are the species people are most interested in.

Fruits of *Syzygium cumini* being prepared for initial trials in Tanzania.
K. Thomsen





**Women in Ghana carrying shea (*Vitellaria paradoxa*) fruits, one of the more important forest products.
P. Lovett**

The big surprise was that many species could indeed be stored, if handled properly. Just under half (46%) of the 61 species screened had seeds that could be dried and stored. A

further 41% were sensitive to desiccation and did not survive, with results for the remaining 13% still inconclusive at the end of the project. By making use of this information in seedling nurseries, foresters can begin to think about extending the range of species they work with in re-afforestation schemes.

In addition to the training that replicating partners were able to offer to the institutes they worked with, the project also organized three regional training workshops, in Africa, Asia and Latin America. In all 53 people from 32 organizations benefited from these workshops and were able to put their enhanced skills to work.

One of the great successes of the project has been the way that it offered a platform for the publication and sharing of results. A Web site (www.dfsc.dk) gave researchers and others access to the latest results. A newsletter, published twice a year by IPGRI and DFSC, not only provided a home for published papers but also extended the scope and reach of the project partners by informing them of meetings and research relevant to the work. For example, other scientists, who were not part of the project but who were working with recalcitrant seeds, submitted short communications and other information. IPGRI and DFSC hope to continue publishing this newsletter even after the end of the project, as a way of extending the life of the International Tropical Forest Recalcitrant Seed Network that the project gave birth to.

At a final workshop the partners discussed the lessons they had learned during the lifetime of the project and the challenges they now faced. The replicating partners noted that sometimes seeds had died or been damaged as a result of lengthy delays during transit from the collecting institute. Ways will have to be found to overcome this, and the partners are thinking about modifying the protocols to improve conditions during transport from the field sites to the laboratories. Germination was also a problem for some species. Obviously not all species are identical in their requirements and it may be necessary to identify different procedures for different species.

Overall, the final workshop identified three objectives that future work should address. First is the need to scale up the use of target species in planting programmes, which will mean improving the collection and supply of seeds, better nursery practices, and changes to the way seedlings are planted and cared for. These efforts, however, will be valuable only if they are a response to increased demand, which will require a public awareness programme to disseminate the results, conclusions and recommendations of the project to those involved in tropical forestry and to the general public. And, finally, there remain outstanding research questions that will require further study to improve the use of high-value tropical tree species.

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A new project designed to help national governments navigate the maze of policy options around genetic resources is getting under way.

The International Treaty on Plant Genetic Resources for Food and Agriculture, adopted by the member countries of the Food and Agriculture Organization of the UN in November 2001, is the latest formal recognition of the vital contribution that genetic resources make to food security, poverty alleviation and environmental sustainability. While the Treaty, with its emphasis on multilateral access and equitable benefit sharing, is welcome, it creates yet another factor that national governments have to take into account as they frame their laws and policies about genetic resources. IPGRI has long been involved in the analysis and synthesis of policy options but in 2002 a new project, the Genetic Resources Policy Initiative (GRPI), got under way in earnest.

GRPI is supported by governments and foundations and is jointly executed by IPGRI and Canada's International Development Research Centre (IDRC). It is rooted in the idea that regulation of the use, control, management and conservation of genetic resources has become increasingly complex and fragmented across different policy-making bodies in any given country. In part these challenges arise from technology. New ways to divide and make use of genetic resources, such as the direct manipulation of DNA, bring forth new arguments about the ownership and use of new products and processes. In part the challenges arise from socioeconomic changes as newly empowered stakeholders, such as farmers, indigenous peoples and even governments, raise their own concerns and demands.

Faced with the clamour of competing claims, government departments and policy-makers do their best but often lack the basic evidence on which to make policy decisions. They may also have very limited budgets, and in some cases are wary of developing any policies



Members of the GRPI task force and appraisal team in Zambia. Left to right: Prudence Musonda, Dr Judith Lungu, Sande Ngalande, Ronald Msoni, Mwendabai Uyoya, Dr Catherine Mungoma, Brian Mwitwa Chimbanga, Dr Walter de Boef, Lovemore Simwanda and Godfrey Mwila. J. Estrella/IPGRI

whatsoever for fear of attracting public disapproval. Often individual policy-makers go their own way and do not consult either with colleagues or with other stakeholders. The result can be an uneven patchwork of policies and laws that reflect uncoordinated and competing priorities.

GRPI aims to use a two-step process to help governments and regional groupings to build a more coordinated policy platform. The first phase of the project is the Southern Country Demand Analysis. This consists, essentially, of getting to know what it is that national partners need in the way of genetic resources policy. It begins with primary contact, usually in the department of agriculture, through which the project gets in touch with as wide a range of stakeholders as possible. Missions by GRPI staff to the country generally follow and involve preliminary meetings with 20 to 30 representatives of various interested parties. These include non-governmental organizations (NGOs), local communities, farmers' organizations, government departments, private sector interests, Future Harvest Centres, internationally funded projects and so on. In these initial meetings the GRPI team probes the willingness of each party to work with others in multi-stakeholder, multi-sectoral processes. If they are willing to work together then GRPI supports them to create a small national GRPI task force to undertake the demand analysis.

"So far, almost everyone has been willing," commented Michael Halewood, who oversees the project and has helped GRPI task forces start work on demand analysis in Nepal, Peru and Zambia. (Work in Egypt, Ethiopia and Vietnam was due to start early in 2003, as was the establishment of the GRPI project office in IPGRI's regional office for sub-Saharan Africa in Nairobi, Kenya.) The demand analysis covers a wide range of questions, assessed through interviews and questionnaires. What laws and policies currently affect genetic resources? Who is doing what with respect to genetic resources? What are the hot topics in genetic resources that the country will have to address in the near future? What resources have they got to address those issues? What resources do they need?

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).

Collaborating institutions (hosting task forces):

- Institute for Biodiversity Conservation and Research, Ethiopia
- National Agriculture Research Council, Ministry of Agriculture (NARC), Nepal
- Instituto Nacional de Investigación Agraria (INIA), Peru
- Ministry of Agriculture and Cooperatives, Zambia
- East African Plant Genetic Resources Network (EAPGREN)
- Genetic Resources Network for West and Central Africa (GRENEWECA)

Discussions with partners in the Comunidad Andina, Egypt and Vietnam, are continuing.

The demand analysis will culminate in a national workshop at which the interviewed parties come together to use the results of the survey to agree a list of priority areas for action and a work plan to undertake them. That meeting ends with the expansion of the task force to include still more representatives of different partners, to guide the projects in the work plan. Carrying out the activities identified by the demand analysis and incorporated into the

work plan by the stakeholders constitutes phase 2 of the GRPI project in each country. It is anticipated that phase 2 will take between 3 and 4 years.

Groundnuts—originally from South America—are a vital crop in Zimbabwe. This two-tone variety is called 'Zaire', further evidence of the movement of varieties that underpins agricultural development.
A. King/IPGRI



The report and work plan formulated at the end of the demand analysis will be formally submitted to the government and regional groupings. The actions and research will also come to a GRPI International Steering Committee, which will evaluate each country's plans and may, if necessary, offer suggestions as to how different GRPI countries could work together to achieve synergies and efficiencies.

And when it is all over, what will the outcomes be? To some extent that will depend on the needs identified by each country. Broadly speaking, however, the project foresees several different kinds of output, beyond the surveys. There will be research papers and training materials. Domestic governments will be more capable of formulating their policies on genetic resources and of ensuring that all parties are consulted and represented in a coordinated system. The project may have a core of draft national policies and laws related to genetic resources which, it is hoped, will be part of an Internet-based brokerage service that will link national policy-makers, trainers and researchers to a compendium of documents of various types, and that will enable them easily to communicate with one another. Ultimately, though, these are simply steps on the road to a framework within which the use, control, management and conservation of genetic resources are based on a sound foundation of fair and effective policies and laws.

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Traditional foods, modern diets and the conservation of biodiversity

Making greater use of minor crops is just one aspect of a new approach that forges links between nutrition, health, conservation and biodiversity.

In India, food scientists use ancient ingredients and modern technology to prepare snacks for sale in local supermarkets. In Bolivia, farmers plant grains that are more nutritious than both wheat and soybean. In Egypt a community-based seed system is supplying improved oregano seeds to the farmers who in turn supply a growing market for herbs. What unites all these activities is that they are making the most of plant species that have been bypassed by mainstream agricultural research and development. They are just three examples from a global study coordinated by IPGRI and supported by the International Fund for Agricultural Development (IFAD).

The programme has grown from modest early beginnings. The Italian government supported an effort to investigate neglected and underutilized species of the Mediterranean region some 10 years ago. That transformed a wild salad-leaf, rocket, into a fashionable foodstuff and gave new life to the hulled wheats, especially *farro*. The lessons learned and approaches adopted in that early work have now been applied in several IPGRI projects and they feed into a new strategic direction for IPGRI, one that focuses squarely on nutrition. The IFAD study is only in its first year, but has already made considerable progress in all of its areas of interest.

One important objective of the study is to make sure that local people can improve their livelihoods in a sustainable way by working with the target species. The people at the start of the process of agricultural production are the ones doing the vital work of maintaining and growing the diversity, and yet at present they reap very little of the rewards for doing so. An earlier case study of the *filière*, or commodity chain, for capers in Syria brought to light some of the problems. Picking wild capers is typically a job for young children in marginal areas. They get about Euro 0.70 a kilogram from intermediaries, who do a little preliminary processing and then sell the capers to a Syrian trader for about Euro 1.30 per kg. The Syrian trader sells to a Turkish trader for about Euro 2.00 per kg.

The Turkish trader does the final processing and packaging and sells into the European Union market, where consumers pay the equivalent of about Euro 27.00 per kg. That is a final markup of more than 3800% from the child gathering the capers to the shopper in the supermarket. If just a little more of that could be passed back to the families it would make a



In Bolivia Fundación PROINPA holds 2727 varieties of quinoa. All are being evaluated to see which would be most useful. A. King/IPGRI

Linking nutrition and biodiversity

huge difference to their standard of living—and enable them to buy the food they need to be healthy. So working with commodity chains to ensure that farmers get a fair return is an important component of the project.

At the other end of the chain are consumers, whose needs may be very different. The Kolli Hills in the centre of Tamil Nadu state, in the south of India, have seen some remarkable developments thanks to the IFAD project and the M.S. Swaminathan Research Foundation. As a result, people in nearby towns and cities now have access to cheaper and more nutritious foods based on various kinds of millet.

Millets underpin much of the agriculture in the Kolli Hills, and under the guidance of the project, farmers' self-help groups were established to promote and exploit these small-grain cereals. The groups identified two products as worthy of further development, malt made from a finger millet and a mixed-grain preparation that is particularly useful to diabetics. The groups are organizing micro-finance schemes to enable them to buy simple milling and processing equipment, which will give them a bigger share of the added value. And food technologists have worked with the people in the groups to develop new products, such as biscuits and snacks, that make use of the processed millet grains.

One task the project still has to address is that urban shoppers may not be aware that millet-based products are often healthier than more expensive alternatives. Urbanites often tend to associate traditional foods with the peasantry and 'backwardness' and it will take concerted educational efforts to change their minds. The result, however, is a win-win virtuous circle that protects genetic diversity and the wider environment, offers farmers a better standard of living, and thus better health, and also offers shoppers the chance to buy healthier food.

Linking urban and rural dwellers in the quest for a better life

A bold new proposal arising from IPGRI's successes achieved to date is under development in the Institute's office for sub-Saharan Africa. Bringing together a wide range of partners, the goal of the project is to improve urban health and rural livelihoods in Africa. It will do so by raising the awareness of the value of traditional food species for health and nutrition and influencing national and international food policies and research agendas to take note of this. It will also gather and develop recipes and improve marketing channels so that these foods can be used in urban diets. Thus, by increasing the demand for traditional foods, the project will increase the incomes of farmers and at the same time sustainably conserve genetic resources, in line with IPGRI's mission. The project plans to take an innovative approach, for example tapping into a growing global interest in cooking shows on TV, and with a variety of national and pan-African components. Imagine the bambara groundnut, cowpea leaves and sorrel reclaiming their central place in the modern African diet and demonstrating that good value, good taste, good health, and culture can thrive together.

It is the prospect of so many multiple benefits that has increasingly led IPGRI to work more on nutrition. The African Leafy Vegetables project is just one example that has shown that locally important plants, such as cat's whiskers (*Cleome gynandra*) and black nightshade (*Solanum nigrum*), generally contain considerably more minerals and vitamins than introduced crops such as cabbage. Promoting the use of indigenous crops can improve the health of farming families directly and, by stimulating demand in nearby cash markets, can also contribute to better incomes. Similar approaches are possible throughout the developing world, which is why during 2002 IPGRI worked with Honorary Fellow Professor Tim Johns, taking a sabbatical from McGill University in Canada, to develop a new nutritional strategy.

The crucial observation is that worldwide, peoples' diets are becoming simpler, less varied and with lower nutritional value. This is especially so as people move from rural to urban areas. The simpler diets are often energy rich but nutritionally poor, and the result is poor



**The Karanje Limuni Women's Seed Saving Group in Santa Monica, Kenya, is helping to ensure that people can buy good seed of local leafy vegetables.
A. King/IPGRI**

health, with the incidence of obesity and diseases such as diabetes and heart disease growing dramatically among the urban poor. In diet, as in agriculture, diversity is often of value in its own right. A rounded nutritional strategy will make use of a mutually reinforcing cycle of improvement.

As an example, imagine boosting the demand for a traditional rural foodstuff among city dwellers. The people who buy the food enjoy greater health. That gives them a certain independence and will probably contribute to their ability to earn a living themselves. The farmers who grow the food, and the people who process and sell it, will make more money too, which will enable them to enjoy better health, and will contribute to keeping social and cultural traditions alive. The need to grow the food will promote its conservation and thus add to the protection of the environment, and that too can help maintain traditions. And finally, a better environment also contributes to the nutrition and health of people in cities and rural areas alike.

There is enough evidence, from IPGRI projects and elsewhere, to suggest that a strategy to link nutrition, health and the conservation of biodiversity has much to recommend it. People need a diet that gives them quality as well as quantity, and affordability is often the limiting factor. Urban dwellers, who buy their food in a cash economy, may be in an even worse position than those who have access to land in rural areas. If the connections can be made it will benefit everyone.

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Tree conservation strategies for sub-Saharan Africa

Wide-ranging pilot studies of important tree species in three countries have indicated the best options for ensuring that they will continue to provide useful goods.

IPGRI and FAO jointly established the sub-Saharan Africa Forest Genetic Resources Programme (SAFORGEN) in 1999. One of the key requirements to emerge from initial workshops with partners was the need to develop conservation strategies for selected species. In August 2000 a project funded by UNEP began in three countries—Benin, Kenya and Togo—to examine the status of target species in each country. Preliminary results are now in and have indeed resulted in recommendations for conservation strategies.

Each country chose two tree species, one with a wide distribution and one more geographically restricted. In Benin the choices were two fodder trees, *Khaya senegalensis* and *Azizelia africana*. Kenya chose two food species, *Dialium orientale* and *Tamarindus indica*. In Togo the choices, *Alstonia boonei* and *Nauclea latifolia*, are used primarily as a source of medicines against malaria. The choices thus fit with SAFORGEN's existing sub-networks, which concentrate on species used as food, medicines, fodder, and wood and fibre. The decision to concentrate this study on species important for food and medicine was deliberate, as malnutrition and disease are among the most pressing problems for people in the region.

In each country the same sorts of parameter were studied, with slightly different emphasis depending on local conditions. These included the distribution of the target species, the level of threat, including patterns of use, reproduction and seed dispersal, natural regeneration, and levels of diversity within populations and the species as a whole.

Benin

A. africana is broadly distributed while *K. senegalensis* is restricted to the northern part of the country. Both species are used primarily to feed animals, by lopping branches, although they are also used for timber and medicinal purposes. The level of threat varied

Project partners

- National University of Benin, Benin
- Kenya Forestry Research Institute, Kenya
- CERPHALATA (NGO), Togo

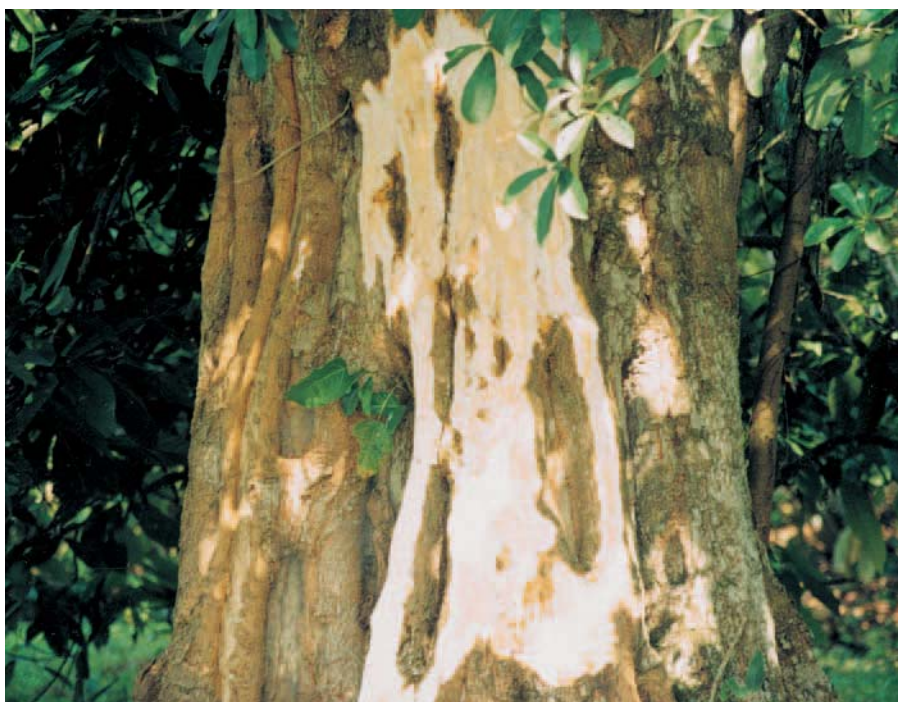


The leaves of *Nauclea latifolia* are valued in Togo for their medicinal properties.
O. Eyog-Matig/IPGRI

across the country. In the north more than 97% of the specimens of *K. senegalensis* showed some evidence of harvesting branches. To conserve the species the project suggested two options. First, both can be conserved in forest reserves and national parks, where the threat is lower. And secondly, in northern areas, the species can be conserved in plantations, possibly with improved selections, which would take the pressure off natural populations.

Kenya

T. indica and *D. orientale* are both harvested for their fruit, which may be eaten alone as pulp or juice or used to flavour other dishes such as porridge. Both species are in decline, but of the two *D. orientale* is at greater risk. In part this is because its range is more restricted, to just the coastal region of Kenya. It is also threatened by urban expansion. The project recommended that *ex situ* conservation measures be implemented as soon as possible to establish collections of seed in genebanks and perhaps also trees in field genebanks. For *T. indica*, which is more widely distributed and less threatened, *in situ* conservation within gazetted forests, which have been officially designated for protection, and *ex situ* conservation in genebanks were recommended.



Debarking specimens of *Alstonia boonei* for medicinal use is a serious threat in Togo.
O. Eyog-Matig/IPGRI

Togo

As in the other two countries, the surveys confirmed that one species, *N. latifolia*, is widely distributed all over the country, while *A. boonei* is restricted to the less extreme climate in the southwest. Even there it is not common, and many species have had most of their bark removed because it is believed to be medicinal. It is also logged for timber and fuel. *N. latifolia* is uprooted for medicinal purposes, and people eat its fruits too. Both species are at risk, particularly because natural regeneration is very low. *In situ* conservation was felt to be the best option for safeguarding *N. latifolia*, especially in the northern areas where it is both relatively plentiful and under most severe pressure. For both species, the project recommended that the way they are harvested be examined and, if possible, improved.

SAFORGEN members

At the end of 2002 the following countries had appointed national coordinators and participated in one or more of SAFORGEN's activities: Benin, Burkina Faso, Chad, Congo (Brazzaville), Ethiopia, Gambia, Guinea, Kenya, Madagascar, Mali, Niger, Senegal, South Africa, Sudan, Togo and Uganda.

Further information
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Start with a Seed: the Global Conservation Trust

Global Conservation Trust

After two years of stakeholder discussions and feasibility studies, the campaign for the Global Conservation Trust was formally launched in 2002. The campaign, a partnership between IPGRI (for the CGIAR) and FAO, seeks to establish an endowment to support the conservation—in perpetuity—of the world's crop diversity collections. The goal is to raise US\$260 million from multilateral and bilateral agencies, corporations, foundations and governments. As well as conservation, the Trust will support training and other upgrading assistance to crop collections in need.

The partners announced their plans to establish the Trust at the World Summit on Sustainable Development in Johannesburg. The announcement followed on the heels of the release of a study by Imperial College, UK, 'Crop Diversity at Risk: the Case for Sustaining Crop Collections'.

The study drew largely on information gathered by FAO in 2000 from about 100 countries. Its findings were alarming: not only is crop diversity disappearing from the fields, but also a large proportion of the crop resources 'safeguarded' in genebanks around the world could soon be lost due to lack of funding. The report found that while the number of samples held in crop collections has increased in 66% of countries since 1996 (the last time FAO gathered such data), genebank budgets have been reduced in 25% of countries and have remained static in another 35%. Not surprisingly, the majority of budget cutbacks have taken place in the poorest countries, which are home to the diversity of the world's most critical crops.



At a community genebank in UMP District, Zimbabwe, local people clean the seeds before storage. The Trust encourages genebanks to work with farmers.
A. King/IPGRI

Efforts to underwrite the future of globally important collections of plant genetic resources are moving forward.

The issue of regeneration is perhaps even more revealing. The new data show that some 52% of developing countries have more samples in need of urgent regeneration than they did in 1996. Among developed countries, 27% reported increased need.

Some genebanks have barely averted disaster, when duplicate seeds held in other lands have been used to replace collections lost in the course of war or natural disaster. Rwanda, Burundi, Somalia and Romania provide a few such examples. Other genebanks have lost or are at risk of losing portions of their collections, Albania, Fiji and Nigeria among them.

The state of genebanks in Latin America

Until now, the world community has dealt with genebank crises in an *ad hoc* manner. The Imperial College report made it clear that such an approach cannot work indefinitely. Even some of the world's largest genebanks are facing severe budget cuts: the Future Harvest Centres of the Consultative Group on International Agricultural Research (CGIAR) have seen their core funding—the funds that support the genebanks—drop by 50% since 1994. The report recommended the establishment of a global endowment fund for *ex situ* conservation as the best way to ensure humanity's ability to meet the long-term nature of its conservation needs.

Public awareness is at the heart of the campaign to establish the Global Conservation Trust. It is a vital way to reach donors—particularly 'new' donors who are likely to be unfamiliar with genebanks and their importance. In addition, the intensely political nature of genetic resources issues and the great interest shown by countries in the Trust means that it is critical to ensure openness and transparency in every step taken towards its establishment.

Global media coverage of the Trust has been intense, spanning five continents. Material developed for the Trust's communications programme received a bronze award in 2002 from Agricultural Communicators in Education (ACE), an international professional society of communicators. (See the Trust's Web site at www.startwithaseed.org.)

A lengthy process of research and consultation with stakeholder groups during 2002 examined options for the oversight and governance of the Trust, as well as for stakeholder involvement in decision-making, structure, financial management, allocation of resources, tax efficiency and transaction costs. At the request of and in consultation with a number of key stakeholder groups, FAO and IPGRI, on behalf of the CGIAR, appointed an Interim Panel of Eminent Experts (IPEE) to oversee the establishment of the Trust.

Research by Francisco Morales, assisted by Tito Franco, both at IPGRI's office for the Americas, revealed the major threats to the *ex situ* conservation of plant genetic resources in the region. Morales surveyed 103 genebanks, about 40% of those located in the region. The survey clearly demonstrated that the majority (85%) of the curators who replied believe that their infrastructure is not adequate for conservation purposes. The second most important constraint was the lack of adequate seed processing and conservation equipment. A majority of respondents also mentioned pests and diseases and abiotic factors such as drought and flooding, as significant challenges.

Genebanks in the region are also adversely affected by lack of official support, trained personnel, technical support, and lack of proper facilities to conduct strategic and basic research. The lack of documentation and pertinent information on plant genetic resources management is contributing to the loss or deterioration of plant genetic resources in the collections.

Morales concludes that proposals for donor funding should pay close attention to the upgrading needs identified in the survey. Otherwise, the genetic erosion occurring in genebanks could begin to rival that which is already going on in the field.

The IPEE will decide the preferred legal status, governance and financial mechanisms for the Trust, based on consultations with a large number of governments, individuals and organizations, South and North. The Interim Panel will also decide upon questions like the proper balance to be achieved in the allocation of funds. The Panel will hold its first meeting in early 2003. (Further information on Trust governance can be found at <http://www.startwithaseed.org/pages/governance.htm>.)



**Workers clean seed before it enters the national Andean Grain genebank in Peru.
A. King/IPGRI**

The Global Conservation Trust initiative was presented to the Ninth Regular Session of the Commission on Genetic Resources for Food and Agriculture in October 2002. The Commission strongly endorsed the initiative, saying in its report: “This initiative was universally appreciated and supported, and appeals were made to donors to assist in the establishment of the Trust. The Trust would, it was hoped, attract new and additional funds from a wide-range of donors. The Commission stressed the need for the Governance of the Trust to work in a transparent and efficient manner, as

proposed, and requested progress regarding the Trust to be reported at sessions of the Inter-governmental Technical Working Group.” The Trust also received “consistently strong statements of support from the floor” when it was presented to the FAO Commission on Plant Genetic Resources for Food and Agriculture during its meeting from 14 to 18 October.

By year’s end, the Trust had received significant commitments from public and private sector sources and from developed and developing countries. It is expected that the Trust will reach its first goal of US\$100 million by the end of 2003. In that case, the first call for proposals from genebanks will take place in mid-2004 with the initial grants awarded at the end of that year.

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New banana project on target

A package of new varieties, new technologies and new approaches to marketing will improve the livelihoods of banana growers in Africa.

The disease resistant and high-yielding varieties of plantain and banana developed over the past few years represent the most significant scientific achievement in the history of breeding *Musa*. They are between two and five times more productive than traditional varieties and yield well without the need for labour-intensive management, which makes them especially useful in countries ravaged by AIDS. Along with other techniques, such as the bulk production of disease-free planting material and improved post-harvest handling and processing, the new varieties could make an enormous contribution to food security and poverty alleviation in sub-Saharan Africa.

In 2002 a joint project of IPGRI and the International Institute for Tropical Agriculture (IITA), funded by the Technology Access Fund of the Technology Applications for Rural Growth and Economic Transformation (TARGET) programme of the United States Agency for International Development, started to roll out a package of benefits in four African countries: Cameroon, Ghana, Mozambique and Tanzania.

The starting point for the programme is the new varieties. These were selected with partners in each participating country to ensure that they met the farmers' needs. Thus in Tanzania the choices are good for cooking and brewing, while in Mozambique dessert varieties were chosen with an eye on the nearby export market in South Africa. IPGRI supplied virus-tested *in vitro* cultures to a commercial laboratory in South Africa, which is bulking them up so that it can send thousands of rooted plantlets to specially built weaning facilities in each country. There the plantlets are weaned off their special nutrients, hardened off, and grown to about 30 cm in height before being despatched to the participating farmers.

Roughly 500 farmers are taking part in each country, about 50 in each of 10 villages. They get not only the improved varieties but also considerable amounts of training. The project is working with community extension workers and representatives of the farmers, training these trainers so that they can spread the word about how to make best use of the new varieties. Training covers managing the plants for maximum productivity and, more importantly, improving the market quality of the fruit they harvest.

The project is also working with the communities in each village to develop and promote new ideas about sales and marketing. The focus will be on adding value to the crop. So, for example, communities will learn how to make sun-dried banana chips and banana juice, both of which extend storage and improve the value of the harvest. There are also plans for communities to develop handicrafts that make use of banana fibre and the like.

The final strand is particularly innovative as it closes the cycle, making the project both self-sustaining and capable of rapid expansion. At the



Women from the village of Loum 99 in Cameroon gather to unload healthy plants supplied by the project. A. Nkakwa Attey

for improved livelihoods
for banana growers

Ignatius Nkondung, one of five extension agents recruited by the project in Cameroon. He works with about 100 farmers in two villages, to whom he is taking a variety called FHIA 17.
A. Nkakwa Attey



end of the first year each farmer will be expected to return one sucker for every plant he or she received. These will go back to the central facility in each country, where they will be cleaned up so that they can be given to a second wave of farmers. Thus in the second year another batch of farmers will be given clean planting material of the improved varieties. Project workers expect this to carry on beyond the life of the project to ensure a continual and expanding supply of improved planting material.

That's the plan, and implementation has been going extremely well. Project sites have been identified in each country and arrangements made to manage them. Some 64 000 plants of eight varieties were bulked up and rooted, ready to be sent to the farmers early in 2003. Workshops in the villages have introduced the ideas and gained the support of the farmers and extension workers.

Experience in more limited trials gives great cause for optimism. At the core are the resistant varieties, which can restore the productivity of areas ravaged by black Sigatoka disease. Clean planting material has already proved effective against nematode worms and weevils in trials in Cameroon, Ghana, Tanzania and Uganda. In Uganda, more than 90% of farmers who used clean planting material found the mature plants more vigorous and robust and the fruit of higher quality. In Ghana, clean planting material was an essential component of an improved management package that increased farmers' incomes by about US\$475 a year. Marketing too has proven its worth. Low-tech options for storage, such as banana chips and banana juice, have been rapidly adopted in trials in Uganda and Tanzania. Another idea pioneered in Uganda, selling bananas of some varieties singly, instead of by the bunch, not only allows farmers to market small bunches that were previously unsaleable, but also meets the needs of the urban poor, who may not be able to afford to buy a whole bunch at a time. The need, now, is not for further trials but for the wider promulgation of a package of best practices.

On conservative estimates the project could easily enable each farmer to earn an extra US\$80 in the first year. By the end of the second year, the project could be helping the farmers involved to earn an extra US\$1 million in total, with the ability to continue rapid deployment beyond the life of the project. Thus there is every chance that the project will achieve its goal of improving the food and income security of small-scale farmers in selected countries in sub-Saharan Africa.

Project partners

Implementing agencies: IPGRI, IITA

Cameroon: Centre Africain de recherche sur bananes et plantains (CARBAP); Cameroon Gatsby Trust

Ghana: Council for Scientific and Industrial Research; World Vision International

Mozambique: Instituto Nacional de Investigação Agronómica; Extension Department, Ministry of Agriculture and Rural Development; University Eduardo Mondlane; Institute of Tropical and Subtropical Crops; Technoserve

Tanzania: Agricultural Research and Development Institute; Adventist Development and Relief Agency; FAIDA; Kagera Community Development Project

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Participating in better breeding efforts

Two system-wide programmes came together in 2002 to examine the quality of science in participatory plant breeding. The verdict? It is good.

Participatory plant breeding explicitly brings together farmers, plant breeders and development personnel in the effort to create and disseminate improved varieties and to strengthen farmers' own local materials. The idea is that each brings special insights and skills to the effort. As a result, their combined whole contribution will be greater than the sum of its parts. To what extent, however, is this wishful thinking? Perhaps not at all, if popularity is any judge. From roughly nowhere 10 years ago, by 2002 there were about 120 such projects going on around the world, with 80 of them well documented on the Web site (www.prgaprogram.org) of the CGIAR's Program on Participatory Research and Gender Analysis in Technology Development and Institutional Innovation (PRGA). Then again, maybe that popularity merely reflects fashion—among donors and executing agencies.

Prompted by these concerns a System-wide Review of Plant Breeding Methodologies in the Future Harvest Centres recommended that "Centres should evaluate the use of [participatory plant breeding] as an organic part of each Centre's entire breeding programme". In response, the PGRA and the System-wide Genetic Resources Programme (SGRP) got together to organize a week-long meeting that was held at IPGRI's headquarters. To have two system-wide programmes co-host a meeting was somewhat unusual. Yet it encouraged a diversity of perspectives, and ensured that the links between plant breeding and crop diversity would be integral to the review process, rather than simply *ad hoc*. And of course an integrated, diverse, holistic perspective is exactly the basis on which farmers manage their land, their use of natural resources, their households, and so on.

Although the meeting was small—just 35 participants—it brought together the leading people in participatory plant breeding from the Future Harvest Centres and, as would be expected given the topic, expertise from farmers' organizations, non-governmental groups, university departments, development workers and national agricultural research systems. A

total of 17 papers were presented, grouped by the planning committee into six umbrella topics. What follows is a brief selection. The proceedings, including all the papers and discussions and full attributions of the multidisciplinary teams involved in so much of the research, is available at www.prgaprogram.org/participatory.htm.

Priority setting

Participatory plant breeding is founded on the shift from technology push to demand pull. But if breeders are really to



Community leaders in Takaka, on the altiplano of Bolivia, helped organize their participation in an evaluation of cañahua, an Andean grain related to quinoa.

A. King/IPGRI

Participatory Plant Breeding

comprehend what farmers are demanding they need to have a deep understanding of the farmers' production systems and goals, and how they reach their decisions. In Nepal's western Gulmi district, Li-Bird (a local NGO), with support from IPGRI/PRGA and partners, has worked to establish *Krishak Anushandhan Samuha*, or Farmers' Research Committees. These act as a bridge between farmers and researchers to plan, implement and evaluate participatory maize breeding. The farmers in Nepal have used mass selection to isolate three new maize varieties from diverse material they were supplied with, and these are being widely adopted.

In East Africa too, farmers have been working on maize. Commercial varieties do very poorly against old favourites, which prompted researchers from the International Maize and Wheat Improvement Center (CIMMYT) to get together with farmers and the formal sector in a breeding programme. By engaging farmers early in the selection process many people assess many breeding lines at many locations. After three years, some interesting observations have emerged. Breeders seem less interested in the process than farmers, perhaps because these experiments generate large, messy data sets that the breeders find hard to handle. More interestingly, there was little correspondence between the evaluations of the farmers and those of the breeders. For farmers, yield accounts for only about half of the total score they give a variety; many other criteria are important. Breeders seem focused on yield *per se*. This suggests that one reason commercial varieties do not do well is that they do not meet farmers' needs.

Scale-up

Putting a few farmers in touch with a breeder or two is one thing. But in north-eastern Brazil 1500 families in more than 70 communities are working with the cassava improvement programme to try new varieties. Each farm grows plots of 50 plants of each of the most promising new varieties to emerge from preliminary breeding, plus a local variety for comparison. The most tangible outcome has been the release of two new varieties resistant to root rot, a scourge of cassava growers. The effort has also changed the way breeders and farmers work. The breeders get feedback on their choices early and often, which makes it more likely that the needs of the farmers will be met and that the new varieties will be adopted. The farmers get more cassava diversity on their properties, which seems itself to offer some protection against pests and diseases. In general, the flow of information about varieties and the varieties themselves has been enhanced. It remains to be seen how the efforts of farmers that result in the official release of new varieties can be recognized, if at all.

Farmers in Sergipe State in Brazil with a new cassava that is resistant to root rot. The farmers chose this variety from a selection of crosses supplied by government breeders.
W. Fukuda



Intellectual property rights

Ethically, all collaborators in a project should benefit from their collaboration.

That would see the benefits that accrue from the release of a variety produced as a result of participatory plant breeding shared among all the participants. At present, however, there are no clear guidelines for how this might be achieved. Indeed, most work to date has skirted the issue with one of two very different strategies. In the first case, varieties have been fed into the formal sector with no reward for farmers' inputs. In the second, the varieties have been released into the farming communities with no official launch and no direct reward for the breeders. Neither is fully satisfactory. As a contribution to the debate, Louise Sperling (International Center for Tropical Agriculture—CIAT) and Dan Leskien (independent consultant) reviewed the legal requirements of collaboration, including joint inventorship and employee inventions in the USA, UK and Germany (and many other countries) in a bid to uncover elements that might be used to establish joint breedership and employee varieties. They conclude that "existing legal regimes may not be sufficient for ensuring that [participatory plant breeding] collaborations unfold fairly for all partners." A formal agreement may be needed to examine benefit sharing as well as more general access issues. The use of such a 'Code of Conduct' is presently being reviewed by the PRGA. Much is at stake.

Impact

Just how valuable is participatory plant breeding? The International Center for Agricultural Research in the Dry Areas (ICARDA) has made use of participatory barley breeding since 1996 and has undertaken a detailed economic study of the costs and benefits for research institutes and farming communities. The greatest gains come from the reduction in research time and the speed with which varieties developed with the participation of farmers reach rural households, generally 3 or 4 years before conventional varieties. In the Syrian context, increased speed of uptake alone can more than double the return on investment. There are other benefits too. Putting farmers on the team helps identify early-maturing varieties, which are especially useful for the poor.

Increasing holism and integration

One of the challenges facing participatory plant breeding is to mesh it more closely with existing efforts to conserve and broaden the use of genetic diversity in farmers' fields. That, of course, requires a deep understanding of how farmers conserve and use the diversity they already have. In Nepal, for example, informal networks may not promote the exchange of information and diversity. In response, communities have been encouraged to hold diversity fairs, which act as a source of seed for newly developed varieties as well as for more traditional selections.

In Rajasthan, in India, farmers do not simply replace their old pearl millet varieties with modern seed. They make seed mixtures, and use small amounts of modern seeds and seeds gathered from hybrid varieties as breeding material, along with their local populations. Knowing this, researchers have worked to support the farmers' own breeding efforts. One problem is that plant populations that farmers have modified, perhaps by selection, or mixture, are often better when conditions are favourable but offer no advantage at all under drought stress. So the poorest people, in the most marginal

In Nepal old varieties of rice hang in a display. Farmers are working with researchers to improve their traditional varieties.
A. King/IPGRI



environments, do best by also guarding their traditional varieties. This too needs to be borne in mind by breeders wishing to work with farmers.

Future horizons

Most participatory breeding to date has built on farmers' traditional practices and wisdom. Is there a place for modern technology in participatory efforts? Probably so. A study of rice in India and Nepal used an approach called marker-assisted selection to improve efficiency. Marker-assisted selection uses genetic markers to screen the offspring of a breeding cross for the presence of a particular trait, often genetically rather complex and poorly inherited. The idea of the study was to create bulk populations that brought together markers for several traits, for example those that help plants avoid and tolerate drought, such as deep roots, early flowering and retaining green leaves. The breeders crossed two varieties, one that has many qualities that farmers prefer and another that is drought resistant but shunned by farmers. Marker-assisted selection allowed the breeders to find those offspring of the cross that combined the good qualities of both varieties. These were bulked up and given to farmers to grow alongside their usual varieties. The farmers consistently preferred the breeders' crosses to their own varieties, although those crosses are still quite variable. The breeders were especially pleased that the farmers had noticed that one of the bulks had the characteristic smell of aromatic rice, which commands a higher price in the market and which had never before been grown by upland farmers in Eastern India.

While more remains to be done, this study shows that modern technology can provide participating farmers with material that already matches their needs. Moreover, the scientists are now looking at varieties that the farmers had selected from random offspring and asking whether those selections can be used to discover genetic markers for the specific qualities that the farmers prefer. First indications are that they can.

Conclusions

As this all-too-brief survey reveals, there is much that is good—and getting better—in participatory plant breeding. Of course challenges remain. For example, the formal sector is still pretty resistant to the idea, and participatory plant breeding tends to be carried out project by project rather than being institutionalized. Nevertheless, the meeting ended on an upbeat note as evidence is growing that participatory plant breeding indeed offers a valuable set of approaches to the problem of improving overall food security, reaching more marginal farmers—and saving money along the way.

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Farmers in India with the bulk populations of rice that had already been selected to have a good chance of bringing together desirable qualities.
K. Steele

New light on the value of old rice

A fundamental assumption of the early days of the Green Revolution was that the new varieties being produced were so superior that farmers would be foolish not to replace their traditional landraces. Indeed, to suggest that they continue growing old varieties was to condemn them to perpetual poverty. And since they would inevitably abandon old varieties, the only safe way to conserve the diversity of the old varieties was to collect seeds and store them off site, in *ex situ* genebanks. Strangely, not all farmers did give up their old varieties. In some environments, they continued to grow them. On this observation was built the complementary strategy of *in situ* and on-farm conservation. The question remains: why do some farmers in some places continue to grow old varieties?

Many studies by IPGRI, its partners, and others, have offered answers. Most often these are couched in terms of the non-market value of the old varieties under particular conditions. Diversity may be needed to cope with different land on the same farm, for example wet valley bottoms and dry uplands. Different varieties may be preserved because they are adapted to different uses. Varieties may have spiritual or medicinal value. Until recently, the straightforward relative economic costs and benefits of landraces versus modern varieties had not been examined. Over the past year, however, intriguing results have begun to emerge.

The most complete study to date concerns the rice farmers of Nepal, where IPGRI's *in situ* project has a long and fruitful collaboration. Devendra Gauchan, of the Nepal Agricultural Research Council, is completing a doctoral dissertation that illustrates the complexity of assessing the value to farmers of old and new rice varieties. In Bara, a fertile, lowland site on the southern border with India, Gauchan and other researchers surveyed the farmers to measure the costs and benefits associated with traditional and modern varieties. In good environments the modern variety China-4 is much more profitable than the traditional Nakhisaró. In fact for every additional rupee they invest in China-4 instead of Nakhisaró,



Farmers not only still grow traditional varieties in Bara, Nepal, but they also store them in traditional clay pots, sealed with animal dung to keep insects out.
A. King/IPGRI

Detailed economic studies are beginning to add a deeper understanding of why some farmers continue to grow old varieties—and how to encourage them.

farmers can expect to earn more than 13 rupees, a rate of return that is more than 10 times higher than the minimum rate of return that farmers expect. Taking the community as a whole, the cost of not growing China-4 would be more than rupees 1 million per season (more than US\$15 000 in 1999). Small wonder then that China-4 is indeed replacing traditional varieties such as Nakhisaró.

But only in favourable environments—those where farmers have access to productive,

Value of traditional varieties

irrigated land, modern seed and well-functioning markets. In marginal environments, such as the uplands and swamps of Bara, no modern varieties can compete with traditional landraces. Farmers lose nothing by growing old varieties. Indeed, they would be foolish not to.

The researchers divided the farmers into three categories, rich, medium and poor. Farm size varied with wealth, as did the amount of irrigated land. But astonishingly, it was the poor farmers overwhelmingly who grew only modern varieties. About two-thirds grew no traditional landraces, while 60% of the rich and medium farmers grew ancient and modern varieties simultaneously. It may be that wealthier households can absorb the labour and management costs associated with a more complex pattern of rice-growing, but in any case this result must give policy-makers pause for thought as they wonder how to support on-farm conservation of diversity.

Neoclassical economic theory has a hard time explaining why farmers might grow two or more varieties simultaneously. 'Efficient' farmers should grow only the most profitable. However, just as the farmers' decisions make sense if one factors in, for example, different growing conditions in different fields, so too they can make sense if the household is faced

Hungarian home gardens (re)valued

In Hungary, during the period of collectivized agriculture, small plots ranging in size from a few square metres to 5 hectares remained in private hands. These home gardens are micro-agro-ecosystems, farmed intensively with family labour. They are a treasure house of ancient crops and livestock breeds that improves family diets at the same time as enriching the biodiversity of the Hungarian countryside. A partnership of IPGRI and national scientists (Dr László Holly leads the National On-Farm Conservation Project in Hungary; this work is part of Ekin Birol's doctoral dissertation) recently completed a preliminary economic analysis of the value to farmers of home gardens in three environmentally sensitive areas. The team assessed the relative importance of five dimensions of diversity: number of crop species; presence of old varieties; mixed farms with crops and livestock; organic methods; and food self-sufficiency.

All were important, but their relative importance depended on other factors. The region of Dévaványa has good roads, is close to the centre of the country and has plenty of local food markets. The soil is good and suited to intensive agriculture. People there rated a mixed farm and organic methods the most important attributes of a home garden. Old landraces and number of species were much less important. By contrast, the region of Örség-Vendvidék is isolated with poor soils and few village food markets. Feed is costly and organic methods do not apparently work. Farmers in Örség-Vendvidék say they want high diversity of species and many older varieties in their home gardens, but do not rate mixed farms or organic methods as valuable.

Education and employment offers another view of the ideal home garden. Better educated farmers, with jobs off the farm and higher incomes, prefer a simpler home garden with fewer crops, no landraces, and no time-consuming livestock. Households with more children also prefer simpler home gardens, "perhaps," as the report says, "because they are substituting one labour intensive activity (child rearing) with another (tending of a home garden)."

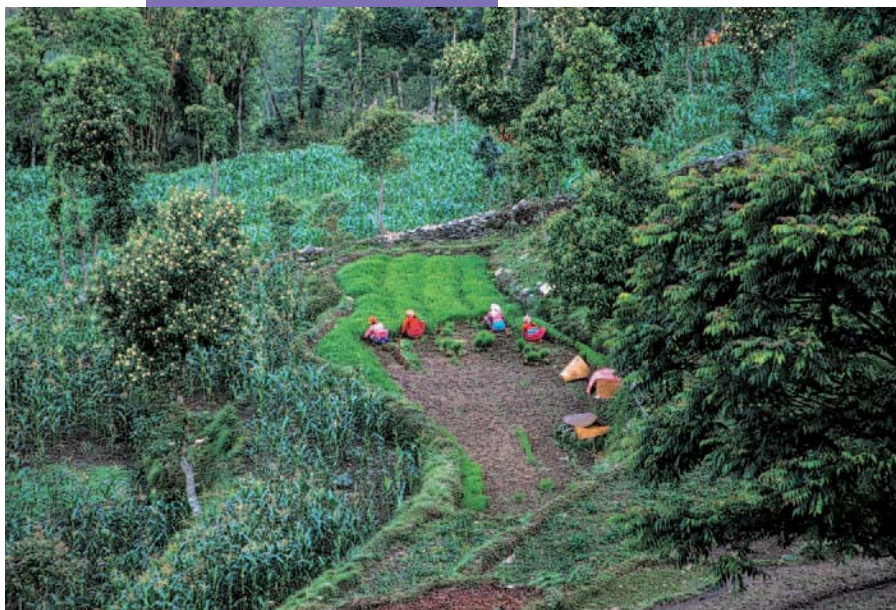
As Hungary's economy changes its orientation the government needs to design appropriate policies that will make the most of these home gardens in the context of the European Union. Studies such as this one will feed into that process.

with poorly functioning markets, especially if the farm is only semi-commercial, dividing its production between rice to eat and rice to sell.

When agriculture is semi-subsistence, or semi-commercial, depending on your point of view, each household may well make different decisions about how much of their production to eat and how much to sell. Most landraces, for example, fetch a poor price in the market but some, such as Basmati, command a premium and can compete with modern varieties. But traders do not generally like to deal with landraces because they are often available only in smaller quantities and are of variable quality. So one policy option might be to create stronger links between growers and traders. Another might be to promote the branding of particular landraces which would protect their identity and quality.

On the steep hillsides of Nepal, traditional landraces of rice may be more valuable than modern varieties.

A. King/IPGRI



The choices farmers make are complex. In the survey, for example, there were significant relationships between the variety combinations grown and characteristics of the household. This goes beyond the simple richer-poorer dimension and includes factors such as the number of bullocks and the self-sufficiency of the household. Thus the benefits of growing landraces vary considerably among farm households, and it may not be possible to generalize.

Yet another explanation for the choice to grow landraces is provided by the reasons the farmers themselves give. These often hinge on attributes of the variety that are not related to the yield and which are therefore not easily captured by neoclassical economics. For example, farmers themselves say that the most important reason for growing Nakhisaró is that it is adapted to poor, rain-fed soils. But this is not the prime reason for growing another variety, Sathi. This variety has religious significance in Hindu culture, and incidentally boasts much better eating quality than Nakhisaró.

In the end, having established the costs and benefits of growing traditional and modern rice varieties in Nepal, the studies concluded that economists need to use a diversity of tools to assess the value of diversity. This will be done and, it is hoped, will offer guidance to policy-makers about the best routes for influencing the on-farm conservation of crop diversity.

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Domesticated yams develop farmers' diversity

Farmers domesticate Yams

More than 90% of the world's harvest of yams (*Dioscorea* species) grows in west and central Africa. The yam belt stretches from Guinea through Ghana, Togo, Benin and Nigeria down to western Cameroon, Central Africa and the Congo basin. Much of it is grown by small and medium scale farmers, and a large part of the community depends on yam for food security and income. The word yam covers a multitude of species. Cultivated yams include traditional varieties assigned to the *D. rotundata*–*cayenensis* complex, other indigenous species such as *D. bulbifera* and *D. doriatorum*, and introduced species such as *D. alata* and *D. esculenta*. There are also wild species, such as *D. burkilliana*, *D. abyssinica* and *D. praehensilis*, which farmers may have adopted and which may have contributed to the genetic diversity of current landraces.

Given the importance of yams to local communities and their food security, IPGRI joined the International Institute for Tropical Agriculture (IITA), another Future Harvest Centre, in a study that aimed at a better understanding of how farmers domesticate yam and what that contributes to yam improvement and production. The three-year project ended in 2002 and, as part of it, two students at the National University of Benin, Nasser Baco and Florent Okry, made anthropological studies of yam domestication the subject of their theses. This work was complemented by broader surveys and biochemical and molecular analyses carried out by other partners. The combination of techniques helped provide a deeper understanding of domestication.

Of the 80 farmers who were actively domesticating yam in the study, 78 were men, and all were the heads of their households. One reason only heads of households domesticate yams may be that it is a risky business. Yams contain toxins that have been known to kill people. Domestication consists in part of reducing the toxic load, and only when the yam is 'safe' are other members of the household permitted to cultivate, harvest, process and sell the new variety, which then becomes incorporated in the family's basket of yam varieties. In general each farmer is domesticating just one kind of yam, although 14% had two and 4% three. There is no formal support for people domesticating yams. Roughly three-quarters said they had acquired the skills from their neighbours, the other quarter from relatives.



A study with farmers in Benin reveals that they are continuously boosting the diversity on their plots with the offspring of wild and cultivated yams.

Different farmers approach the domestication of yams in different ways. For example some, but not all, place a piece of pottery beneath the roots, and offer various explanations of why this is a good thing. But almost all select from

Yams are a mainstay of local food security in much of West and Central Africa.
IITA



Farmers in Benin examine the thorny stems of a wild yam.
M. Grum/IPGRI

each harvest the tubers of the individual plants that most nearly approach their ideal of a domesticated variety and plant these the following year. The study could find no relationship between the methods used and any aspect of the outcome.

Why do they do it? Mostly to develop more productive varieties. Farmers say that cultivated yams lose vigour over time (which might be expected if they accumulate diseases), and that bringing in fresh blood from wild yams will maintain, or even increase, productivity on the farm. The farmers classify yams as wild or domesticated based on their appearance. Wild yams have thorny stems and roots and the tubers are thin. As domestication proceeds the number of thorns goes down and the tubers thicken. The farmers also gave the plants under domestication specific variety names, often the names of existing varieties. They start doing this before the domestication process is complete, and adopt the name of the variety they expected to end up with. However, individual farmers often disagreed about which variety a wild yam would produce when it had been domesticated.

Technical studies looked in detail at the morphology and genetics of the varieties, cultivated and domesticated. In one study of 68 newly domesticated yams, just under a quarter were biochemically and morphologically very similar to existing varieties. Of the rest, half were similar but not identical to some landraces, but the other half were completely different. This confirms for the first time that domestication makes a significant contribution to the genetic diversity of the yam farmers' agricultural system.

Domesticators tend to find their yams in the savannah forest margins, with almost a fifth coming from old fields that have been abandoned to fallow

Project partners

- International Institute for Tropical Agriculture
- Bariba, Nago and Fon farmers selected through surveys
- Université National du Bénin in collaboration with IRD (L'Institut pour le recherche pour le développement)
- Institut National des Recherches Agricoles du Bénin (INRAB)
- CIRAD-IITA Yam Research Coordination Unit (YRCU)

for a long time. Yams on the farm are generally multiplied as clones, using tubers from the previous harvest. But the species also multiplies by seed. So yams from the fallow and field margins could be either remnants of old clones or else seedlings from chance matings. The biochemical and molecular studies indicate that at least two things are going on. First, domesticators are selecting offspring of matings between cultivated varieties

which, because they grow from seed, initially look very similar to wild plants. This is in effect a gradual breeding process. Secondly, they are also in rare cases selecting hybrids between wild and cultivated material. Over a number of cycles this is bringing fresh genetic diversity into the population of cultivated varieties, as newly domesticated varieties remain in fallow fields and offer further generations of seedlings for possible selection. The farmers are not aware of this long-term cycle.

Farmers do not actually appreciate that yams produce true seed and that they are using selection from true seed as a method to create and select improved clones. This offers great opportunities for improving the yam crop through participatory breeding. Already one researcher from the University of Benin has established a non-governmental organization specifically to work with farmer-breeders. In the future, one can imagine breeders making deliberate crosses of favoured cultivars in order to supply farmers with seed to assess and domesticate. Farmers, too, can be taught about true seed and encouraged to think of ways to incorporate this knowledge in their individual breeding efforts. Either way, the close study of domestication as practised by the yam farmers of Benin indicates not only the value of maintaining diversity in the areas around the farms, but also the vital part that their domestication plays in securing their food supply and improving their livelihoods.



Domesticated yams, as seen here, have thicker tubers and less thorny stems.

M. Grum/IPGRI

Further information
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Tropical fruit project grows to maturity

In 10 countries across Asia IPGRI has been working with local partners to improve the conservation and use of tropical fruit species. The project is funded by the Asian Development Bank and, at roughly the three-quarters point in its life, can already point to some impressive achievements: diversity has been collected and characterized, people have been trained, techniques have been advanced, and ways found to improve the part tropical fruits can play in rural livelihoods.

Finding and collecting diversity remains a key focus of the project, which encompasses six fruits: mango, citrus, rambutan, jackfruit, litchi and mangosteen. A similar story could be told for each of them, but let us home in on mango (*Mangifera* spp.), and indeed on just some of the project's successes with that fruit. A survey in India resulted in 36 new accessions being added to a field genebank in Bangalore. An expedition in Manipur identified mangoes that were dwarf and matured early, which could be very useful to breed improved commercial varieties. And in Bangladesh, explorers found four varieties that bear their fruits year-round and nine that bear in the off-season, again potentially valuable traits for efforts to improve mangoes.

These are just a few obvious traits. The project has sought to thoroughly characterize and evaluate diversity in the target species. More than 1300 mango accessions have now been assessed, and the information gathered is being transferred to databases for easier searching and exchange. This will ultimately make it easier for breeders and researchers to find the particular qualities they are looking for—anything from less fibrous fruits to the beautiful red rind colour and exemplary storage quality uncovered in Tai Ya, a Chinese variety.

Very few tropical fruits are cultivated on a plantation scale; most are grown in home gardens and small plots. IPGRI projects have been working to improve their value to small farmers.

Project countries

- Bangladesh
- China
- India
- Indonesia
- Malaysia
- Nepal
- the Philippines
- Thailand
- Sri Lanka
- Vietnam

***Mangifera odorata* on sale at a roadside market stall.**
I. de Boreghy/IPGRI



Of course valuable diversity that is represented by the collected varieties needs to be conserved if it is to be useful to farmers and growers. In Vietnam an Italian NGO, Centro Internazionale Crocevia, has helped to establish an *in situ* conservation garden at the northern town of Son La. About 5000 rootstocks are being grafted with 12 local varieties for eventual distribution to people in the district. And while *ex situ* collections are being expanded in most countries, the detailed efforts at characterization have suggested that some of the varieties in the Vietnamese field genebank are in fact duplicates. With further testing it may be possible to rationalize the Vietnamese collections and thus improve the cost-effectiveness of their conservation.

Socioeconomic factors, such as the return on investment, consumer preferences, marketability and the like, influence the attitude of farmers and growers to tropical fruits. The project has carried out some work along these lines. For example, in Malaysia a preliminary investigation of the value of a mango species known locally as *kuini* (*M. odorata*) has identified the value of individual trees to farmers and estimated that the total acreage of some 700 hectares is worth about US\$250 000 a year. Project partners noted in 2002 that additional socioeconomic studies, to look at all aspects of production, processing and marketing, should be carried out. These would necessarily involve collaboration with other organizations, such as UTFANET (Underutilized Tropical Fruits in Asia Network) and TFNet (International Tropical Fruits Network), and during the year the project appointed a full-time socioeconomist.

Another important goal of the project is to develop human resources and build capacity in the partners. While informal capacity building takes place in almost all exchanges, the project also conducted four formal training workshops during 2002. These ranged from the



Tropical fruits are often very important in local food markets, like this one in Yucatan, Mexico.

H. Jaenicke/ICRAF

A farmer in Chitwan District, Nepal, is growing one of the Indian mangoes that bears fruit all year round.
A. King/IPGRI



very technical—a course on the use of molecular techniques to study and understand fruit genetic diversity—to the much more general—training on how to write scientific papers and proposals for funding. In this way the project helps national programmes to become self-sustaining in the future. Indeed the sustainability of the effort once the project has ended is an important consideration. Many of the Country Coordinators are making efforts to ensure that the activities that they have been looking after become integrated into national research and development programmes.

The project has also made plans to make use of an idea that IPGRI and its partners have promoted elsewhere, that of diversity fairs. These are gatherings at which farmers display the diversity of their crops, and are rewarded for the breadth of their varieties, rather than for the quality or yield of a particular variety. Diversity fairs at district, regional and national levels have proved an ideal mechanism for allowing farmers and growers to exchange selections and information. Researchers too can gather samples and the knowledge associated with them, perhaps with a view to diffusing varieties with desirable traits.

Further information
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- IPGRI Annual Report 2001
- Networking Bananas and Plantains: INIBAP Annual Report 2001
- Selected Highlights of 2001
- GeneFlow 2002 (*English and Spanish*)
- Endowing Future Harvests: the Long-term Costs of Conserving Genetic Resources at the CGIAR Centres (*with SGRP and IFPRI*)
- Atlas of Wild Potatoes. Systematic and Ecogeographic Studies on Crop GenePools 10 (*with CIP*)
- FAO/IPGRI PGR Newsletter Nos 128–131 (*with FAO*)
- Plant Genetic Resources Abstracts, Volume 11 (*with CABI*)
- Towards Sustainable National Plant Genetic Resources Programmes Policy, Planning and Coordination Issues (*with DSE/ZEL*)
- L'approche participative dans la recherche sur le mode de gestion des espèces cultivées localement en fonction du genre au Mali: méthodologie et techniques: cas du Mali (*with FAO*)
- Home Gardens and *In Situ* Conservation of Plant Genetic Resources in Farming Systems (*with DSE/ZEL and GTZ*)
- Ruby Treasure: Securing the Wealth of Pomegranate in Central Asia (*in English and Russian*)
- Forest Genetic Resources Conservation and Management: In Managed Natural Forests and Protected Areas (*In Situ*)—Vol. 2 (*with FAO and DFSC*)
- Programme de ressources génétiques forestières en Afrique au sud du Sahara (*with SAFORGEN*)
- Promoting the Conservation and Use of Plant Genetic Resources by Training and Research: Capabilities and Capacities for Plant Genetic Resources Training in Public Universities and Institutions in Eastern Africa
- FAO/IPGRI Technical Guidelines for the Safe Movement of Germplasm: *Acacia* spp. (No. 20) and *Pinus* spp. (No. 21) (*with FAO*)
- Report of the 4th and 5th Noble Hardwoods Network Meetings (*with EUFORGEN*)
- Flax Genetic Resources in Europe (*with ECP/GR*)
- European Collections of Vegetatively Propagated *Allium* (*with ECP/GR*)
- The Economics of Conserving Agricultural Biodiversity On-farm (*with SDC, BMZ, DGIS, IDRC and IFPRI*)
- IPGRI Technical Bulletins on Accession Management Trials (No. 5), Forest Tree Seed Health (No. 6) and *In Vitro* Collecting Techniques (No. 7, *with CATIE and FAO*)
- Strategy for the Global *Musa* Genomics Consortium (*with the Global Musa Genomics Consortium*)
- Global Evaluation of *Musa* Germplasm for Resistance to *Fusarium* Wilt, *Mycosphaerella* Leaf Spot Diseases, and Nematodes: In-depth Evaluation. INIBAP Technical Guidelines 6 (*in English, French and Spanish*)
- Oferta tecnológica de banano y plátano para América Latina y el Caribe: una contribución de MUSALAC a la investigación y desarrollo de la Musáceas
- Coconut Embryo *In Vitro* Culture: Part II (*with COGENT*)

Support to plant genetic resources programmes and regional networks in the Americas

(Project Coordinator: David Williams)

assists countries in Latin America and the Caribbean to build up their capacities to conserve and use plant genetic resources

Support to plant genetic resources programmes and regional networks in Asia, the Pacific and Oceania

(Project Coordinator: V. Ramanatha Rao)

assists countries in Asia, the Pacific and Oceania to build up their capacities to conserve and use plant genetic resources

Support to plant genetic resources programmes and regional networks in Europe

(Project Coordinator: Jozef Turok)

assists countries in Western and Eastern Europe to build up their capacities to conserve and use plant genetic resources

Support to plant genetic resources programmes and regional 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

Support to plant genetic resources programmes and regional 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

Global capacity building and institutional support

(Project Coordinator: Issiaka Zoungrana)

develops options and tools for institutional frameworks to strengthen plant genetic resources 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

Promoting sustainable conservation and use of coconut genetic resources

(Project Coordinator: Pons Batugal)

promotes national, regional and global collaboration through COGENT among coconut-producing countries and partner institutions in the conservation and use of coconut genetic resources

Locating and monitoring genetic diversity

(Project Coordinator: Luigi Guarino, Prem Mathur)

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

Ex situ conservation technologies and strategies

(Project Coordinator: Ehsan Dulloo)

develops improved low-input technologies for the *ex situ* conservation of plant genetic resources, and investigates *ex situ* conservation strategies

In situ conservation of crop plants and wild relatives

(Project Coordinator: Devra Jarvis)

develops a scientific basis for effective on-farm conservation that meets farmer and community needs and maintains diversity; assists national systems in locating, monitoring and maintaining viable *in situ* populations of wild relatives of crops

Linking conservation and use

(Project Coordinator: Toby Hodgkin)

takes *ex situ*, *in situ* and complementary approaches; emphasizes neglected and underused crops and supports the use of cocoa genetic resources

For the year ended 31 December 2002, in US dollars (000s)

Human and policy aspects of plant genetic resources conservation and use

(Project Coordinator: Pablo Eyzaguirre)

strengthens links between conservation and the well-being of people, particularly poor rural people, emphasizing gender, nutrition, income, indigenous knowledge, traditional resource rights and participatory approaches

Information management and services

(Project Coordinator: Paul Neate)

builds capacity in information management and service provision to meet national, regional and international responsibilities; provides publications and information to support the research activities of IPGRI staff and their partners

Public awareness and impact assessment

(Project Coordinator: Ruth Raymond)

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: Suzanne Sharrock)

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

Musa germplasm improvement

(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 and communication

(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

Support to regional Musa programmes

(Project Coordinator: Suzanne Sharrock)

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

CGIAR System-wide Genetic Resources Programme and policy support

(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).

Unrestricted and Attributed

Australia	238
Belgium	271
Canada	446
China	120
Denmark	527
France	302 ¹
Germany	192
India	75
Italy	1364 ²
Japan	442
Korea, Republic of	50
Mexico	10
Netherlands	1407
Norway	467
Philippines	17 ³
South Africa	50
Sweden	361
Switzerland	559
Thailand	8
USA	650
World Bank	2431

Subtotal 9987

Restricted

ACIAR	117
ADB	471
AfDB	53
AusAID	8
Belgium	1016
Brazil	16
CAPRI	43
CAS	5
CATIE	7
CFC	1032
CGIAR Secretariat	53
CIDA	4
CIRAD	167
COL	14
CORAF/WECARD	32
CTA	85
DAGS-Malaysia	16
Danida	66
DFID	1079
DFSC	10
DSE	4
European Countries	558
European Union	1739
FAO	202
FECYT	14
FFTC	19
Finland	53
FONTAGRO	69
France	187
Gatsby Foundation	136
GTZ/BMZ	700
ICIPE	10
ICRAF	16
IDRC	161
IFAD	445
IFPRI	8
IFS	4
IICD	15
ISNAR	3
Italy	106
Japan	428
Korea, Republic of	126
KUL	6
Luxembourg	44
Mexico	46
Multi-donors to Genetic Resources Policy Initiative	128
Multi-donors to Global Conservation Trust	679
Multi-donors to World Summit on Sustainable Development	167
National Geographic Society	8
Netherlands	403
Norway	115
NZAID	85
OAS/CICAD	914
Peru	73
Pioneer	4
Portugal	11
PRGA	22
Quebec	93
Rockefeller Foundation	58
SDC	768
SIDA	110
Spain	101
SPC	3
Technova	9
Uganda	592
UNDP-GEF	564
UNEP-GEF	225
USAID	340
USDA	46
VVOB	176
World Bank	64
Worldview Foundation	7

Subtotal 15 161

Total Grants 25 148

¹ France's 2002 unrestricted contribution of Euro 287 597 at year-end rate of exchange of Euro 0.9529=US\$1.00.

² Italy's 2002 unrestricted contribution of Euro 1 300 000 at year-end rate of exchange of Euro 0.9529=US\$1.00.

³ The Philippines' 2002 unrestricted contribution of PHP487 700 at year-end rate of exchange of PHP53.385=US\$1.00.

Continued

Restricted projects

	Agricultural Biodiversity in Mozambique	14		
	Subtotal	85		
	DAGS—Malaysia			
	Cyber Plant Conservation Project	16		
	Danida			
	Danish Junior Professional Officer—Benin	11		
	Effective Conservation and Use of Intermediate and Recalcitrant Tropical Forest Tree Seed Phase II	55		
	Subtotal	66		
	DFID			
	Coconut Genetic Resources	72		
	<i>Ex Situ</i> Conservation Technologies and Strategies	263		
	Farmer Testing of Banana IPM Options in East Africa	101		
	Gender and Diversity	4		
	Human and Policy Dimensions of Genetic Resources	288		
	Plant Genetic Resources Programmes in Sub-Saharan Africa	263		
	Support to Regional <i>Musa</i> Programmes	88		
	Subtotal	1079		
	DFSC			
	Forest Genetic Resources Conservation and Management: in Managed Natural Forests and Protected Areas (<i>In Situ</i>) Guidelines	10		
	DSE			
	Home Gardens Publication	4		
	European Countries ¹			
	ECP/GR—Phase VI	325		
	EUFORGEN—Phase II	233		
	Subtotal	558		
	European Commission			
	Biodiversity and Economics for Conservation (BioECON)	48		
	European Plant Genetic Resources Information Infrastructure (EPGRIS)	2		
	European Crop Wild Relative Diversity Assessment and Conservation Forum	17		
	Gene-Mine	1		
	Global Forest Genetic Resources Strategies—Latin America	133		
	Global Forest Genetic Resources Strategies—MEDA	153		
	Locating and Monitoring Genetic Diversity—Asia	127		
	Locating and Monitoring Genetic Diversity—MEDA	137		
	Promoting Sustainable Conservation and Use of Coconut Genetic Resources—Asia	185		
	Promoting Sustainable Conservation and Use of Coconut Genetic Resources—Latin America	167		
	Support to Plant Genetic Resources Programmes and Regional Networks in Sub-Saharan Africa—ACP	285		
	Support to Regional <i>Musa</i> Programmes—Asia	254		
	Support to Regional <i>Musa</i> Programmes—Latin America	230		
	Subtotal	1739		
	FAO			
	Adaptation of Existing Systems for the Management and Exchange of Information on Plant Genetic Resources for Food and Agriculture	10		
	Biotechnology and Biosafety in non-EU Pre-accession Countries in Central and Eastern Europe (Balkans) and Caucasian countries	7		
	Collecting Mission in Middle East	10		
	Development of the User Manual of the Electronic Reporting Format for Monitoring the Implementation of the Global Plan of Action on Plant Genetic Resources for Food and Agriculture	5		
	Expert Consultation and Development of a List of Indicators and a Reporting Format for Monitoring the Implementation of the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources	35		
	FAO/Plant Genetic Resources Activities for Consultation with Stakeholders and Development of a Mechanism to			
ACIAR	SINGER-International Crop Information System	7		
	Technical Support for Regional Plant Genetic Resources Development in the Pacific	96		
	Associate Expert—Nematology in Vietnam	14		
	Subtotal	117		
ADB	Conservation and Use of Native Tropical Fruit Species Biodiversity in Asia	177		
	Developing Sustainable Coconut-based Income-generating Technologies in Poor Rural Communities	294		
	Subtotal	471		
AfDB	Plant Genetic Resources in Sub-Saharan Africa	53		
AusAID	Taro Genetic Resources Conservation and Utilization	8		
Belgium	Collaborative <i>Musa</i> Research—KUL	335		
	INIBAP <i>Musa</i> Conservation Research	305		
	INIBAP Transit Centre—KUL	189		
	<i>Musa</i> Coordination in Africa	185		
	Study of Diversity (<i>Colletotrichum</i> and <i>Stylosanthes</i>) Phase II	2		
	Subtotal	1016		
Brazil	The Lusophone project	16		
CAPRI	Strengthening Community Institutions to Support the Conservation and Use of Plant Genetic Resources in Uzbekistan and Turkmenistan	43		
CAS	Workshop—International Treaty on Plant Genetic Resources for Food and Agriculture	5		
CATIE	Training in Black Sigatoka Management	7		
CFC	Cocoa Germplasm Utilization and Conservation	377		
	Coconut Germplasm Utilization and Conservation	156		
	Farmer Participatory Evaluation and Dissemination of Improved <i>Musa</i> Germplasm	499		
	Subtotal	1032		
CGIAR Secretariat	Human Resources Policy Initiative	30		
	African Evaluation Association Conference	23		
	Subtotal	53		
CIDA	Developing Decision-making Strategies on Priorities for Conservation and Use of Forest Genetic Resources	4		
CIRAD	<i>Musa</i> Publications	88		
	Nematode Research	79		
	Subtotal	167		
COL	Biodiversity and Distance Education Internship	14		
CORAF/WECARD	Promoting Fonio Production in West and Central Africa through Germplasm Management and Improvement of Post Harvest Technology	32		
CTA	Information Services/Publications	54		
	<i>Musa</i> Germplasm Information System Training Workshop	17		
	Training Workshop on Gender Analysis and Participatory Approaches for Sustainable Use and Conservation of			

¹ These countries supported both ECP/GR and EUFORGEN: Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, 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, Romania. Luxembourg supported EUFORGEN.

Facilitate the Implementation of the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources	6	Based Seed Management	13
FAO/IPGRI Activities for the Review and Development of Indicators for Genetic Diversity, Genetic Erosion and Genetic Vulnerability	25	Regional Roundtable on Contribution of Plant Genetic Resources in Africa's Economic Renewal	10
FAO-IPGRI Technical Guidelines for the Safe Movement of Germplasm— <i>Acacia</i> spp. and the FAO-IPGRI Technical Guidelines for the Safe Movement of Germplasm— <i>Pinus</i> spp.	10	Symposium on Managing Biodiversity	7
Governance paper for the Global Conservation Trust	3	Subtotal	161
<i>In Vitro</i> Conservation and Cryopreservation of Tropical Genetic Resources for Asia	3	IFAD	
Internet-based Plant Biotechnology Inventory and Further Development of a Plant Biotechnology Web Site	40	Enhancing the Contribution of Neglected and Underutilized Species to Food Security, and to Incomes of the Rural Poor	352
Meeting on 'The Evolving Role of Genebanks in the Light of Developments in Molecular Genetics'	6	<i>In Situ</i> Conservation and Utilization of Plant Genetic Resources in Desert-prone Areas of Africa	73
National Programme Strategies and <i>In Vitro</i> Conservation Manual	5	Workshop—Developing Sustainable Coconut-based Income-generating Technologies as a Strategy to Promote Poverty Reduction and On-farm Conservation of Coconut Genetic Resources	20
Plant Genetic Resources Newsletter	28	Subtotal	445
Workshop on 'Agricultural Biodiversity Measurement: with a Special Focus on Sorghum and Wheat'	9	IFPRI	
Subtotal	202	Impact Assessment in Uganda	8
FECYT		IFS	
Meeting on 'The Evolving Role of Genebanks in the Light of Developments in Molecular Genetics'	14	Forestry Genetic Resources Workshop	4
FFTC		IICD	
Germplasm Multiplication Training Workshop	19	Collecting and Propagating Local Development Content—Indigenous Biodiversity Case Studies	15
Finland		ISNAR	
Associate Expert—Malaysia	53	Evaluation of Organizational Capacity Development	3
FONTAGRO		Italy	
Utilization of Papaya Genetic Resources for their Improvement and Promotion	69	Fellowship on Molecular Tools for Enhancing the Management of Crop Diversity	6
France		Associate Expert—Forest Genetic Resources Research	85
Acropolis Plateforme Project	9	Associate Expert—Socioeconomic Studies on Neglected and Underutilized Species in CWANA	15
Coconut Genetic Resources Network	30	Subtotal	106
Commodity Chains Project	50	Japan	
Peri-urban Banana Production in West Africa	1	Associate Researcher—Ethnobotany	12
Research on Tropical Fruit	41	CGIAR Genetic Resources Support Programme Policy Research and Coordination of the System-wide Genetic Resources Programme	100
The Montpellier Biotech Platform	56	Global Forestry Genetic Resources Strategies—Research on the Genetic Resources of Bamboo Rattan	108
Subtotal	187	Global Forestry Genetic Resources Strategies—Research on the Genetic Resources of Bamboo Rattan	125
Gatsby Foundation		Plant Genetic Programme in Asia, the Pacific and Oceania	3
<i>Musa</i> Germplasm Conservation	136	Plant Genetic Programme in Asia, the Pacific and Oceania	80
GTZ/BMZ		Subtotal	428
Access and Benefit Sharing: Exploring Options to Implement the International Treaty on Plant Genetic Resources for Food and Agriculture	9	Korea, Republic of	
Baseline Survey on Neglected and Underutilized Crops in East and Central Africa	43	Associate Scientist	90
Forest Genetic Resources in Brazil and Argentina	200	Associate Scientist Research Grant	16
Home Gardens and <i>In Situ</i> Conservation	3	Medicinal Plants in 16 countries in Asia-Pacific	20
<i>In Situ</i> Conservation (Morocco component)	6	Subtotal	126
<i>In Situ</i> Conservation (Morocco component) Phase II	227	KUL	
Patterns of Genetic Diversity and Genetic Erosion of Traditional Crops in Peru	212	ITC <i>Musa</i> Collection Data System	6
Subtotal	700	Luxembourg	
ICIPE		Development of National Programmes on Plant Genetic Resources in Southeastern Europe Phase II	44
Conservation of Biodiversity of Gramineae and Arthropods	10	Mexico	
ICRAF		Genomics Research on BSV Virus	46
Conservation and Use of the Mountain AgroBiodiversity in the East African Highlands	16	Multi-donors to Genetic Resources Policy Initiative, GRPI ²	
IDRC		Genetic Resources Policy Initiative Expenditure	128
Crucible Meetings—Publications in French and Spanish	6	Multi-donors to Global Conservation Trust Campaign Phase I ³	
<i>In Situ</i> Conservation of Agricultural Biodiversity Phase II	64	Global Conservation Trust Campaign Expenditure Phase I	407
<i>Musa In Situ</i> Conservation	61	Multi-donors to Global Conservation Trust Campaign Phase II ⁴	
Promoting Traditional Seed Systems and Community		Global Conservation Trust Campaign Expenditure Phase II	272
		Multi-donors to World Summit on Sustainable Development ⁵	
		World Summit on Sustainable Development Expenditure	167
		National Geographic Society	
		Emergency Expedition to Rescue Wild Peanut in Bolivia	8

² The following provided support for the Genetic Resources Policy Initiative, GRPI: BMZ, IDRC, Netherlands, Rockefeller Foundation.

³ The following provided support for the Global Conservation Trust Campaign Phase I: Brazil, CGIAR Finance Committee, CIAT, CIFOR, CIMMYT, CIP, Colombia, ICARDA, ICLARM, ICRAF, ICRISAT, IFPRI, IITA, ILRI, IRRI, ISNAR, IWMI, SDC, USAID, WARDA.

⁴ The following provided support for the Global Conservation Trust Campaign Phase II: SDC, USAID.

⁵ The following provided support for the World Summit on Sustainable Development: CDC, CGIAR Secretariat, IDRC, PARC.

Continued

Netherlands				
Associate Expert—Forest Genetic Resources Research—Americas	70		<i>In Situ</i> Conservation in Peru	11
Associate Expert—Forest Genetic Resources Research—CWANA	85		Technology Transfer Project (<i>Musa</i>)	26
Associate Expert—Fruit and Nut Tree Complementary Conservation Strategies	59		Training Programme	44
Associate Expert—Information Management, Networking and Capacity Building in Conservation and Use of Forest Genetic Resources in Sub-Saharan Africa	53		Subtotal	101
Associate Expert—Restoration of Plant Genetic Diversity	42		SPC	
<i>In Situ</i> Conservation in Burkina Faso and Nepal	94		Taro Genetic Resources Conservation and Utilization	3
Subtotal	403		Technova	
Norway			Research on Sweet Potato	9
Policy Unit	115		Uganda	
NZAID			<i>Musa</i> Biotechnology for Uganda Project	592
Pacific Plant Genetic Resources	85		UNDP-GEF	
OAS/CICAD			Participatory Management of Date Palm Plant Genetic Resources in Oases of the Maghreb	564
Introduction of Improved Banana Varieties to Alto Beni, Bolivia	24		UNEP-GEF	
Organic Banana Project—Bolivia	890		Community-based Management of On-farm Plant Genetic Resources in Arid and Semi-arid Areas of Sub-Saharan Africa	204
Subtotal	914		<i>In Situ</i> Conservation of Crop Wild Relatives through Enhanced Information Management and Field Application	15
Peru			<i>In Situ</i> /On Farm Conservation of Agricultural Biodiversity (Horticultural Crops and Wild Relatives Species) in Central Asia	6
Strengthening the Scientific Basis of the <i>In Situ</i> Conservation: Manejo y monitoreo de variedades locales de cultivos amazónicos	50		Subtotal	225
Organic Banana Project	23		USAID	
Subtotal	73		Empirical Studies with IFPRI	14
Pioneer			Meeting on 'The Evolving Role of Genebanks in the Light of Developments in Molecular Genetics'	10
Advisory Committee Meeting on Public Domain/Public Goods	4		Support to FHIA Breeding Programme	75
Portugal			Target Project—Increasing Productivity and Market Opportunities for Banana in Africa	241
Improving Coconut Production in Mozambique through Germplasm Characterization and Evaluation of Promising Hybrids	5		Subtotal	340
The Lusophone Project	6		USDA	
Subtotal	11		Collection of Germplasm in Bolivia and Guyana	8
PRGA			Collection of Germplasm of <i>Phaseolus</i> spp. and <i>Arachis hypogaea</i> L. in Venezuela	22
Quality of Science in Participatory Plant Breeding	22		Development/Testing of Geographical Information System for Locating Cultivated Plant Diversity	6
Quebec			Documentation and Management of Plant Genetic Resources in Developing Countries	3
Internship on Plant Genetic Resources Policy	11.5		<i>In Situ</i> Conservation of Wild Crop Relatives in Paraguay	7
Internship on Impact Assessment Uganda	11.5		Subtotal	46
Internship on <i>Musa</i> Germplasm Information System	11.5		VVOB	
Internship on Forestry Policy	6		Associate Scientist—Nematology in Costa Rica	60
Internship on Genetic Resources Policy Issues	10		Associate Scientist—Technology Transfer in Uganda	60
Internship on Integrating Print and Electronic Publishing	8		Associate Scientist—Nematology in Cameroon	59
Internship on Impact of IPGRI's Work	11.5		Subtotal	179
Internship on World Summits	11.5		World Bank	
Internship on SINGER Crop Portal	11.5		CGIAR Genetic Resources Policy Committee	55
Subtotal	93		Germplasm Conservation in Central Asia and the Caucasus	9
Rockefeller			Subtotal	64
<i>Musa</i> Baseline Project	14		World View Foundation	
Research and Training of a PhD student	44		Temuan Tribe Indigenous Local Community (Orang Asli) Working Together to Conserve and Sustainably Use their Environment via Sustainable Livelihoods	7
Subtotal	58			
SDC			Total Restricted Grants	15 161
CGIAR—Plant Genetic Resources Policy Research Unit	118			
Enhancing Contribution of Home Gardens to On-farm Management of Plant Genetic Resources and to Improve Livelihoods of Nepalese Farmers	66			
<i>In Situ</i> Conservation of Agricultural Biodiversity Phase III	526			
Legal Research on Traditional Intellectual Property to Plant Genetic Resources	16			
SINGER Gateway Model	42			
Subtotal	768			
SIDA				
Genetic Resources Policy	82			
Regional Roundtable on Contribution of Plant Genetic Resources in Africa's Economic Renewal	14			
Advisory Committee Meeting on Public Domain/Public Goods	14			
Subtotal	110			
Spain				
<i>Cherimoya</i> Germplasm Bank in Peru	20			

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John Dyer, resident artist
for the Eden Project.

© John Dyer.

Right: John Dyer at work.



IPGRI office locations





Annual Report

2002

The International Plant Genetic Resources Institute (IPGRI) is an international scientific organization, supported by the Consultative Group on International Agricultural Research (CGIAR). IPGRI's mandate is to advance the conservation and use of plant genetic resources for the benefit of present and future generations. IPGRI's headquarters are in Maccarese near Rome, Italy, with offices in another 22 countries worldwide. It operates through three programmes:

- **Plant Genetic Resources**
- **CGIAR Genetic Resources Support**
- **the International Network for the Improvement of Banana and Plantain (INIBAP).**

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