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Rwanda civil war disrupts key African food program

Rwandan farmers with their climbing bean crop in happier times.

Civil war has temporarily shut down one of Africa's most successful agricultural programs—the introduction of improved climbing beans from Latin America into the Great Lakes Region of Rwanda, Burundi, and western Zaire. Two CIAT bean scientists were evacuated with their families from war-torn Rwanda on 9 April.

CIAT plant breeder Dr. Wayne Youngquist was evacuated from Rwanda to Burundi with his wife, three children, and father-in-law, in a land convoy of 75 cars. There U.S. Marines, previously on a ship off Somalia, airlifted the refugees to Kenya. Dr. Robin Buruchara, CIAT plant pathologist, was in Kenya when the unrest began. His wife and year-old baby were able to leave Rwanda safely and are also now in Kenya.

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The International Center for Tropical Agriculture (CIAT, from the Spanish acronym) is dedicated to the alleviation of hunger and poverty in developing countries of the tropics by applying science to agriculture to increase production while sustaining the natural resource base.

CIAT is one of the 18 international centers sponsored by the Consultative Group on International Agricultural Research (CGIAR), a group of 40 nations and international agencies that fund research for development. The Centers focus on the crops and livestock that provide 75% of the food for the developing world.

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"Leaving was sad. It was pulling the rug from under people who were trying to do things level-headed," Youngquist says. "I want to move our office to Burundi to continue working. Right now—we're on hold."

A stable food source for millions of Rwandans

"The civil war has put at great risk a stable food source for millions of Rwandans," says Dr. Julia Kornegay, head of the CIAT Bean Program. "Beans mean survival for Rwandan families. Rwanda has almost no industry, and tourism is negligible.

"Rwandans eat more beans than anyone else in the world, but don't have enough land to grow them," Kornegay says. "Farms average only one-half to 1 hectare each, with 500 impoverished people living on each square kilometer of rural land. There's just not enough farm land—or food—for everyone."

CIAT, working with the Rwandan Ministry of Agriculture, began to test climbing beans—which grow upward on stakes—on farmers' fields in 1985. Farmers quickly adopted the new climbers because they outyield traditional bush beans, are more stable under drought, resist diseases, and their tasty green leaves add vitamins and variety to limited diets.

Climbing beans have tripled bean yields

About half a million Rwandans—40% of the country's bean farmers—now grow improved climbing beans on 20% of the country's farm land. Climbers have tripled bean yields, adding at least 33,000 tons of beans to Rwanda's harvest yearly—an extra US$18 million.

"Drought took most of southern Rwanda's bean crop last year, which doubled the price of beans," Youngquist says. "But when fighting broke out in early April, rains were good and most farmers had already planted. The next harvests are six to 10 weeks away. If we can get back into Rwanda within a month —before the weeds take over— we can continue the program without losing much.

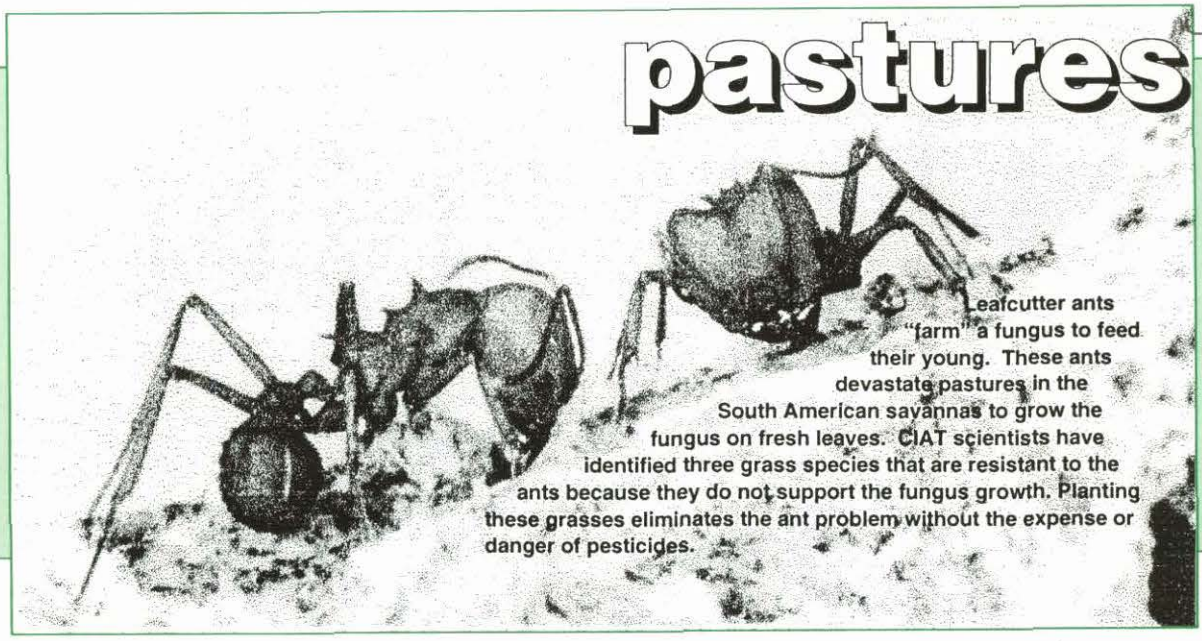
"But right now people worry more about their lives than about weeds."

CIAT and partners are now multiplying seeds of Rwanda's most popular beans, both bush and climbers, to send to Rwandan farmers when the fighting ends.

The Great Lakes Regional Bean Research Network, sponsored by the Swiss Development Cooperation and CIAT, has coordinated the climbing bean program since 1983.

by **Gail Pennington**
photo by **Howard Gridley**

Greener ant-proof pastures



Leafcutter ants "farm" a fungus to feed their young. These ants devastate pastures in the South American savannas to grow the fungus on fresh leaves. CIAT scientists have identified three grass species that are resistant to the ants because they do not support the fungus growth. Planting these grasses eliminates the ant problem without the expense or danger of pesticides.

for South American savannas

Night-raiding leafcutter ants are the worst pest for cattle ranchers in the vast savannas of Brazil, Colombia, Venezuela, and Bolivia.

But scientists have identified three ant-proof grass varieties that stop ant attacks without pesticides, says Dr. Stephen Lapointe, CIAT entomologist.

"Leafcutter ants are found from New Jersey to Argentina," Lapointe says. "But the species *Acromyrmex landolti* devastates pastures in the South American savannas. These ants can remove almost 5 metric tons of grass from 1 hectare in a year."

The ants "farm" a fungus to feed their young

The ants don't eat the plants, Lapointe explains. They snip off and carry leaf bits to their nest where they "farm" a fungus on the fresh-cut leaves. This fungus, which grows only in leafcutter ant nests, is the main food for raising their young.

Some leafcutter ants build extensive colonies and travel as far as 1 km to gather leaves. But *Acromyrmex* colonies are small, and these ants reap within a few square meters of the colony entrance.

Acromyrmex cut only thin, tender grass shoots. In 3 or 4 years the ants can destroy an established pasture. In that time, grass and cattle production diminish steadily. If the ants attack a recently planted pasture, it won't grow back. Ranchers must replant, or abandon the site.

"We have counted as many as one colony per clump of grass in susceptible pastures," Lapointe says. "That's 6,000 colonies, with about 10,000 ants in each, on 1 hectare of pasture. A total of 60 million ants. In a large field, eradication with pesticides is more than costly or difficult—it's impossible."

Scientists carried out field experiments with common savanna grass varieties at the Carimagua research station of the Colombian Institute of Agriculture and Livestock (ICA). They observed that the ants ravaged some fields but didn't touch others. In laboratory tests, CIAT scientists discovered why: the ants' fungus grows only on certain grasses. Others inhibit its growth.

Brachiaria species inhibit fungus growth

The ants die out when three ant-proof grass species, *Brachiaria decumbens, B. humidicola,* and *B. brizantha*, are planted. Farmers can then plant more susceptible grasses, even rice, before the ants return.

"We are now trying to isolate the element that inhibits fungus growth," Lapointe says. "Then we can identify resistance in new grass hybrids with a quick lab test. The present process takes 20 days."

Scientists might also be able to breed new, ant-resistant grasses with other favorable traits such as disease resistance, or higher nutritional value.

The savannas, four times the size of France, produce more than US$15 billion worth of meat and milk annually.

by **Gail Pennington**
photo by **Luis Fernando Pino**

Integrated research catalyzes Colombian cassava industry

A cassava-drying yard in the North Coast of Colombia. The starchy cassava roots have already been chipped and are uniformly spread out to dry in the sun. Every 2 hours or so, the chips are turned over, using wide-toothed wooden rakes. After about 2 days of sun-drying, the chips are bagged and sold to the animal-feed industry.

The North Coast of Colombia benefited by almost US$22 million when research to improve cassava and its crop management was integrated with research on its processing, marketing, and consumer preferences, says Dr. Guy Henry, CIAT cassava economist.

Cassava is a starchy root crop that feeds about 500 million people in the tropics. Almost all is grown by farmers who rank among the world's poorest.

New markets for cassava

To link these farmers, their cooperatives, and small cassava businesses to new and lucrative markets, the CIAT Cassava Program established an Integrated Cassava Project for developing the crop in northern Colombia in the 1980s.

"We targeted the fast-growing animal-feed industry to expand and stabilize cassava markets," says Dr. Rupert Best, CIAT Cassava Program leader. "We introduced rural cassava chipping-and-drying cooperatives, together with better varieties and farming technologies."

US$18 for each $1 invested

"The project cost $1.2 million—yet the return was about $18 for every dollar

invested," Henry says. "Farmers gained $15 million from 1984 to 1991."

Poor urban consumers benefited by $2 million through lower and more stable prices of fresh cassava. Dried-cassava processors benefited by $1.1 million. "But most processors are also farmers," Henry points out. "So they benefited twice.

"Only one group—middlemen for fresh-cassava markets—did not benefit from the project: they lost about $660,000. The marketing system had become more efficient, and farmers and consumers gained part of the profit margin."

The new technology spreads

New technology was adopted faster in areas where cassava-drying cooperatives already existed than in areas with only traditional fresh-root markets, an impact study showed. Benefits from research that integrated crop improvement, crop management, postharvest technology, and marketing were seven times more than benefits from crop improvement alone.

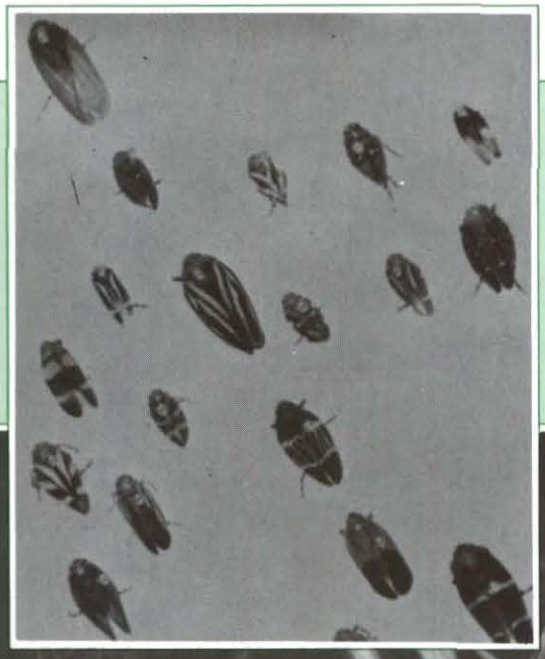
"Integration of all aspects of cassava research could optimize the use of scarce research funds by national agricultural programs," Henry says.

The concept of integrated cassava projects has been adopted by national programs with CIAT's support, and successful projects are also operating in Argentina, Bolivia, Brazil, Ecuador, and Paraguay.

Collaborators and donors for the project are various Colombian research and development institutes, the Canadian International Development Agency (CIDA), the UN World Food Program, Canada's International Development Research Centre (IDRC), and the UK's Natural Resources Institute (NRI).

by **Elizabeth de Páez**
photo by **Luis Fernando Pino**

Protecting pastures from the spittlebug



Brachiaria grasses, tropical America's most important pastures, are attacked by the spittlebug—so named because its nymphs cover themselves with a frothy white mass.

The nymphs suck out the plant's water and nutrients, eventually killing it. These insects destroy millions of hectares of good-quality pastures.

(*Inset*: Adults of 19 species of spittlebug.)

A newly established breeding program will help brachiaria, tropical America's most important pasture grass, resist the spittlebug. The insect's nymphs cover themselves with a frothy white mass that resembles spittle—hence its common name.

"The nymphs hatch from eggs laid in the soil, attach themselves to the base of the brachiaria plant, and protect themselves with the froth," explains Dr. Stephen Lapointe, CIAT entomologist. "They suck out the plant's water and nutrients, eventually killing it. Then they develop into pupae and emerge as adults, to start the cycle again."

Brachiaria grasses feed tens of millions of cattle in Latin America. They grow well in infertile, acid-soil savannas, and produce quality forage and abundant seed.

"But brachiaria pastures are genetically uniform," says Dr. John Miles, CIAT geneticist for tropical forages. "This is because the grass reproduces asexually, so subsequent generations are identical clones of the mother plant."

Spittlebugs destroy millions of hectares

"Any pest to which they are susceptible can therefore cause considerable damage over large areas. For example, spittlebugs have destroyed millions of hectares of brachiaria in the Brazilian Amazon region."

"We found resistant brachiaria in Africa. Some species carry a chemical compound that prevents the spittlebug nymph from molting. It becomes malformed and eventually dies."

Chemical pesticides can control the tiny pest, but are expensive and may damage the environment. "The best way to control any insect pest is by planting naturally resistant varieties," Miles says.

Wild African varieties provide resistance

"We found resistant brachiaria in Africa. Some species carry a chemical compound that prevents the spittlebug nymph from molting. It becomes malformed and eventually dies. Other species carry a toxin that deters the nymph from eating so that it starves to death.

"But these resistant grasses adapt poorly to nutrient-poor savanna soils. To introduce spittlebug resistance into well-adapted varieties, we had to overcome the latter's cloning mechanism, which prevents us from breeding new varieties."

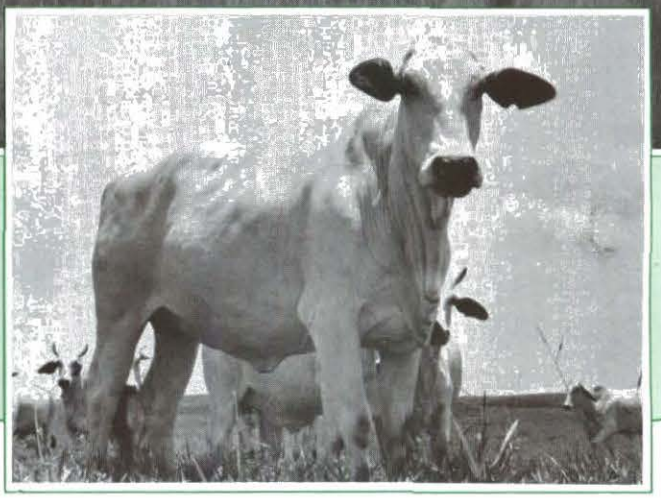
Sexually reproducing species of brachiaria that were compatible, that is, could be bred, with the cloning brachiaria were found by scientists at the Belgian Catholic University of Louvain and EMBRAPA, Brazil's national agricultural research agency. In 1988, CIAT's breeding program was started in collaboration with Dr. Cacilda do Valle of EMBRAPA.

By 1990, the first generation of hybrids between resistant nonadapted and susceptible adapted species was established at the Carimagua research station, operated jointly by CIAT and ICA, the Colombian Institute of Agriculture and Livestock. "We hope to distribute the first resistant, well-adapted lines to national agricultural programs in 1996," Miles says.

CIAT scientists plan to use biotechnology to help manipulate genes for resistance and other agronomic traits in brachiaria. A molecular map of brachiaria is now being constructed to locate and manipulate genes that control different traits.

by **Elizabeth de Páez**
photos by **Mauricio Antorveza**

New group fights acid soil problems of tropical America



Today's acid soils; tomorrow's source of food.

The agricultural frontier of tropical America lies on acid soils. The good soils are already in use, concluded an interdisciplinary group of 31 scientists who met 16-20 August at CIAT.

"Acid soils are fragile and infertile, with toxic levels of aluminum and manganese. They erode easily," says Dr. Rattan Lal, professor of soil science at Ohio State University and member of the steering committee of the newly formed program *Managing Acid Soils* (MAS).

"But most farmers have no choice because 64% of tropical America's soils are acid," Lal adds. "It's a vicious circle. Farmers clear forests to open new land, exhaust the soil after a few seasons, then move to new land. But it, too, soon wears out. We must improve the management of acid soils now in use, to keep pressure off the forests."

Farmers clear forests to open new land, exhaust the soil after a few seasons, then move to new land. But it, too, soon wears out.

Scientists from 15 institutions pool resources

Plant, soil, and social scientists from 15 institutions—all with proven records in tropical research—will pool resources through MAS, says Dr. Raúl Vera, head of the CIAT Tropical Lowlands Program. Technologies will be developed for acid soils in three major ecosystems of tropical America: savannas, steep hillsides, and forest margins.

"We have a lot of synergetic potential," says Dr. Douglas Lathwell, professor emeritus of soil science, Cornell University. "We've crossed our institutional and disciplinary barriers. Together we can tackle the most fundamental to the most technical problems of sustainable agriculture."

"A database of the potentials and restraints of selected agroecosystems will be developed for policy makers," Lal adds. "The MAS group will not make or recommend policies—but will identify and inform decision makers of the consequences of specific actions. The first MAS training course—to transfer research results, basic skills, and technology—begins in September 1995."

A grant from the Rockefeller Foundation provides for participation in MAS planning sessions by scientists from Latin American national agencies.

Participating groups were the Agricultural Research Center for the Humid Tropics (CPATU) and the Agricultural Research Center for the Cerrados (CPAC) of EMBRAPA, Brazil's national agency for agricultural research; the Tropical Agriculture Center of Research and Teaching (CATIE) of Costa Rica; the Colombian Institute of Agriculture and Livestock (ICA); the International Fertilizer Development Center (IFDC), USA; Office de la Recherche Scientifique et Technique d'Outre-Mer (ORSTOM), France; and CIAT.

Various universities also participated: Hohenheim and Bayreuth, Germany; Central of Venezuela; and North Carolina State, Ohio State, Cornell, and the Universities of Florida and Hawaii, USA.

by **Gail Pennington**
photos by **Alexandra Walter**

1993 Outstanding Publication Award goes to Richard Thomas

The 1993 CIAT Outstanding Research Publication Award (ORPA) went to Dr. Richard Thomas, nitrogen cycling scientist in the CIAT Tropical Lowlands Program.

Thomas's paper "The role of the legume in the nitrogen cycle of productive and sustainable pastures" was published in Volume 47 of the 1992 edition of *Grass and Forage Science*, a UK-based journal.

"Only one award is given yearly for the best research publication by a CIAT scientist," said Dr. Richard B. Flavell, chairperson of the Program Committee of the CIAT Board of Trustees. "The award is a valuable instrument for recognizing the quality of research output."

Thomas, a UK citizen, joined CIAT in 1989.

On receiving the award, Thomas said:

The initial ideas for the topic of the publication were a result of interactions within the multi-disciplinary group of the then Tropical Pastures Program . In particular I thank my respected colleagues, Drs. Myles Fisher and Carlos Lascano, who educated, challenged, and inspired me to write the paper and who also broadened my comprehension of the word 'symbiosis'.

Available from CIAT

A World Bank Development Essay

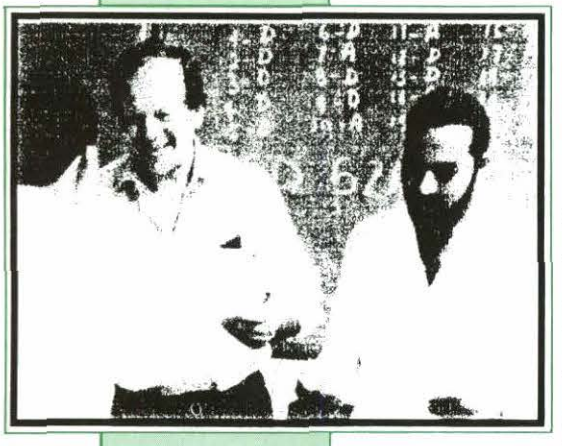
The Quiet Revolutionaries: *A Look at the Campaign by Agricultural Scientists to Fight Hunger*
by David Wigg

This 52-page essay, published by the World Bank, describes how committed scientists at the International Institute of Tropical Agriculture (IITA) in Nigeria and at CIAT launched a successful campaign to save Africa's cassava crop through biological control of insects.

It also tells of the role of the Consultative Group on International Agricultural Research (CGIAR) in fighting world hunger.

Copies in English or Spanish may be purchased for US$6.25 from the World Bank, Office of the Publisher, 1818 H. Street N.W., Washington, D.C. 20433, USA. CIAT is also distributing a limited stock of the publication in both languages: US$3 outside of Colombia and Col$1,000 in Colombia, for postage costs. Write to the Distribution Section, CIAT, A.A. 6713, Cali, Colombia.

"Training trainers" for agricultural extension



We have developed a new 'train the trainers' strategy for agricultural researchers and extensionists in Latin America, says Dr. Vicente Zapata, CIAT training project coordinator.

The strategy enables CIAT to train local scientists to train others. "It also strengthens links between researchers, who generate new technologies, and extensionists, who teach—or extend—them to hundreds of farmers," Zapata says.

More than 4,000 have received training

"While we have trained more than 4,000 people in beans, cassava, tropical forages, and rice since 1970, we began our first 'train the trainers' experiment in 1989," Zapata explains. CIAT has since trained 107 trainers in 18 countries, including trainers for rice in Colombia, the Dominican Republic, Ecuador, and Venezuela; for cassava in Argentina, Brazil, and Paraguay; and for beans in Central America, Haiti, and Mexico.

"Eighty of the 107 trainers taught about 500 extensionists during the Project's development," Zapata says. "The graduates are expected to train another 5,000 in the next 5 years.

"We carefully selected the trainers-to-be for their expertise in actual field problems of farmers," Zapata says. The trainers learn to train by planning, organizing, and teaching courses, using established principles of adult education.

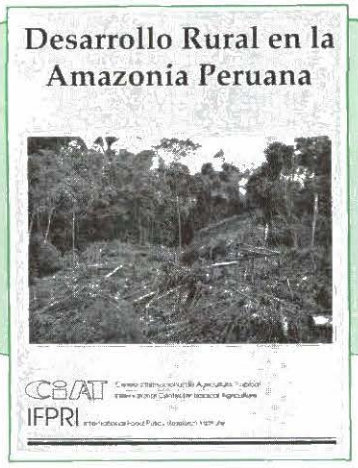
Custom-made teaching units

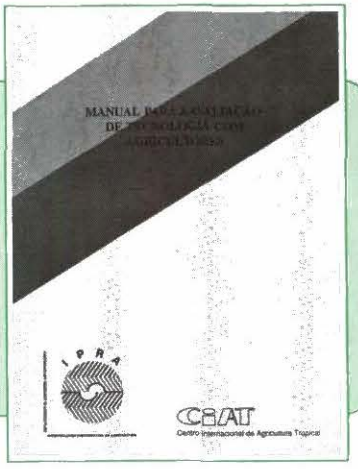
"The resulting instructional materials are up-to-date and custom-made for each national program," Zapata adds. The 30 units published so far are designed for use in the field, the laboratory, and the classroom, or for individual instruction. "Audiences range from other scientists to illiterate farmers," Zapata says. Almost 600 copies have been distributed and 13 units—originally written in Spanish—have been translated into French or Portuguese.

The "Train the Trainers" Project is financed by the Inter-American Development Bank (IDB).

by **Elizabeth de Páez**
photo **CIAT Archives**

Recent CIAT Publications





Desarrollo Rural en la Amazonia Peruana (1993)

(Available in Spanish only)
Loker, W.M.; Vosti, S. (editors)
269 pages. 21.5 x 28 cm.
Perfect bound, paperback.
ISBN 958-9183-54-9.
Price: Colombia, Col$4,100; other developing countries, US$7; developed countries, US$17.
This book is a compilation of five papers on the future of the Peruvian Amazon presented at a 1989 conference in Lima. It analyzes agricultural resources, policy, and development in the ecosystem; the influence of colonization and the role of indigenous people in forest development. A publication of CIAT and the International Food Policy Research Institute.

Descriptores Varietales: Arroz, Frijol, Maíz, Sorgo (1993)

(Available in Spanish only)
Muñoz, G.; Giraldo, G.; Fernández de S., J.
174 pages. 15 x 22 cm.
Perfect bound, paperback.
ISBN 958-9183-27-1.
Price: Colombia, Col$7,200; other developing countries, US$10; developed countries, US$28.
A revised edition of the 1983 handbook *Metodología para Obtener Semillas de Calidad: Arroz, Frijol, Maíz, Sorgo*. The book describes and gives formats for recording varietal characters for each crop. Includes a table of 100 colors, taken from Munsell's *Book of Colors*, to standardize characterization.

Manual para a Avaliação de Tecnologia com Agricultores (1994)

(Also available in French, English, and Spanish)
Ashby, J.A.
100 pages. 21 x 27.5 cm.
Saddle stitched, paperback.
ISBN 958-9183-64-6.
Price: Colombia, Col$4,900; other developing countries, US$7; developed countries, US$9.
Gives general principles, examples, and techniques of a participatory approach to evaluating technology with farmers.