CIAT Annual Report 2005-2006

Partners in Research Cultivating the Future

International Center for Tropical Agriculture

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CIAT Annual Report 2005-2006

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Introductory Message

CIAT is dedicated to using science to help the rural poor improve their livelihoods. The programs highlighted in this Annual Report show how CIAT scientists in collaboration with researchers, community groups, farmers, and other partners are seeking to make small-scale agriculture more competitive, protect and improve local agroecosystems, while stimulating rural innovation and entrepreneurship. To achieve these objectives, CIAT is reorganizing its research under two major themes—Enhancing and Sharing the Benefits of Agrobiodiversity and People and Agroecosystems in the Tropics—in response to a series of external reviews. These changes in programming will continue the implementation of CIAT's Strategic Plan 2001–2010.

Each theme addresses global challenges and presents important opportunities to improve rural livelihoods. Enhancing and Sharing the Benefits of Agrobiodiversity will evolve to focus on developing clearly defined public goods by working closely with partners. It will seek to share genetic resources with other research centers and to develop and introduce, in collaboration with local farmers, improved varieties of important tropical crops. Its objectives are to strengthen international collections of important genetic materials and to use these resources to enhance the competitiveness and profitability of local farm operations and achieve food security.

The People and Agroecosystems in the Tropics program will provide an institutional focus on integrated management of ecosystems in the tropics to attain food security, economic productivity, and agroecosystem stability. It will address the challenges related to land and crop degradation caused by economic pressures and the lack of appropriate knowledge and technical solutions. Its objectives are to improve local decision-making, work with rural communities to develop improved farming practices that can be implemented on a wider scale, and jointly exploit new market opportunities that foster income generation and make technologies and markets work to benefit the poor.

CIAT's research is addressing issues that are neither trivial nor easy to solve. As a result, the Center continues to pursue opportunities to enhance its effectiveness. As mentioned earlier, the past year provided unique opportunities for reflection and forward planning by CIAT staff and management. The Center benefited from four concurrent external reviews that were commissioned in May 2006. These reviews assessed CIAT's major program areas as well as the overall governance and management of the Center. The review teams drew attention to the high quality of both Center staff and the research that was undertaken. In particular, the reviews noted CIAT's proven ability to integrate biophysical and social scientists into teams dedicated to problem solving. Among the more than 60 specific recommendations of the teams, there were two substantive program recommendations: the need to more tightly focus the research program; and the desirability to attain greater

Joachim Voss

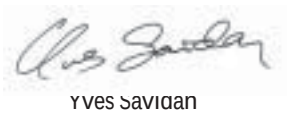
integration of the research program to deliver clearly identified products. Given the importance of these recommendations to future programming, as well as pressures created by declines in external funding, CIAT management has taken appropriate steps to further focus and integrate its research agenda.

Changes always represent significant challenges to staff; however, they offer opportunities for CIAT to build on its recognized strength in interdisciplinary research. The coming year will witness the creation of a working environment that will facilitate and enable truly interdisciplinary research. To achieve this transition, CIAT will evolve from a multi-project based organization into a targeted, product-based organization. These products are expected to range from improved germplasm to integrated management systems. CIAT is currently embarking on a participatory process with staff and partners to identify and select a limited number of focal products. The identified products will then be developed and tested with the target groups and development stakeholders.

A concentration on fewer, well selected, areas of high potential benefit to the poor in the tropics will allow CIAT to achieve fresh vigor and greater impact. In our experience, research focused on a well-defined development outcome is one of the best ways to induce effective interdisciplinary integration. Some of these products will be straightforward and rather obvious, such as working to improve beans, cassava, forages, and rice, within which we are already focusing on stress resistance, improved nutritional quality, and increased productivity. Other products will be more complex, such as the development of policies, institutions, and technologies that can establish markets, especially for high-value products, to benefit the poor.

The long-term plan is to have identified the products, developed the research plans, and organized the research teams by the end of this year for full implementation in 2007. In parallel, scientists will now belong to "communities of practice" that represent their skill sets. Particularly, social scientists will become embedded within each interdisciplinary project.

Significant challenges lie ahead for CIAT's staff and partners. However, we are confident that our rededication to collaborative multidisciplinary research on clearly articulated products will allow us to continue to enhance our reputation as a results-oriented, high-quality organization. We look forward to meeting the challenges that lie ahead.



Yves Savidan
Board Chair

Joachim Voss
Director General

Research Highlights

Enhancing and Sharing the Benefits of Agrobiodiversity

Goal:
Contribute to diminishing the risk of genetic collapse of crops by producing, preserving, and disseminating germplasm specifically adapted to multiple biotic and abiotic stresses in the tropics.

Objective:
Contribute to the sustainable increase of productivity and quality of mandated and other priority crops, and to the conservation of agrobiodiversity in tropical countries for the benefit of the poor.

Conservation and Use of Tropical Genetic Resources

www.ciat.cgiar.org/biotechnology/index.htm

Promote more efficient conservation and use of agrobiodiversity by developing novel technologies for assessing the genetic diversity of wild and cultivated gene pools and conserving seeds and genetic information; and broadening the genetic base of crops -through research partnerships.

International conservation standards

Good progress was made on upgrading the CGIAR[1] genebanks at CIAT. Accessions of more than 10,000 beans and 5,000 tropical forages were planted to increase the availability of seed and to replace aging seeds. The Genetic Resources Unit (GRU) operates four field stations in Colombia: Palmira, Quilichao, Popayán, and Tenerife. More than 10,000 accessions were harvested, processed, and dried; nearly 2,500 accessions were secured in the long-term vault; and the viability of almost 5,000 seed accessions was tested. To date, about 12,000 seed accessions of beans and forages have been shipped to CIMMYT for backup, and close to 1,200 accessions of cassava have been shipped to CIP. The core cassava collection (630 accessions) is presently conserved in liquid nitrogen to test the use of this method as a security backup of the entire collection at the International Network for the Improvement of Banana and Plantain (INIBAP).

International service to world agriculture

In 2005, GRU distributed almost 8,500 samples of accessions from the Food and Agriculture Organization of the United Nations (FAO) designated collections for three commodity crops (beans, cassava, and tropical forages)—a clear indication of continuing interest in the FAO collections. A new Web site was also designed to make it easier for Internet users to consult the databases and request materials. To date, more than 21,000 digital images have been taken of seeds, cassava-root sections, forage plants, and herbarium vouchers to help users tailor their germplasm requests. More than 80% of the entire cassava collection has been tested and certified against important viruses.

Social relevance of conservation efforts

After hurricane Katrina devastated several areas of the Caribbean in August 2005, GRU was able to help restore cassava clones in Cuba. A study was also completed with the Colombian Corporation for Agricultural Research (CORPOICA) to determine the diversity and redundancy in the national collection of avocado in Colombia. To help expand the cassava collection, while reducing costs of *in vitro* maintenance, research was undertaken to track down duplicated accessions. At the request of

1. A list of all acronyms and abbreviations is included at the end of this report.

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the Ministry of Agriculture and Rural Development (MADR), a protocol was developed to conserve seeds of the peach palm in liquid nitrogen. This method may also be used for other palm species such as the African oil palm, which can be used to produce biodiesel.

International cooperation and capacity building

Throughout the year, GRU staff continued their efforts to interact with peers. This work included lectures, presentations, input into training courses, poster presentations, and publications. In addition, GRU staff supervised research by graduate students.

Molecular marker-assisted selection (MAS)

Many African countries have experienced low adoption rates of improved cassava genotypes produced by centralized breeding programs. For this reason, a decentralized breeding scheme was instituted in Tanzania that used MAS and participatory plant breeding (PPB). The objective was to improve the pest and disease resistance of local, farmer-preferred varieties. Introductions of cassava from CIAT that had resistance to cassava mosaic disease and to the cassava green mite were evaluated in the field, and 80 genotypes were selected. Simultaneously, more than 50 local varieties were selected from the Southern and Eastern zones of Tanzania. The CIAT introductions and local varieties were used to establish breeding trials with the Department for Research and Development (DRD) at the Chambezi experimental station, which is situated about 60 km northwest of Dar es Salaam. More than 20,000 crosses have been made, and it is expected that a total of 60,000 sexual seeds will be produced. The seeds were planted in January 2006, and molecular markers will be used to identify disease- and pest-resistant genotypes for further trials.

Molecular analysis

Wild rice species are valuable genetic resources that can be used to broaden the genetic base of cultivated rice. Two rice samples collected in Salahondita and Santa Rosa in Colombia were identified as tetraploids belonging to the species *Oryza latifolia*. These tetraploid species are a valuable genetic resource for genetic and breeding purposes. After several backcrosses to *Oryza sativa,* fertile plants were recovered with introgressed traits derived from the wild progenitor. Some plants also had additional chromosomes. Polymorphic markers were identified that could be used to assess introgressions from the wild progenitor. Preliminary results showed that *O. latifolia* is resistant to rice blast, rice hoja blanca virus (RHBV), and *Tagosodes oryzicola* (the vector of RHBV). This finding is very important because new alleles are now available for further breeding work.

1.
GRU staff supervises research by graduate students.

2.
In 2005, GRU distributed almost 8,500 samples of accessions.

3.
The core cassava collection.

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Bean Improvement for the Tropics

www.ciat.cgiar.org/beans/index.htm

Increase bean productivity through improved cultivars and natural resource management practices in partnership with national programs and regional networks.

1.
The *marketability* (for both domestic and export concerns) is increasingly important, even for the poorest.

Participatory plant breeding (PPB)

A monitoring tour by 14 scientists from national agricultural research centers (NARS) in eight countries was conducted in May 2005 to highlight trends and accomplishments of the bean networks. More than half of the plant breeders in the Eastern and Central Africa Bean Research Network (ECABREN) and the Southern Africa Bean Research Network (SABRN) are using PPB approaches for variety selection and breeding. In the last 3 years, the bean networks have been successful in getting PPB-selected varieties released through the formal agricultural systems. In Ethiopia, two varieties were released by the Ethiopian Agricultural Research Organization (EARO) [now called the Ethiopian Institute of Agricultural Research (EIAR)] in 2003, and three more are in the pipeline. As well, two varieties from work led by the Southern Agricultural Research Institute (SARI) were released in 2002, and two other varieties were recommended for region-specific use. In northern Tanzania, farming communities, in collaboration with the Selian Agricultural Research Institute (SARI), have selected nine new varieties that will enter seed multiplication in 2006. In Southern Uganda, two varieties were identified by the community of Bukoba in collaboration with the National Agricultural Research Organisation (NARO).

The bean networks and ECABREN, in particular, are developing the capacity to have farmer evaluations taken seriously as an input, and even a determining factor, in the official release of new varieties and in the introduction of PPB varieties. The variety-preference criteria of different users groups (women, men, market-preferences, and home consumption) are now well understood across a range of agroecological zones and are being used to fine-tune formal breeding programs. Although yield and disease resistance remain among the key decision-making criteria, three other criteria stand out across sites: *early maturity* (linked to both drought escape and to “filling the hunger gap”) is perhaps first priority (ahead of absolute yield) in moisture-stressed regions; *marketability* (for both domestic and export concerns) is increasingly important, even for the poorest; and *cooking time* (as well as *taste*) have risen in importance as rural farmers move to supply town and urban markets, and as fuelwood becomes harder to obtain.

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Improved Cassava for the Developing World

www.ciat.cgiar.org/yuca/inicio.htm

Improve cassava production and diversify its end uses by generating high-quality germplasm, new tools, and knowledge that facilitate genetic improvement of cassava.

High-protein roots

During 2005, cassava clones were identified that had two to three times more crude protein in their roots (6%–8% dry weight basis compared with the typical 2%–3%). This high-protein cassava will help improve the diet of millions of people for whom cassava is a daily staple and also increase farm incomes through the production of value-added cassava for livestock nutrition. Because of the low protein content of "normal" cassava, the feed industry only pays 60%–70% of the price of alternative sources of energy (typically maize) for cassava root. The use of high-protein cassava should allow the feed industry to use the same formulations for their feeds (because no additional source of proteins will be required). In many tropical countries, maize is currently imported from temperate regions. Therefore, it is important to find local sources of energy for the feed industry. The high-protein trait adds nutritional value to the root, increases its value, and makes cassava more competitive with maize. Discovery of this trait is expected to increase the possibility of collaboration between the feed industry and the animal nutrition and crop-breeding research communities.

New starch quality mutants

For many years, the cassava-breeding project at CIAT has gradually, but consistently, shifted its attention to the production and identification of cassava clones with high-value industrial uses. For the feed industry, identification of clones with increased nutritional value was a key target. The starch industry has persistently requested clones with altered starch properties in their roots. Clones with molecules simpler than starch are requested by initiatives to produce ethanol fuels and bioplastics. Inbreeding of cassava was introduced, in part, to help identify clones with useful recessive traits. During the past few years, thousands of partially inbred

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An interspecific cross between *Manihot esculenta* and *M. walkerae* produced a plant with roots that did not deteriorate even 3 weeks after harvest.

plants were grown and evaluated—including several mutagenized populations. As a result, several mutants have been identified that have either markedly reduced or twice the normal levels of amylose in their starch and very distinctive amylograms (indicating different pasting properties). The starch produced by these plants offers distinctive advantages for the starch industry. These discoveries are very important, not only because they add value (similar mutations in maize result in 30% increases in their market value), but because they prove that inbreeding of cassava can help identify useful recessive traits.

Overcoming the problem of postharvest physiological deterioration

Cassava roots cannot be stored for more than 1 or 2 days after harvest because postharvest physiological deterioration implies high marketing costs and significant losses between harvest and consumption. An interspecific cross between *Manihot esculenta* and *M. walkerae* produced a plant with roots that did not deteriorate even 3 weeks after harvest. This interspecific cross has been back crossed to cassava. MAS is being used to accelerate the elimination of the wild donor parent genotype and help produce elite lines that have long shelf life.

Deployment of New World tropics germplasm with resistance to cassava mosaic disease (CMD) in Africa

CMD has been rightly described as a shifting, changing, constantly evolving enemy of cassava in Africa and of the 20 million households that depend on its starchy storage roots for livelihood. The disease is now known in the New World tropics. In a bid to accelerate the transfer of useful variability from cassava's center of diversity in the New World tropics to Africa, resistance to CMD was bred into elite parental gene pools at CIAT using MAS. This has led to the development of hundreds of clones having high starch content, good adaptation to lowland humid tropics and acid soils, good resistance to pests and diseases found in the New World tropics, and resistance to CMD. The clones that combine the best characteristics have been tested with many African national programs. In Nigeria, through the National Root Crops Research Institute (NRCRI), three of these clones have entered varietal prerelease regional trials.

Improved Rice for Latin America and the Caribbean

www.ciat.cgiar.org/riceweb/index1.htm

Improve the nutritional and economic well-being of rice growers and low-income consumers in Latin America and the Caribbean through sustainable increases in rice production and productivity.

Varieties for small upland-rice producers

CIAT–CIRAD (French Agricultural Research Centre for International Development) has been conducting participatory rice breeding in Nicaragua in collaboration with the Nicaraguan Institute for Agricultural Technology (INTA) since 2002. These activities have involved local groups of expert farmers and used appropriate participatory breeding approaches and methods. The farmers are involved in the process of evaluating and selecting rice lines, and several varieties are about to be released.

Durable resistance to rice blast

The genetic basis of durable resistance to rice blast in rice variety Llanos 5 is being characterized in collaboration with Kansas State University. It has been discovered that durable resistance in Llanos 5 results from a combination of quantitative and qualitative genes. Researchers now have a much better understanding of what is required for a rice plant to remain resistant to rice blast.

Genetics of resistance to RHBV

Research has determined that resistance to RHBV is the result of a combination of resistance to the virus and to the planthopper vector (*Tagosodes orizicolus*). Several potential quantitative trait loci have now been identified that have resistance to both RHBV and *T. orizicolus*.

Wild rice accessions from Colombia

Wild relatives of rice were collected in Colombia. After identification and molecular characterization of these species, they were shown to be *Oryza latifolia*, a tetraploid species. After several backcrosses to *Oryza sativa*, fertile plants with introgressions from *O. latifolia* were recovered. Preliminary results showed that these wild rice accessions of *O. latifolia* may be a source of resistance to rice blast, RHBV, and the planthopper vector (*Tagosodes orizicolus*).

Composite population improvement

A collaborative project between CIRAD and CIAT concentrates on broadening the genetic base of rice through composite population improvement. This improvement program uses a recurrent selection process combined with conventional breeding methods. The first commercial upland rice variety produced from population breeding was released by Bolivia in January 2006. In addition, some advanced lines are about to be released as new varieties in several countries.

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1. Preliminary results showed that wild rice accessions of *O. latifolia* may be a source of resistance to rice blast, RHBV, and the planthopper vector (*Tagosodes orizicolus*).

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Tropical Grasses and Legumes

www.ciat.cgiar.org/forrajes/index.htm

Optimize genetic diversity for multipurpose use, improve the livelihoods of poor rural -livestock communities, and contribute to greater access by poor urban consumers to safe, high-quality animal products by strengthening forage-based feeding systems and taking advantage of the potential of forages to enhance natural resource management and provide environmental services.

1.
Cratylia, a drought-resistant legume of high nutritional value to livestock.

2.
Tropical Forages, a powerful package, is now freely available on the Internet (www.tropicalforages.info) and on CD-ROM.

Hybrids with multiple resistance to spittlebug

Significant progress was made using a recurrent selection scheme to incorporate resistance to spittlebug into *Brachiaria* spp. In 2004, varying levels of resistance to *Prosapia simulans* (one of the most important species affecting *Brachiaria* in Mexico) were reported in 34 apomictic hybrids. These hybrids had been preselected in Mexico for good adaptation and desirable agronomic characteristics. A series of replicated tests was carried out in 2005 to evaluate the resistance of these genotypes to *Prosapia simulans* and to four other major species of spittlebug in Colombia (*Aeneolamia varia*, *A. reducta, Zulia carbonaria*, and *Mahanarva trifissa*). Six apomictic hybrids were selected for resistance to all five species of spittlebug. In 2005, almost 600 new sexual hybrids were tested for resistance to three spittlebug species (*A. varia*, *A. reducta*, and *Z. carbonaria*) and resistance levels were near 95% to all three species.

Selection of Forages for the Tropics (SoFT)

Forage research over the last 50 years has identified many tropical grasses and legumes that play a role in farming systems in developed and developing countries. Information on the adaptation and use of these species resides in peer-reviewed literature and research reports with limited distribution and, often most importantly, in the memories of forage agronomists with decades of experience working with a wide range of forages in diverse farming systems. An inter-institutional [CIAT, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Queensland Department of Primary Industries (QDPI), ILRI, and the University of Hohenheim] project funded by the Australian Centre for International Agricultural Research (ACIAR) was setup to develop a knowledge system for the identification of forages suitable for specified niches within smallholder farming systems in the tropics and subtropics. The database provides information on the adaptation, uses, and management of forage species, cultivars, and elite accessions and allows easy identification of best-bet species. It

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also includes a bibliography of more than 6,000 references and abstracts on forage diversity, management, and use; global maps of climate adaptation for each species; and a collection of photographs and images of different species. The application was officially released at the XXth International Grassland Congress in Ireland in June 2005. The database is now freely available on the Internet (www.tropicalforages.info) and on CD-ROM. Since its release, there has been a steady increase in the number of visits to the Internet site—from less than 300 in June to almost 5,000 in October 2005.

1.
Lulo (*Solanum quitoense*) is an important fruit crop for small Andean farmers.

2.
Lulo is the main income source for almost 15,000 families in Colombia and Ecuador.

3.
During 2005, CIAT multiplied and distributed healthy elite clones of lulo that had been selected by farmers in Colombia.

Tropical Fruits

www.ciat.cgiar.org/tropical_fruits/index.htm

Use science, technology, and modern information technology to provide information and support to partners in the public and private sector who promote production, processing, and marketing of tropical fruits by rural communities to increase wealth and improve their welfare.

Lulo (*Solanum quitoense*) is an important fruit crop for small Andean farmers. More than 12,000 ha are planted in Colombia and Ecuador, and lulo is the main income source for almost 15,000 families. During 2005, CIAT multiplied and distributed healthy elite clones of lulo that had been selected by farmers in Colombia. The improved performance of these cloned materials created greater interest among farmers to continue with further experimentation in their own plots. The farmers could compare the performance of the cloned plants with the plants grown from seeds and see for themselves the benefits of clonal propagation.

Goal:
Improve the innovative capacity of poor people and communities in the tropics to attain food security, economic productivity, agroecosystem stability, and improved human health and welfare while ensuring the provision of global environmental goods and services.

Objective:
Contribute technical, institutional, and policy innovations to improve the management of tropical agroecosystems that benefit poor communities and the local and global environment by linking market-based approaches with natural resource management.

Crop and Agroecosystem Health Management

www.ciat.cgiar.org/ipm/index.htm

Understand and improve crop and agroecosystem health in the tropics.

This project implements research to achieve four major outputs: to describe and analyze pest and disease complexes; to develop pest-and-disease management components and integrated pest management (IPM) strategies; to strengthen the capacity of NARS to design and execute IPM research and implementation; and to develop global IPM networks (Integrated Whitefly Management Technology) and knowledge systems. Significant advances were made in all four areas.

A number of molecular tools were developed for the diagnosis and detection of pests and pathogens of various crops. A biocidal protein identified from a tropical forage legume (*Clitoria ternatea*) was found to be effective against diseases of tomato under field conditions. The rice-blast-resistance genes present in 211 commercially grown Latin American rice cultivars were identified. Nine groups of potential sources of complementary resistance genes were defined for use in a breeding program to develop commercial rice cultivars that combine desired agronomic traits and blast resistance. Several bean lines with multiple resistance to *Pythium* root rot and angular leaf spot diseases were also selected and will be distributed to several countries for multi-location evaluations. Some lines have already been distributed to Kenya and Malawi. The economic threshold of white grub (*Phyllophaga menetriesi*) was defined for three crops (maize, cassava, and beans). In addition, a methodology for mass rearing of white grub species was developed.

A collaborative mechanism was established to help national partners integrate MAS in their breeding programs. Cohesive and dynamic farmer-research groups (300 groups that include more than 50,000 well-trained farmers) have evolved at project sites in Uganda, Kenya, Tanzania, and Malawi. Farmer-to-farmer knowledge sharing has enhanced technology dissemination and adoption (60%–85% adoption rate) in several countries in Africa. In addition, expanded diffusion of technologies continued within the Department for International Development (DFID)-funded project on Sustainable Management of Whiteflies, and publication of the book *Whitefly and Whitefly-borne Viruses in the Tropics: Building a Knowledge Base for Global Action*.

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Tropical Soil Biology and Fertility (TSBF)

www.ciat.cgiar.org/tsbf_institute/index.htm

Develop and disseminate to clients strategic principles, concepts, methods, and management options for protecting and improving the health and fertility of soils through manipulation of biological processes and the efficient use of soil, water, and nutrient resources in tropical agroecosystems.

1.
Farmer-to-farmer knowledge sharing has enhanced technology dissemination and adoption (60%–85% adoption rate) in several countries in Africa.

2.
The farmer-to-farmer exchange has proven to be a dynamic mechanism of knowledge sharing and an effective way to disseminate integrated soil-fertility management principles.

Conservation and sustainable management of below-ground biodiversity (CSM-BGBD)

A partners' meeting was held in Manaus, Brazil, to present the results of the BGBD inventories carried out in Brazil, Côte d'Ivoire, India, Indonesia, Kenya, Mexico, and Uganda. Also participating in this milestone meeting were mid-term reviewers, technical advisors, steering committee members, and members of the project advisory committee. Technical papers were presented on a wide array of issues. The team of technical advisors concluded that the project had achieved success in agreeing on appropriate standard methods and using them to assemble a unique and comprehensive dataset, a conclusion that was shared by the external evaluators. Based on its mid-term review, the external evaluators recommended a second phase of this project, which was approved by the Global Environment Facility (GEF) in 2006.

Improved decision-making in the Ethiopian highlands

Food security in the Ethiopian highlands is constrained by land degradation, land fragmentation, and limited access to technologies and skills. Enset (*Enset ventricosum*) is a perennial herb with an edible corm that supports about 13 million people in Ethiopia. A household survey, supported by field measurements, was conducted from 2000 to 2002 with 24 representative farmers. The objective was to identify production objectives and quantify available land resources, cropping systems, crop yields, and market prices to be able to develop models that would improve decision-making. Farmers identified three major production objectives depending on their household priorities, socioeconomic status, and resource base: food security (producing enough food from their farm); food security plus the ability to fulfill their financial needs; and solely generating cash income, regardless of its effect on food production.

Using an optimization model, it was possible to predict that enough could be produced by reducing the land area allocated to sweet potato, coffee, wheat, and legumes by 11%, 45%, 22%, and 63%, respectively, while increasing the land area of enset (from 9% to 17%) and kale (from 2.4% to 7.6%). To satisfy both food

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1.
Indigenous knowledge and farmers' experimentation.

2.
The combination of soil fertility and pest and disease management approaches provides a unique opportunity to exploit synergies allowing better control of these limitations to crop productivity.

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and cash demands, the proportions of coffee, potato, beans, and enset would need to be increased by 30%, 15%, 8%, and 3%, respectively, over the current land allocation. This shift would double annual cash income to about USD 140 per consumption unit. Sole interest to cash income would be fulfilled by complete replacement of cereals and root crops by coffee (80.2%) and teff (19.8%), which would generate about USD 230 per consumption unit annually. A change from the current production systems to one based solely on food security could offer high-quality livestock feed; whereas, a move to cash generation would offer low-quality livestock feed (with about 84% of the feed coming from coffee husks). Moreover, a shift from the current system to food security would not affect the level of soil erosion. However, a shift to the other two scenarios would reduce soil erosion by between 39% and 52%, mainly due to expansion of the area planted to perennial crops.

Implementing conservation-farming technology (Fuquene watershed, Colombia)

Reduced tillage, rotations with green manures, and direct drilling of seed are the conservation-farming practices being promoted by the Consortium for Sustainable Development in the Andean Ecoregion (CONDESAN), CIAT, and the German Agency for Technical Cooperation (GTZ) (as part of the Water and Food Challenge Program—WFCP) to reduce the deposition of sediments, nitrogen, and phosphorus in Fuquene Lake, which is already highly eutrophied. Previous studies demonstrated that this alternative could reduce negative environmental impacts by about 50% while increasing net income and employment opportunities. Although these improved practices could increase net incomes, it was suspected that the farmers did not have sufficient cash to incorporate green manures in their crop rotation. This project investigated whether restricted finances were constraining technological change. CONDESAN–GTZ worked with the Regional Autonomous Corporation (CAR) to make sure that the necessary technical assistance was available to implement the required practices. Two farmers' associations were included in the partnership as direct beneficiaries of the credits and also as intermediaries between CONDESAN and the smallest farmers, who do not belong to associations. These development actions both promote technical changes and create *in situ* research opportunities to investigate the real constraints to sustainable soil use. This project will examine the biophysical impacts on both the soil and the lake, and the socioeconomic benefits of the proposed changes. If the results are positive, these practices will become part of an environmental service payment scheme that is promoted by the project.

Farmer-validated management principles

Twenty farmers from drought-prone areas of Nicaragua visited farmers who

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were practicing Quesungual slash and mulch agroforestry systems (QSMAS) on their farms in Honduras. The main objective of their visit was to learn from farmers practicing improved management principles. Six months later, six farmers from Somotillo, Nicaragua, showed their own Quesungual plots to a group of researchers from the integrated soil management (MIS) consortium. The farmers were very excited about the positive benefits of the system and expressed their willingness to teach other farmers from similar regions. This farmer-to-farmer exchange has proven to be a dynamic mechanism of knowledge sharing and an effective way to disseminate integrated soil-fertility management principles.

1.
Plant to make cassava starch.

2.
Sugarcane processing in Cauca, Colombia.

Rural Agroenterprise Development

www.ciat.cgiar.org/agroempresas/ingles/index.htm

Link small farmers to expanding markets so they can develop sustainable livelihoods in the rural sector.

The Rural Agroenterprise Development (RAeD) project is developing methods and tools, and catalyzing new institutional arrangements, to make markets work better for poor farmers. The research agenda includes both action research and strategic studies. Action research is undertaken with public- and private-sector partners within selected supply chains. These studies seek ways to increase the access and competitiveness of smallholders within dynamic markets.

In 2005, several market-chain studies were undertaken to explore “high value products” including: horticultural crops in Latin America; persimmon, cassava-starch, and livestock in Vietnam; and export beans, pigs, and potatoes in Africa. These studies allowed RAeD to investigate how to develop markets that link smallholders to supermarkets in Nicaragua and how to create markets for ethnic minority groups in the uplands of Lao PDR. In each location, common issues were investigated: equity and governance in supply chains; market performance; the sustainability of marketing institutions; and how business-support services and financial services can be delivered to smallholders in a low-cost, sustainable manner.

Based on lessons from the action research, multi-site studies were undertaken to evaluate emerging issues: the minimum social-capital needed for collective marketing; how to integrate savings schemes into enterprise

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1.
In 2005, several market-chain studies were undertaken to explore "high value products".

2.
The RAeD project is developing methods and tools, and catalyzing new institutional arrangements, to make markets work better for poor farmers.

investments versus credit-based investments; ways to foster innovation and experimentation in short-term business planning; how best to access and use market information; and how to design best practice guides that enable service providers to help farmers engage in both informal high-volume and more formalized high-value markets.

The application and scaling up of best practices for enterprise development is being explored through partner-led innovation platforms, such as the agroenterprise "Learning Alliance." Such partnerships have expanded over the past 5 years to more than 30 countries in Latin America, Africa, and Asia. Partners are now able to test and compare best practices in an interactive process that allows learning of new marketing techniques, putting ideas in practice, and reflection on outcomes.

The project is also collaborating with regional centers, northern universities, the CGIAR, and NARS to support knowledge-sharing and capacity-building initiatives for marketing. In 2005, RAeD worked closely with the Global Forum on Agricultural Research (GFAR)–CGIAR on high-value marketing options for the poor; cohosted a conference with the International Water and Sanitation Centre (IRC) on developing learning alliances as a research tool; worked with the Technical Centre for Agricultural and Rural Cooperation (CTA) on prospects for delivering new market information services and commodity exchanges into Africa and the Caribbean; and collaborated with the Royal Tropical Institute (KIT) to publish a book on market-chain empowerment for farmers in Africa. All these efforts are being made to foster market access, improve rural institutions, and raise rural incomes.

Participatory Research Approaches

www.ciat.cgiar.org/ipra/ing/index.htm

Test participatory approaches and analytical tools to incorporate local knowledge and the needs of farmers.

Strengthening farmers' organizations and rural innovation systems

The focus of this research has been on finding how to merge knowledge in ways that produce co-developed technologies. CIAT and the Centers for Learning and Knowledge Sharing (CAIS) are monitoring their co-development efforts to better understand how to facilitate agricultural innovation. The researchers are seeking efficient ways to incorporate local knowledge into the co-development

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of technologies, both those that have been tested by CAIS and those that have resulted from interactions between CIAT and CAIS.

Community-managed participatory monitoring and evaluation (PM&E) systems

In Africa, PM&E systems are being tested at the community and project levels with partners in Kenya, Uganda, and Malawi. Most activities have focused on creating a critical mass of research and development (R&D) staff with skills and experience in applying PM&E systems. To achieve this objective, four training workshops were held for national agricultural research institutes (NARIs) in Malawi, Kenya, Uganda, and Tanzania; nongovernmental organizations (NGOs) in the Southern Democratic Republic of Congo; and representatives from collaborating projects in Eastern and Southern Africa. Efforts have also been made to identify local indicators of change and to establish baselines for the pilot-learning sites.

In Bolivia, the PM&E system has been implemented in 50 projects in three of the four macro-regions, and more than 40 experiences have been documented by the national team of trainers. By working with local grassroots organizations, NGOs, and governmental organizations, a database of information from the communities has been established to feed into a central information system that links the foundations in each macro-region.

Four new participatory methodologies have been developed to actively involve the participating farmers in the evaluation of the different phases of their projects. In addition, a national team of facilitators was created to disseminate the PM&E methodology in Bolivia, and two diploma-granting courses on participatory methodologies were organized with the Foundation for Promotion and Research of Andean Products (PROINPA) and the San Simón University (UMSS). More than 20 agreements and letters of intent have been signed between NGOs, community groups, and the CIAT–FOCAM (Promoting Change) project to participate in PM&E processes in Bolivia.

1.
In Africa, PM&E systems are being tested at the community and project levels with partners in Kenya, Uganda, and Malawi.

2.
Four new participatory methodologies have been developed to actively involve the participating farmers in the evaluation of the different phases of their projects.

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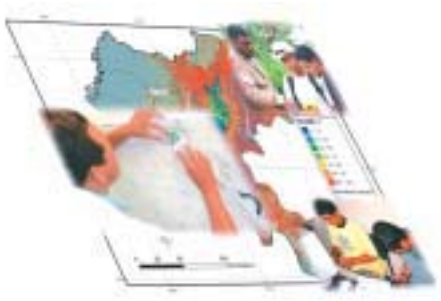

2

Spatial and Economic Analysis for Decision and Policy Support in Agriculture and the Environment

Land Use

http://gisweb.ciat.cgiar.org/sig/inicio.htm

Develop improved systems of natural resource management by using spatial information regarding risks and opportunities at different scales.

1.
The Homologue software defines the probability that any selected location in the tropics will exhibit climatic and soil conditions similar to those of locations that are known to have favorable growing conditions for specific crops.

2.
Geographic information can be used to support supply-chain management of high-value agricultural products based on products quality.

A new software package was developed jointly with the Tropical Fruits Project to help improve genetic-resource management. This Homologue software defines the probability that any selected location in the tropics will exhibit climatic and soil conditions similar to those of locations that are known to have favorable growing conditions for specific crops.

A practical risk-management tool for drought insurance was also developed, implemented, and tested in collaboration with the CIAT Rural Agroenterprise Development Project. The methodology integrates crop-growth modeling with climate simulation. The use of these computer models was successfully demonstrated in case studies in Central America and Southeast Asia.

The Diversification Agriculture Project Alliance (DAPA) has built strong relationships with other academic institutions, such as CIRAD, and importantly with private-sector partners. These relationships foster direct field implementation of results from applied research that targets higher value crops at environmental and market niches. In addition, fundamental knowledge is being generated on the causal relationships between the quality of high-value agricultural crops and their growing environments.

Geographic information can be used to support supply-chain management of high-value agricultural products based on products quality. Projects are being developed to commercially introduce these concepts. As well, the strategic use of environmental information is being improved. Topography information is now included, and greater emphasis is being placed on generating timely climate information.

The GEF project on reversing land degradation has been initiated in the field. The first year will be used to complete assessments that will be used to develop a multi-year project.

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Impact Assessment

www.ciat.cgiar.org/impact/index.htm

Help planners to ensure that scarce resources are being used as efficiently as possible by developing reliable information about the impact of research.

A participatory research project designed to improve the sustainability of cassava systems in the uplands of Southeast Asia demonstrated high adoption rates of improved cassava varieties. Adoption of soil-conservation practices was lower, but still significant. In some cases, soil conservation contributed to yield increases and expansion of cassava area. This expansion in area suggests that conservation practices are allowing farmers to cultivate steeper, more erosive land in a sustainable way. The most significant finding was that farmer participation had a large impact on yield that was independent of the impact of higher levels of technology adoption. Farmers who participated in the trials had higher yields, not only because they were more likely to have adopted the new technologies, but because their participation appears to have increased their human capital in ways that allowed them to better manage their farms.

A farm-level model was developed and tested to analyze joint production of agricultural products and environmental services. When applied to agrosilvopastoral systems in the Colombian Llanos, the incorporation of forestry for both forest products and carbon sequestration was found to be economically viable; however, its success depended on the capital intensity of the operation. Environmental services are only viable for larger, richer farmers. Policies that subsidize the establishment and maintenance of forests, or pre-pay carbon credits, would make environmental service options more pro-poor.

Estimates of the potential benefits of biofortified beans in Central America and cassava in Brazil were compared with those of other biofortified crops. Even under pessimistic assumptions, beans and cassava generate positive returns. However, compared with the results of crops such as rice or wheat in populous countries such as India, they are less attractive from an economic point of view. These results suggest that crop strategies, especially target countries, should be reevaluated.

1.
Plantation of cassava.

CIAT in the Regions

CIAT regional programs pursue progressive research on technologies and processes that help rural communities build sustainable livelihoods through competitive agriculture, healthy agroecosystems, and rural innovation. The programs work closely with national institutions, NGOs, and the private sector and use participatory methods to ensure that rural people play an active role in devising better ways to improve crops, build rural agroenterprises, and manage soil fertility, pests, and plant diseases.

Regional Coordination—Africa

www.ciat.cgiar.org/africa/index.htm

The competitive grants approach adopted for the Challenge Program is likely to produce mixed results in terms of collaboration among CGIAR Centers in Africa. However, the report of the Africa Task Force commissioned by the Science Council provided fresh impetus for all Centers to integrate their work. This report provided a sound diagnosis of the real problems, while presenting a range of possible solutions—from merging Centers to integrating programs. With the formation of the Alliance Executive, the Centers and the Science Council agreed to develop two mid-term plans (MTP) among the Centers working in the Eastern and Southern, and in the West and Central, subregions of Africa. ILRI and the Africa Rice Center are leading the development of these MTPs. A searchable database of all projects, outputs, and outcomes is nearing completion, and potential themes for integrated work are being revisited. In Eastern and Southern Africa, for example, these research themes are likely to be in the areas of integrated natural resource management (INRM), exploiting genetic diversity, information and knowledge, and post-conflict rehabilitation of capacity for research-for-development. When considered with the new high-level Framework for African Agricultural Productivity, there is an opportunity for the Centers to engage in strong collaboration around a smaller number of large projects.

Regional Coordination—Asia

www.ciat.cgiar.org/asia/index.htm

Cassava

Two successful cassava projects are on-going in Asia. One, funded by ACIAR, aims to improve the cassava-production systems in Indonesia and to establish improved systems in East Timor. The second, funded by the Nippon Foundation, works on improving on-farm production and use of cassava in Lao PDR and Cambodia.

In Asia, cassava has a bright future in ethanol production as a substitute for fossil fuels, in industrial uses of starch, particularly waxy starch, and in the animal-feed industry. A number of partner countries are interested in developing cassava varieties that are better suited to these uses. CIAT is well positioned to play an important role in these developments through the genetic

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resources available in its germplasm bank and its expertise in both traditional and biotechnology-based plant breeding techniques.

Forages

Significant changes occurred during 2005 in the forage and livestock systems in the region. A project funded by the Australian Agency for International Development (AusAID) on forages and livestock systems was completed in Lao PDR and produced significant impacts both on the capacity of national staff and on farmers. A multi-country livestock and livelihood systems project, funded by the Asian Development Bank (ADB), also made significant impacts and produced a cadre of regional forage scientists. In 2005, CIAT and ILRI designed a loan project for the ADB and the Government of Lao PDR. In late 2005, a new ADB-funded project was established to build provincial and national capacity in readiness for the implementation of the loan project, which should start in late 2006 or early 2007. As well, a research for development project based on earlier research findings was approved to develop technologies for greatly improved village-based pig feeding systems. Considerable potential exists to further develop R&D links in the forage and livestock systems of countries in the region.

R&D support, agroenterprise development, analysis, and new directions

In collaboration with CIP, the Participatory Research for Development in the Uplands (PRDU) project continues to provide methodological and technological support to loan projects of the International Fund for Agricultural Development (IFAD) in Lao PDR, Vietnam, and China. This type of project emphasizes the critical role CGIAR Centers have in providing a link between R&D, although much work remains to improve the flow of ideas from research to development projects.

There is a great deal of interest in linking farmers to markets, and several CIAT activities in the region are having impact in this area. A project funded by the Swiss Agency for Development and Cooperation (SDC) on small-scale agroenterprise development in the uplands of Lao PDR and Vietnam continues to show very interesting

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1.
The report of the Africa Task Force commissioned by the Science Council provided fresh impetus for all Centers to integrate their work.

2.
Significant changes occurred during 2005 in the forage and livestock systems in Asia.

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1.
Two successful cassava projects are on-going in Asia.

2.
There is a great deal of interest in linking farmers to markets, and several CIAT activities in Asia are having impact in this area.

impacts. This is a new area of work for most governments in the region. However, local governments appreciate the relatively immediate benefits that results from an improved dialogue between all stakeholders in the market chain and a better understanding of the structure of the market chain.

In northern Lao PDR, a project funded by the Austrian Development Agency (ADA) is analyzing the livelihood strategies, market chains, associated risks, and the spatial arrangement of small-scale agroenterprises. The project has led to an improved understanding of how poor farmers can move out of systems based on subsistence agriculture. This work should link closely with activities undertaken in association with the Japan International Research Center for Agricultural Sciences (JIRCAS) on spatial analysis and remote sensing of land-use systems in complex farming systems in the uplands of Lao PDR.

Additional activities are anticipated to enhance regional collaboration in Asia, particularly the involvement of other countries and donors. Expansion into new areas of activity such as beans, fruit trees, and other high-value crops and into new countries in South, Southeast, and East Asia also appears possible.

Regional Coordination—Central America and the Caribbean

Collaborative partnerships with national research institutions and ministries are central to dissemination and applied research. However, greater reliance is also being placed on a growing network of partners ranging from worldwide NGOs, such as Catholic Relief Services (CRS), CARE, and the famine relief organization OXFAM, to development agencies such as GTZ and Netherlands Development Organisation (SNV), and to local municipalities such as San Dionisio, Nicaragua, and Yorito, Honduras. Work with INTA in Nicaragua intensified across several CIAT projects (e.g., Watershed Management, Forages, Rice, Sorghum, Beans, Biofortification, Cassava, Tropical Soil Biology and Fertility). Additional effort will be made to obtain similar levels of collaboration in Honduras, El Salvador, Guatemala, and Haiti, although a good number of collaborative projects are now being implemented.

An outstanding example for partnership work is the Learning Alliance. This

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activity triggered a process of mutual learning and training, research, and development with a series of research institutions, development partners, and donors in Central America. It also allowed additional CIAT projects to use the alliance as a platform to intensify their work with partners. The alliance has proven to be an effective "door opener" for new bilateral partnerships and multilateral activities.

Throughout the region, universities continued to be our natural partners in research activities. But a growing number of intensified partnerships with advanced research institutions and universities in the North were also developed to enhance North–South collaboration. At the heart of all collaborative work are partnerships with farmers and farmer groups. Although participatory instruments in project development, management, and monitoring are increasingly applied, additional effort is needed to optimize the process and the communication channels.

Additional interactions with other CGIAR Centers are desirable. In 2006, there was an opportunity to collaborate with The World Vegetable Center (AVRDC), which is intensifying its work in Central America. In addition, collaboration with the Inter-American Institute for Cooperation on Agriculture (IICA) and the Tropical Agricultural Research and Higher Education Center (CATIE) is ongoing to develop several activities and proposals in different countries. To maintain and intensify partnerships in the region, plans are underway to increase the number of CIAT projects that have staff placed within the region.

1.
Work with INTA in Nicaragua intensified across several CIAT projects.

2.
A good number of collaborative projects are now being implemented in Haiti.

3.
An outstanding example for partnership work is the Learning Alliance in Central America.

Public–Private Partnerships and Agronatura Science Park

Public–private partnerships are playing an increasingly important role in agrobiodiversity and agroecosystems. In Latin America and the Caribbean (LAC) the main sources for funding are producer associations (private sector) and civil society organizations. Contacts were made with African palm and cattle associations to promote replication of the cooperative models illustrated by FLAR and CLAYUCA. Representatives of the cacao, tropical flower, and plantain industries are currently discussing the feasibility of implementing similar mechanisms. Proper handling of intellectual property rights will be an important aspect of this work.

Agronatura is carrying out several initiatives to increase CIAT's role in Colombia. A group called "*Amigos del CIAT*" promotes local application of CIAT discoveries and fosters enhanced collaboration with the host country.

Latin American and Caribbean Consortium to Support Cassava Research and Development (CLAYUCA)

www.clayuca.org

Help improve living standards and sustainable natural resource management in regions of LAC where cassava plays an important role in agricultural production systems. Generate, transfer, and exchange technologies, information, and scientific knowledge among public- and private-sector institutions and farmer groups.

Technology package for cassava production

Technical assistance provided to a commercial-scale cassava project in Nigeria, in collaboration with technical personnel from the National Research Institute on Tropical Root Crops (INIVIT) in Cuba, was instrumental in obtaining yields of more than 30 t/ha. The first harvest in Nicaragua of cassava clones introduced *in vitro* from CIAT, which were hardened and grown with technical assistance from CLAYUCA and supervised by INTA, gave yields of between 40 and 50 t/ha for some of the clones, with high dry-matter content and good quality cassava roots. CLAYUCA coordinated *in vitro* shipment of improved cassava clones to Suriname, Peru, Mexico, Nicaragua, and South Africa. As well, CLAYUCA acted as a technology clearinghouse for private-sector companies in Nigeria and South Africa and helped them to import cassava-planting machines purchased in Brazil.

Technology package for producing refined cassava flour

Important advances were made in the refinement process for cassava flour for industrial uses and human consumption.

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From an initial processing capacity of about 100 kg/h of dry cassava chips, and using basically the same equipment, the current capacity has been increased to about 350 kg/h. With minor changes in the design, it should be possible to increase the capacity to about 750 kg/h.

Rapid multiplication of cassava planting material

An innovative method was developed to rapidly multiply cassava planting material. The method uses 1-bud and 2-bud mini-stakes grown using a combination of field and greenhouse growing periods. This technique was field tested at three different sites in Colombia, Nigeria, and South Africa with excellent results. The method is now a proven strategy for producing significant amounts of planting material in a short time. However, CLAYUCA continues to evaluate the effect that the small size of the planting material could have on yields. Preliminary results indicate that this effect may be negligible. If so, a radical change may be possible in the multiplication of cassava planting material, especially when farmers want to extensively plant a promising new variety.

Coordination of activities

South Africa and Nigeria are now members of CLAYUCA—in both cases through a private company implementing cassava projects. CLAYUCA staff conducted technical assistance missions in both countries. In addition, Costa Rica and Haiti became the seventh and eight countries to join CLAYUCA.

1.
CLAYUCA Web site.

2.
Important advances were made in the refinement process for cassava flour for industrial uses and human consumption.

3.
Drying cassava starch.

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Latin American Fund for Irrigated Rice (FLAR)

www.flar.org/inicio.htm

Meet the needs of partners for continuous innovations in irrigated rice production. Make rice production more competitive, profitable, and efficient by employing environmentally friendly crop-management practices, lowering prices to rice consumers, and strengthening the rice sector in member countries.

1. FLAR Web site.

2. Regional Workshop on Integrated Crop Management of Rice and Technology Transfer.

In 2004, FLAR and CIAT made a commitment to collaborate on irrigated rice in Latin America. This agreement was extended for 5 years in 2005, and the fund grew to 14 member countries. Peru announced its intention to become the fifteenth member before the end of 2006.

Breeding is at the core of FLAR activities. The sub-program for the tropics has introduced improved materials to member's breeding programs for several years, and new cultivars are now being registered and are in the seed-multiplication stage: one in Venezuela, one in Nicaragua, one in Guatemala, two in Panama, and two in Costa Rica (one for irrigated and one for uplands). In Colombia, three FL advanced lines are undergoing final evaluation trials.

The sub-program for temperate rice started several years later and focuses on increasing yield potential, better agronomic traits, high quality, and cold tolerance in different growing stages. A new screening methodology for cold tolerance of seedlings was developed and has been added to current screening protocols. A cold chamber was constructed to improve screening capacity throughout the seed, seedling, and reproductive stages. Trials in countries of the Southern Cone have shown an improvement in recently sent material and good adaptation to these environments.

FLAR activities in agronomy were increased during the last stages of a project funded by the Common Fund for Commodities (CFC) to improve yields of irrigated rice in Venezuela and Brazil. Adoption of improved management not only in these countries, but in Nicaragua, Costa Rica, Guatemala, and Argentina, showed that in farmers' demonstration plots, yields were increased by 1–3 t/ha with no cost increases. These results indicate the potential to increase the competitiveness of the rice sector and demonstrate the effectiveness of farmer-to-farmer methods for transferring good crop-management practices. FLAR will

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continue this project with its own funds in 2006 extending it to all 14 member countries.

A new project recently approved by CFC will focus on rice markets. It will provide non-market and market-based instruments to manage rice-price fluctuations in Latin America and the Caribbean. Use of these instruments will help manage marketing and financial risks associated with trade liberalization and the extension of high-yielding rice technologies.

1.
Breeding is at the core of FLAR activities.

2.
Farmer at a Colombian savanna.

Cooperation with Colombia

CIAT enjoys a very positive relationship with its host country. Under the government's new competitive approach to the financing of agricultural research and rural development projects, CIAT raised USD 945,000 in 2005 through 27 proposals that were developed in alliance with national partners, both from the public and the private sector: CORPOICA; the Colombian Institute for Rural Development (INCODER); the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM); the Alexander von Humboldt Biological Resources Research Institute (IAvH); the Foundation for Agricultural Research and Development (FIDAR); the National Fund for the Promotion of Horticulture (ASOHOFRUCOL); and the Departmental Governments of Cauca and Valle del Cauca. These research proposals covered cassava, beans, tropical fruits, agroenterprises, watersheds, biotechnology, and land-use planning.

In addition, CIAT signed three cooperative agreements with the Colombian Ministry of Agriculture to support research, development, and institutional strengthening. The total value of these agreements was USD 3,450,000.

Several CIAT scientists and professionals were invited to participate in the boards and executive and administrative committees of public institutions, such as CORPOICA, The Francisco José de Caldas Colombian Institute for the Development of Science and Technology (COLCIENCIAS), the Association of Farmers and Livestock Producers of Valle, and ASOHOFRUCOL.

HarvestPlus Challenge Program

www.harvestplus.org

Reduce micronutrient malnutrition by harnessing the powers of agriculture and nutrition research to breed nutrient-dense staple foods.

Co-convened by CIAT and IFPRI, the HarvestPlus Challenge Program is breeding nutrient-dense staple foods and making them available to the undernourished. All plant breeding research and work to reach and engage end-users of biofortified crops is coordinated at CIAT. Sixteen staple crops are being bred to be high in vitamin A, iron, and/or zinc. The reaching end-user component is working with CIP-developed orange fleshed sweet potato to build strong seed systems, ensure markets, and understand the complexities of creating demand for biofortified crops.

Impact research is also being conducted by CIAT. The HarvestPlus team works on geographic targeting to support the biofortification strategy. Standard impact-assessment methods often fail to account for geographic differences in health status, crop production and consumption, and other factors that vary within and between countries. Crop production and farming-systems information must also be reconciled with health status and poverty information. Geographic information is being used to conduct spatial analysis of the data to address these problems and to support breeder strategies that seek to reach end-users.

Further research is underway on the links between the HarvestPlus crops (maize, wheat, and rice), socioeconomic conditions, and health conditions. The project is carrying out a series of modeling efforts and will ultimately provide tools and data for refined decision-making throughout variety development, testing, and dissemination.

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Generation Challenge Program

www.generationcp.org/index.php

Use plant genetic diversity, advanced genomic science, and comparative biology to develop tools and technologies that enable plant breeders in the developing world to produce better crop varieties for resource-poor farmers.

Three large proposals were approved during 2005. The first seeks to transfer useful genes from wild relatives of cassava into elite progenitors. This project is conducted in partnership with the Brazilian Agricultural Research Corporation (EMBRAPA) and the National Research Center for Cassava and Tropical Fruits (CNPMF), the Crops Research Institute (CRI) Ghana, NRCRI Nigeria, and the Namulonge Agricultural and Animal Production Research Institute (NAARI) Uganda. The second involves collaboration between Cornell University, the Institute of Research for Development (IRD) France, WARDA, EMBRAPA–CNPMF, and Fedearroz Colombia on exploitation of natural genetic variation in wild relatives of rice. The third project attempts to identify the physiological and genetic traits that make cassava one of the most drought-tolerant crops. It involves EMBRAPA–CNPMF, as lead institution, CIAT, IITA, and Cornell University.

1.
CIAT, in partnership with the African Highlands Initiative (AHI) and the Rwandan Institute for Agricultural Sciences (ISAR), was selected as the lead institution for the Lake Kivu pilot learning site (PLS).

Sub-Saharan Africa Challenge Program (SSA CP)

www.fara-africa.org/SSA%20CP.htm

Address the most significant constraints to reviving agriculture in Africa—failures of agricultural markets, inappropriate policies, and natural resource degradation—by applying a new paradigm, Integrated Agricultural Research for Development (IAR4D).

Managed by the Forum for Agricultural Research in Africa (FARA), this multi-stakeholder effort creates novel partnerships with a wide range of R&D partners (including CGIAR Centers, NARS, universities, NGOs, farmers' organizations, government institutions, and the private sector) around the broad theme of integrated agricultural research for development (IAR4D).

CIAT, in partnership with the African Highlands Initiative (AHI) and the Rwandan Institute for Agricultural Sciences (ISAR), was selected as the lead institution for the Lake Kivu pilot

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1.
Water and Food Challenge Program Web site.

learning site (PLS). This site covers contiguous areas of the Democratic Republic of the Congo, Rwanda, and Uganda and includes densely populated and fragile highland environments across three countries at very different stages of emergence from severe civil disruption. As lead institution, CIAT provides and facilitates administrative and research support to approximately 50 organizations that belong to the pilot learning team, and liaises closely with the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), which has management oversight for this PLS and FARA.

Over the year, efforts have been made to develop partnerships of research teams (task forces) to compete for funds through a competitive grant system. CIAT won one of three competitive grants to lead a multi-institutional task force for a 3 year project on *Wealth creation through market access and rural agroenterprise diversification in the Lake Kivu PLS*.

Water and Food Challenge Program

www.waterandfood.org

Create research-based knowledge and methods for growing more food with less water. Develop a transparent framework for setting targets and monitoring progress that recognizes that most food demand will be met by improving the productivity of rainfed systems.

CIAT is the lead institution for coordination of Theme 2 in the Water and Food Challenge Program (WFCP)—Water and People in Catchments. This responsibility covers research, technical, scientific monitoring, and evaluation activities. As part of a comprehensive assessment, a paper was written on the main links between poverty, gender, and water management in agriculture and the search for promising pathways to improve water management. In addition, six papers were prepared for a special issue of *Water International* on integrating scales of analysis and action in water-resources management from a development perspective. The results of research on social-network analysis and the methodological tools that it encompasses were prepared to explore the relationships between the actors who manage water resources and the biophysical conditions of two upper catchments in the tropics.

A CIAT scientist, seconded to the WFCP, is coordinating the activities of the basin focal projects (BFPs). Ten strategic research projects, with a collective budget of USD 8.5 million, are being

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developed in nine benchmark basins, plus the Niger basin. The purpose of the BFPs is to assess the current condition of agricultural-water management within the basins. This analysis, together with assessments of opportunities and threats to improvement, will determine how specific changes in water-management systems can satisfy competing demands made by the food and other sectors. Projects, led by IWMI, CSIRO, the University of California, Davis, and IRD, have been initiated for the Karkheh, Mekong, São Francisco, and Volta basins. Competitive grant projects for the Andes, Indus–Ganges, Limpopo, Niger, Nile, and Yellow River basins are due to start in November. The BFPs include USD 900,000 for an impact assessment project. This project is led by CIAT and includes research that will lead to more formal benefit–cost analysis.

1.
Tropical Whitefly IPM Project Web site.

2.
The IPM package distributed to small-scale farmers with the improved germplasm emphasizes the use of minimum chemical inputs.

Tropical Whitefly IPM Project

www.tropicalwhiteflyipmproject.cgiar.org

Improve the livelihoods of rural families through the effective management of whiteflies and whitefly-transmitted viruses, which will result in increased crop production and reduced environmental impact through the elimination of toxic insecticides.

This system-wide project continues to disseminate information on whitefly and virus-disease management as well as improved cassava, common bean, sweet potato, and tomato germplasm in Asia, Africa, and Latin America, where these pests are endemic. Technical guidelines have been distributed to agricultural professionals and farmers on how to manage whiteflies, which are pests and vectors of plant viruses of important food and industrial crops. Common bean varieties possessing resistance to whitefly-borne viruses are being multiplied in Central America to provide certified seed to small-scale farmers free of charge. The IPM package distributed to small-scale farmers with the improved germplasm emphasizes the use of minimum chemical inputs.

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Participatory Research and Gender Analysis (PRGA)

www.prgaprogram.org

Develop and promote methods and organizational approaches for gender-sensitive participatory research on plant breeding and on management of crops and natural resources.

1. PRGA Web site.

This program has successfully catalyzed the generation of a sizeable body of research to assess the impact of participatory research and gender analysis methodologies, and culminated in several publications. The program is fueling a broad effort to mainstream these findings into practice, notably with African NARIs. Efforts to increase peer-reviewed publication, PhD dissertation research, and e-learning initiatives with university partners have had a positive effect on information dissemination.

Lessons learned

The PRGA program organized an impact-assessment workshop with CIMMYT to discuss the measurement and interpretation of the impact of participatory research and gender analysis. The goal was to provide an all-too-rare forum for sharing of experiences, learning, and discussion. As a result, 25 empirical impact studies are now available on the PRGA Web site, and a number of lessons have been documented. These resources will provide input for both individual impact-assessors and R&D organizations, and affect stakeholders at all levels—from farming communities, to R&D agents, to donors.

Some of the key lessons learned through the impact-assessment workshop included:

- the need to "build on the positive"—learning from the positive experiences of others to make technical and social science research more focused on poverty reduction and social inclusion;
- the realization that there is no "one way" of doing impact assessment of participatory R&D; in particular, assessments that rely solely on quantitative techniques no longer work and integrated impact-assessment methods must be applied;
- in many cases, the *principles* of impact assessment—particularly integrated impact assessment—are more easily transferable than methods;
- including all types of stakeholders (especially end-users and donors) in the planning and conduct of impact assessment contributes to learning and change;
- impact-assessors need time to reflect on their results, rather than moving straight on to the next task; and
- effective communication of results is vital, as all too often impact results are lost in the details of lengthy reports.

Mainstreaming Gender Analysis in African Agricultural Research

A PRGA project, begun in 2004 with ASARECA, was designed to build capacity in gender analysis and mainstreaming in

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African NARS. In the first year, learning workshops and mentoring were undertaken to develop capacities to conduct gender analysis, train others, and apply concepts and skills to mainstream these methods. In 2005, a total of 17 participants from NARS in eight countries attended a workshop on strategic planning for gender analysis and organizational change. After some additional training, the NARS representatives were able to analyze their institutional situations and to build work plans around their knowledge of the starting point (i.e., the status quo) and the desirable end-point (i.e., mainstreamed gender sensitivity). In the long term, mainstreaming of gender analysis is expected to help research better target poverty alleviation.

1.
Amazon Eco-Regional Program Web site.

2.
Land degradation in the forest.

Amazon Eco-Regional Program

www.asb.cgiar.org/regions/amazon/ai.asp

Help prevent, reduce, and reverse land degradation by promoting policies and technologies for sustainable land management in the region.

The establishment of an Amazon Initiative System-Wide Eco-Regional Program within the CGIAR structure was approved by the Alliance Executive. A proposal to the Science Council was submitted in mid-2006 to support research that focused on integrated socioenvironmental assessment, enhanced landscape management, natural resource governance, and collaborative monitoring and evaluation of research development and outcomes. In addition, the National Institute of Agricultural and Food Research and Technology (INIA) in Spain renewed its support for institutional development of the Amazon Initiative (AI), and the International Centre for Migration and Development (CIM) approved funds to hire an environmental services expert.

Nine subregional workshops were carried out in the six member countries and attracted representatives from more than 220 institutions. The objectives of these workshops included the dissemination of the AI vision, identification of priorities, creation of an inventory of technologies, services, and products supplied in the subregion, and an assessment of major gaps. As well, 11 thematic networks were formed, and a training workshop was held for network facilitators in Lima, Peru.

In collaboration with Association of Amazonian Universities (UNAMAZ), students enrolled in Amazonian universities are supported through short-term internships in research projects carried out in NARS and CGIAR Centers. In addition, EMBRAPA has earmarked funds for use on AI activities, and five major collaborative proposals have been submitted for funding.

An Overview of CIAT

The International Center for Tropical Agriculture (CIAT) is a not-for-profit organization that conducts socially and environmentally progressive research aimed at reducing hunger and poverty and preserving natural resources in developing countries. CIAT is one of the 15 centers funded mainly by the 64 countries, private foundations, and international organizations that make up the Consultative Group on International Agricultural Research (CGIAR).

Donors

CIAT receives funds through the CGIAR or under specific projects from the countries and organizations listed below. We gratefully acknowledge their commitment and contributions. CIAT also receives funds for research and development services provided under contract to a growing number of institutional clients.

Asian Development Bank (ADB)
Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)
Australia
- Australian Agency for International Development (AusAID)
- Australian Centre for International Agricultural Research (ACIAR)

Austria
- Austrian Development Agency (ADA)
- Austrian Federal Ministry of Finance (BMF)

Belgium
- General Administration for Cooperation in Development (AGCD)

Bill and Melinda Gates Foundation
Brazil
- Brazilian Agricultural Research Corporation (Embrapa)

Canada
- Canadian International Development Agency (CIDA)
- International Development Research Centre (IDRC)

Colombia
- Colombian Corporation for Agricultural Research (CORPOICA)
- Colombian Institute for the Development of Science and Technology (COLCIENCIAS)
- Ministry of Agriculture and Rural Development (MADR)

Common Fund for Commodities (CFC)
European Commission (EC)
Food and Agriculture Organization (FAO) of the United Nations
France
- French Agricultural Research Centre for International Development (CIRAD)
- Institute of Research for Development (IRD)
- Ministry of Foreign Affairs

Germany
- Federal Ministry of Cooperation and Economic Development (BMZ)

Inter-American Institute for Cooperation on Agriculture (IICA)
International Fund for Agricultural Development (IFAD)
Italy
- Ministry of Foreign Affairs

Japan
- Ministry of Foreign Affairs
- The Nippon Foundation

Latin American and Caribbean Consortium to Support Cassava Research and Development (CLAYUCA)
Latin American Fund for Irrigated Rice (FLAR)
Mexico
- Grupo Papalotla

Netherlands
- Catholic University of Leuven
- Directorate General for International Cooperation (DGIS)
- Ministry of Foreign Affairs

New Zealand
- New Zealand Agency for International Development (NZAID)

Norway
- Norwegian Agency for Development Cooperation (NORAD)
- Royal Ministry of Foreign Affairs

OPEC Fund for International Development
Peru
- National Institute for Agricultural Extension and Research (INIA)

Regional Fund for Agricultural Technology (FONTAGRO)
Spain
- National Institute of Agricultural and Food Research and Technology (INIA)

Sweden
- International Programme in the Chemical Sciences (IPICS) of Uppsala University
- Stockholm Environment Institute (SEI)
- Swedish International Development Cooperation Agency (SIDA)

Switzerland
- Swiss Agency for Development and Cooperation (SDC)
- Swiss Centre for International Agriculture (ZIL)
- Swiss Federal Institute of Technology Zurich (ETH)

Technical Centre for Agricultural and Rural Cooperation (CTA)

United Kingdom
- Department for International Development (DFID)
- Natural Resources Institute (NRI)

United Nations Environment Programme (UNEP)

United States of America
- The Rockefeller Foundation
- United States Agency for International Development (USAID)
- United States Department of Agriculture (USDA)
- W.K. Kellogg Foundation
- World Vision

World Bank

Mission

To reduce hunger and poverty in the tropics through collaborative research that improves agricultural productivity and natural resource management.

Project Portfolio

In response to a series of external reviews, CIAT has organized its diverse project portfolio around two initiatives: Enhancing and Sharing the Benefits of Agrobiodiversity; and People and Agroecosystems in the Tropics.

Enhancing and Sharing the Benefits of Agrobiodiversity

Conservation and Use of Tropical Genetic Resources
Bean Improvement for the Tropics
Improved Cassava for the Developing World
Improved Rice for Latin America and the Caribbean
Tropical Grasses and Legumes
Tropical Fruits

People and Agroecosystems in the Tropics

Crop and Agroecosystem Health Management
Tropical Soil Biology and Fertility (TSBF)
Rural Agroenterprise Development
Participatory Research Approaches
Spatial and Economic Analysis for Decision and Policy Support in Agriculture and the Environment

Financial Results

The following tables show CIAT's financial position and provide a statement of activities for the years 2004 and 2005.

CIAT projected a surplus of USD 0.3 million for 2005; however, a continued decline in core contributions, accelerated revaluation of the Colombian peso, additional expenditures incurred by implementing the carryover policy, and difficulties in obtaining full cost recovery from restricted projects created a deficit of USD 0.9 million for 2005. This left the financial indicators below the CGIAR targets.

During 2006, CIAT initiated a reorganization based on a new business plan approved by the Board of Trustees. This plan includes cuts of USD 2 million across the board and another USD 2 million in strategic cuts. It also includes changes in the budgeting system. CIAT will move from cost-recovery to full-cost budgeting, which will require restricted projects to pay all associated costs, including personnel, research and technical support, and indirect cost. The downsizing resulted in an additional USD 3 million for staff termination, which created a deficit of USD 2 million in 2006. CIAT forsees surpluses of USD 2.5 million in 2007 and USD 3 million in 2008. After full implemented of the business plan by the end of 2008, CIAT reserves will amount to USD 9 million, which will be on target with CGIAR financial indicators.

CIAT Statement of Financial Position (thousand USD)
As of 31 December 2005 and 2004

	2005	2004
Assets		
Current Assets		
Cash and cash equivalents	14,559	11,197
Accounts receivable		
Donors	7,181	6,011
Employees	357	259
Others	1,546	1,559
Inventories	348	334
Prepaid expenses	176	173
Total Current Assets	24,167	19,533
Non-Current Assets		
Property, and equipment	10,021	10,093
Other assets	6	11
Total Non-Current Assets	10,027	10,104
Total Assets	34,194	29,637
Liabilities and Net Assets		
Current Liabilities		
Accounts payable		
Donors	8,551	7,179
Employees	774	595
Others	3,417	3,098
Accruals and provisions	145	163
Support to partners Challenge Programs	3,620	852
Funds in trust	889	267
Total Current Liabilities	17,396	12,154
Non-Current Liabilities		
Accruals and provisions	1,091	860
Others	514	536
Total Non-Current Liabilities	1,605	1,396
Total Liabilities	19,001	13,550
Net Assets		
Undesignated	4,068	5,041
Designated	11,125	11,046
Total Net Assets	15,193	16,087
Total Liabilities and Net Assets	34,194	29,637

CIAT Statement of Activities (thousand USD)
For the years ended as of 31 December 2005 and 2004

	Unrestricted	Restricted		Total 2005	Total 2004
		Temporary	Challenge Programs		
Grants	10,981	25,182	4,053	40,216	36,008
Other revenues and support, net	1,248	-	-	1,248	968
Total revenues, gains, and other support	12,229	25,182	4,053	41,464	36,976
Program related expenses	8,851	24,543	3,918	37,312	31,688
Management and general expenses	6,871	639	135	7,645	6,420
Other expenses	198	-	-	198	358
Total expenses and losses, net before indirect cost recovery	15,920	25,182	4,053	45,155	38,466
Indirect cost recovery	(2,797)	-	-	(2,797)	(2,025)
Total expenses and losses, net	13,123	25,182	4,053	42,358	36,441
Net Surplus (Deficit)	(894)	-	-	(894)	535
Memorandum items:					
Operating expenses by natural classification					
Personnel costs	10,939	8,110	1,590	20,639	18,584
Supplies and services	34	8,931	1,467	10,432	8,840
Collaborators-Partnerships costs	-	5,256	541	5,797	4,248
Operational travel	1,026	2,246	320	3,592	3,291
Depreciation of fixed assets	1,124	639	135	1,898	1,478
Total operating expenses, net	13,123	25,182	4,053	42,358	36,441

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Juan Antonio Garafulic, Director of Finances**
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Rod Lefroy, Upland Systems Specialist and Coordinator for Asia, Lao PDR
Axel Schmidt, Agronomist and Coordinator for Central America and the Caribbean, Nicaragua

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Mathew Blair, Bean Germplasm Specialist and Breeder
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Acronyms and Abbreviations

ACIAR	Australian Centre for International Agricultural Research
ADA	Austrian Development Agency
ADB	Asian Development Bank
AGCD	General Administration for Cooperation in Development, Belgium
AHI	African Highlands Initiative
AI	Amazon Initiative
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASOHOFRUCOL	Fondo Nacional de Fomento Hortifruticola, Colombia (*National Fund for the Promotion of Horticulture*)
ATDT	Agricultural Technology Development and Transfer
AusAID	Australian Agency for International Development
AVRDC	The World Vegetable Center, Taiwan
BFPs	basin focal projects
BGBD	below-ground biodiversity
BMF	Austrian Federal Ministry of Finance
BMZ	Federal Ministry of Cooperation and Economic Development, Germany
CAIS	Centros de Aprendizaje e Intercambio de Saberes (*Centers for Learning and Knowledge Sharing*)
CAR	Corporación Autónoma Regional (*Regional Autonomous Corporation*)
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza, Costa Rica (*Tropical Agricultural Research and Higher Education Center*)
CFC	Common Fund for Commodities
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical, Colombia (I*nternational Center for Tropical Agriculture*)
CIDA	Canadian International Development Agency
CIM	Centrum für Internationale Migration und Entwicklung (*International Centre for Migration and Development*)
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo, Mexico (*International Maize and Wheat Improvement Center*)
CIP	Centro Internacional de la Papa, Peru (*International Potato Center*)
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (*French Agricultural Research Centre for International Development*)
CLAYUCA	Consorcio Latinoamericano y del Caribe de Apoyo a la Investigación y al Desarrollo de la Yuca (*Latin American and Caribbean Consortium to Support Cassava Research and Development*)
CMD	cassava mosaic disease
CNPMF	Centro Nacional de Pesquisa de Mandioca e Fruticultura Tropical, Brazil (*National Research Center for Cassava and Tropical Fruits*)
CODEPO	Consejo de Población para el Desarrollo Sostenible, Bolivia (*People's Council for Sustainable Development*)
COLCIENCIAS	Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnología "Francisco José de Caldas" (*The Francisco José de Caldas Colombian Institute for the Development of Science and Technology*)
CONDESAN	Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (*Consortium for Sustainable Development in the Andean Ecoregion*)
CORPOICA	Corporación Colombiana de Investigación Agropecuaria (*Colombian Corporation for Agricultural Research*)
CRI	Crops Research Institute, Ghana
CRS	Catholic Relief Services
CSIRO	Commonwealth Scientific and Industrial Research Organisation, Australia
CSM-BGBD	conservation and sustainable management of below-ground biodiversity
CTA	Technical Centre for Agricultural and Rural Cooperation ACP-EU

DAPA	Diversification Agriculture Project Alliance
DFID	Department for International Development, UK
DGIS	Directorate General for International Cooperation, the Netherlands
DRD	Department for Research and Development, Ministry of Agriculture, Tanzania
EARO	Ethiopian Agricultural Research Organization
EC	European Commission
ECABREN	Eastern and Central Africa Bean Research Network
EIAR	Ethiopian Institute of Agricultural Research
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária *(Brazilian Agricultural Research Corporation*)
ETH	Swiss Federal Institute of Technology Zurich
FAO	Food and Agriculture Organization of the United Nations, Italy
FARA	Forum for Agricultural Research in Africa
FCRI	Field Crops Research Institute, Thailand
FIDAR	Fundación para la Investigación y Desarrollo Agrícola, Colombia (*Foundation for Agricultural Research and Development*)
FLAR	Fondo Latinoamericano para Arroz de Riego (*Latin American Fund for Irrigated Rice*)
FONTAGRO	Regional Fund for Agricultural Technology
GEF	Global Environment Facility
GFAR	Global Forum on Agricultural Research
GRU	Genetic Resources Unit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (*German Agency for Technical Cooperation*)
IAR4D	integrated agricultural research for development
IAvH	Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Colombia (*Alexander von Humboldt Biological Resources Research Institute*)
ICRAF	World Agroforestry Centre, Kenya
IDEAM	Instituto de Hidrología, Meteorología y Estudios Ambientales, Colombia (*Institute of Hydrology, Meteorology and Environmental Studies*)
IDRC	International Development Research Centre, Canada
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute, USA
IICA	Inter-American Institute for Cooperation on Agriculture, Costa Rica
IITA	International Institute of Tropical Agriculture, Nigeria
ILRI	International Livestock Research Institute, Kenya
INCODER	Instituto Colombiano de Desarrollo Rural (*Colombian Institute for Rural Development*)
INIA	Instituto Nacional de Investigación y Extensión Agraria, Peru (*National Institute for Agricultural Extension and Research*)
INIA	Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Spain (*National Institute of Agricultural and Food Research and Technology*)
INIBAP	International Network for the Improvement of Banana and Plantain
INIVIT	Instituto Nacional de Investigaciones en Viandas Tropicales, Cuba (*National Research Institute on Tropical Root Crops*)
INRM	integrated natural resource management
INTA	Instituto Nicaragüense de Tecnología Agropecuaria (*Nicaraguan Institute for Agricultural Technology*)
IPGRI	International Plant Genetic Resources Institute, Italy
IPICS	International Programme in the Chemical Sciences, Sweden
IPM	integrated pest management
IRC	International Water and Sanitation Centre, the Netherlands
IRD	Institut de recherche pour le développement, France (*Institute of Research for Development*)
ISAR	Institut des Sciences Agronomiques du Rwanda (*Rwandan Institute for Agricultural Sciences*)
IWMI	International Water Management Institute, Sri Lanka

JAICAF	Japan Association for International Collaboration in Agriculture and Forestry
JIRCAS	Japan International Research Center for Agricultural Sciences
KIT	Royal Tropical Institute, the Netherlands
LAC	Latin America and the Caribbean
MADR	Ministerio de Agricultura y Desarrollo Rural, Colombia (*Ministry of Agriculture and Rural Development*)
MAS	molecular marker-assisted selection
MIS	manejo integrado de suelos (*integrated soil management*)
MTP	mid-term plan
NAARI	Namulonge Agricultural and Animal Production Research Institute, Uganda
NARIs	national agricultural research institutes
NARO	National Agricultural Research Organisation, Uganda
NARS	national agricultural research centers
NGOs	nongovernmental organizations
NRCRI	National Root Crops Research Institute, Nigeria
NRI	Natural Resources Institute, UK
NORAD	Norwegian Agency for Development Cooperation
NZAID	New Zealand Agency for International Development
OPEC	Organization of the Petroleum Exporting Countries
PABRA	Pan-African Bean Research Alliance
PLS	pilot learning site
PM&E	participatory monitoring and evaluation
PPB	participatory plant breeding
PRDU	Participatory Research for Development in the Uplands
PRGA	Participatory Research and Gender Analysis
PROINPA	Promoción e Investigación de Productos Andinos, Bolivia (*Foundation for Promotion and Research of Andean Products*)
QDPI	Queensland Department of Primary Industries, Australia
QSMAS	Quesungual slash and mulch agroforestry systems
R&D	research and development
RAeD	Rural Agroenterprise Development
RHBV	rice hoja blanca virus
SABRN	Southern Africa Bean Research Network
SADC	Southern African Development Community
SARI	Selian Agricultural Research Institute, Tanzania
SARI	Southern Agricultural Research Institute, Ethiopia
SDC	Swiss Agency for Development and Cooperation
SEI	Stockholm Environment Institute, Sweden
SIDA	Swedish International Development Cooperation Agency
SNV	Netherlands Development Organisation
SoFT	Selection of Forages for the Tropics
SSA CP	Sub-Saharan Africa Challenge Program
TSBF	Tropical Soil Biology and Fertility
UMSS	Universidad Mayor de San Simón, Bolivia (*San Simón University*)
UNAMAZ	Associação de Universidades Amazônicas (*Association of Amazonian Universities*)
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WARDA	Africa Rice Center, Benin
WFCP	Water and Food Challenge Program
ZIL	Swiss Centre for International Agriculture

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