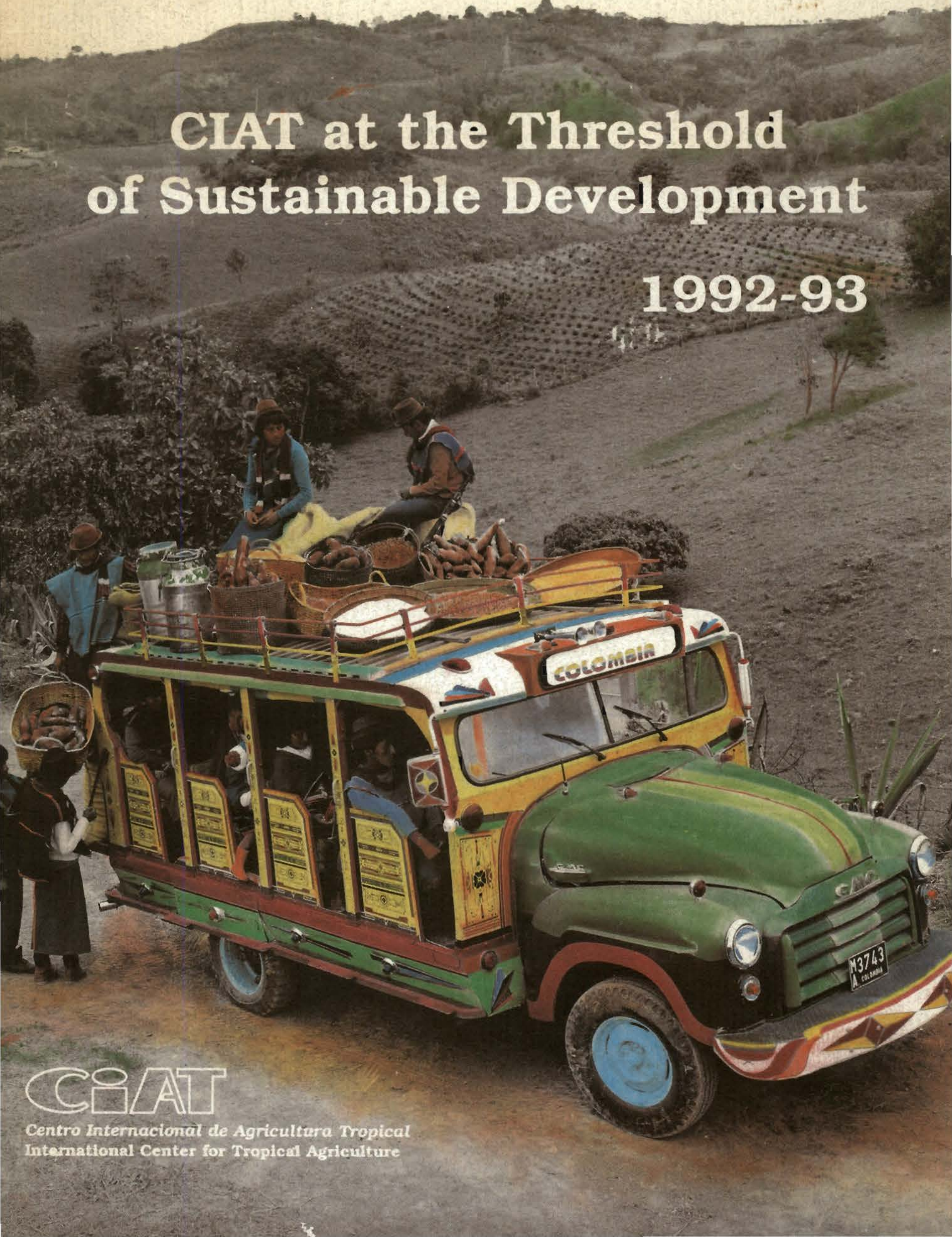
# CIAT at the Threshold of Sustainable Development

## 1992-93




CIAT

*Centro Internacional de Agricultura Tropical*

International Center for Tropical Agriculture

## A rural community at the threshold of sustainable development

*Soy un loquito inquieto.*

(I'm restless—and a little crazy.)

I've lived here for more than 60 years, and I know how the farmers suffer. They suffer because they don't have options. Coffee doesn't pay. Growing food crops on hillsides is a risky business, too. Cutting down trees to sell firewood or make charcoal doesn't earn much either . . . and it's slowly destroying our forests and ruining our water supply. But you can't just prohibit the felling of trees. You have to provide alternatives.

*Hay una cantidad de ideas que uno tiene en la cabeza.*

(One can imagine so many possibilities.)

Eight hundred meters away from here is the Pan-American Highway. It leads to Cali—a big local market. From there it's only a hundred kilometers to the port of Buenaventura. And that leads to the world beyond. By diversifying farming in this area, maybe we can connect ourselves to the rest of the world . . . and give people a way of putting money in their pockets without cutting down trees and destroying the soil.

*Necesitamos diversificar. ¿Pero con qué?*

(We need to diversify, but with what?)

When I look at a typical farm in this area, I imagine a little coffee here, plots over there for food crops, with live barriers to prevent soil erosion. Some pasture to support a few milk cows. Maybe some fruit crops, too. And a local support system that helps keep it all going.

*Una tarea ardua*

(An arduous task)

Getting a steady supply of water here, more than 20 years ago, was an arduous task. Nobody thought we could do it. To achieve integrated development will be even harder. But we'll spend the time and energy it takes to benefit our community.

# To Investors in Sustainable Development:

1992 found CIAT in a quandary similar to Don Raúl's—we saw the need to diversify . . . *¿pero con qué?* We had just developed an ambitious plan of strategic research that addresses the most pressing challenges of international agricultural development in our time. But our resources to execute that plan were cut—suddenly and significantly.

We had only two options: either postpone indefinitely the institutional transformation through which CIAT can meet future challenges or go ahead in spite of the financial shortfall. Our problems resulted largely from a reduction in core funding. But an unexpected influx of US dollars into Colombia made our situation worse by devaluing the dollar against local currency.

After intensive deliberation, we chose to move forward. We reduced the resources allocated to CIAT's commodity programs, while sharpening the focus of germplasm development on the most pressing constraints. With the core resources made available through that move, we created a basic structure for resource management research. These measures required difficult adjustments, including heavy reductions in staff.

Our justification for these actions is the plan itself. It reflects CIAT's commitment to help developing countries reconcile three potentially conflicting goals: (1) more efficient agricultural production and higher economic growth in the humid tropics, (2) social equity—to ensure that economic development benefits the poor, and (3) preservation and enhancement of the natural resources required for agricultural production.

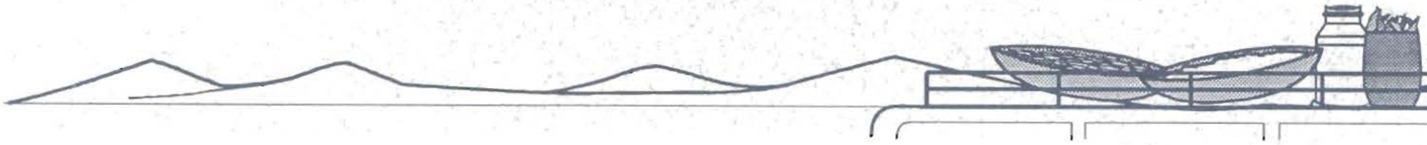
The prospect of more economic growth is a matter of widespread concern to people in our environmentally conscious age. They rightly fear that nature may be sacrificed irretrievably to the unrelenting pursuit of material progress. We share their reservations but also believe that the developing world must grow economically to combat poverty and satisfy the needs of its rapidly increasing population. Failure to do so will lead to unprecedented human suffering and will eventually undermine positive social and political changes in many countries. The destruction of tropical forests and other fragile ecologies will continue and maybe even accelerate. Deepening troubles in the South will bring dire consequences—including unmanageable numbers of economic and ecologic refugees—to the North.

But growth, by itself, will not be sufficient to alleviate hunger and poverty. All of us know about situations where the benefits of more efficient production have bypassed those who need them most. Clearly, no country can just grow its way out of human misery.

Nor can we just "grow our way into sustainability," as a recent book on this subject puts it. While generating important short-term benefits, a more productive agriculture can also propel the destruction of soil, water, and biodiversity—transferring the costs of production to other members of society and to future generations. The challenge in agricultural research is to help create the conditions required to increase productivity, while protecting and even enhancing the natural resources that we will pass on to our children. To alter current patterns of poverty and environmental destruction will require renewed efforts in technology development as well as far-reaching changes in national institutions and policies.

The 1992 Earth Summit held at Rio de Janeiro was an important step in the right direction. It initiated a global democratic process for setting the world on a clear course toward sustainable development. We at CIAT are struggling to pursue a research program that measures up to that task. The strength of our program lies in its diversity—from crop genomes to geographic information systems. In the sections that follow, our staff talk about challenges across this wide range of activities.

**Lucia Vaccaro**
*Chairman, Board of Trustees*



# How CIAT Can Contribute

**Gustavo Nores**
*Director General*

We can contribute meaningfully to sustainable development by making wise decisions about what we work on, how, where, and with whom. The answers to these questions were reasonably clear during most of CIAT's 25-year history. We worked on several major crops, using the best techniques available for genetic improvement and crop management research. Through training and networks, we made available the products of this work—high-yielding, pest-resistant varieties, biological control techniques, and better farming practices—to national commodity programs. They used our products to develop technology for farmers and provided us with feedback on its performance.

Implicit in that approach was a view of individual farmers primarily as crop producers and recipients of new crop technology. Over time we learned the value of a broader, richer approach. We began to treat farmers as participants in research to solve their problems. We also found ways for them to produce improved seed, especially for beans, and, for cassava, to develop markets for expanded output.

*"In the end . . . the 'greening' of technology can, at best, . . . serve as a 'necessary' condition to sustainability. The 'greening' of the public mind is the ultimate prerequisite to dealing with the real obstacles, which are psychological, social, institutional, and political."*

K.A. Bezanson, President, IDRC

Increasingly, we view farmers as managers of land. Equally important, we're starting to take into account their position as members of communities, where their private, immediate gains from the exploitation of land and other resources may be a source of conflict. We must also come to terms more fully with the heterogeneity of agriculture—with the diversity of priorities in rural communities. Reconciliation of farmers' differing interests is a precondition for more equitable and sustainable land management. Our efforts to reach this goal must stand or fall at the community level.

How can CIAT and other international centers contribute meaningfully to better land management at that level, given that the needs and opportunities in rural areas are location specific?

Part of the answer is that we can develop a range of technology options that help rural communities satisfy both the short-term need for increased production and the long-term need for resource preservation. Providing these options requires that we exploit the potential of genetic resources and harness the power of new techniques to shape germplasm more closely to the requirements of sustainable development. We must also integrate this work into resource management research at representative sites in major agroecosystems. That research must lead to the development of sustainability indicators, land-use strategies, research methodologies, and prototype technology components.

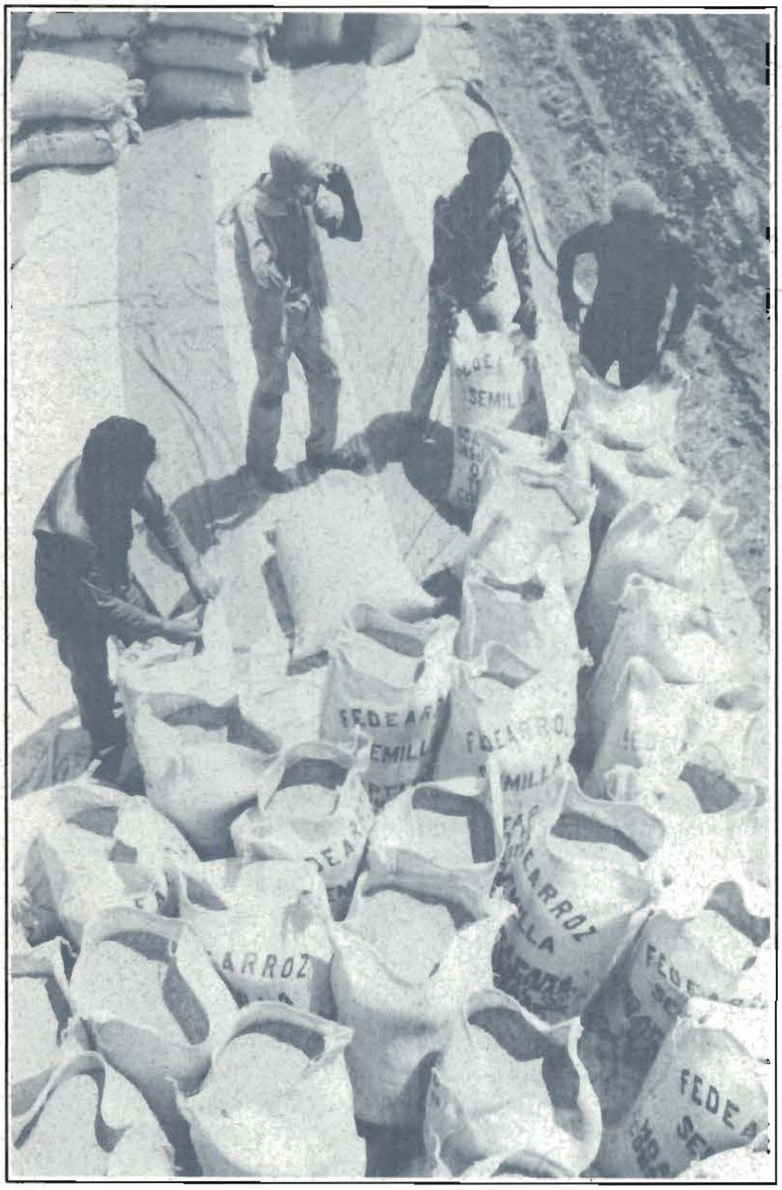
To ensure that these products are relevant locally—matching farmers' needs and market opportunities—we must develop them in close cooperation with local research institutions and farmer organizations. To increase their international relevance, we must choose with special care the agroecosystems, representative sites, and research topics on which we work.

CIAT's stronger emphasis on strategic research will come at the expense of adaptive, commodity-specific research. Because the financial situation of many national programs has deteriorated over the past decade, this may widen the gap in the chain of technology development and transfer—at least in the short term. But to replace old patterns of assistance, we will help create new forms of cooperation through

The joint efforts of CIAT and national institutions have paid off handsomely. To cite just one example, rice production has doubled in Latin America since the mid-1960s, and the cost to consumers has dropped by 24 percent.

regional networks. These should help dynamic national institutions capture a larger share of the regional and bilateral resources available. They can also provide a framework for mobilizing local support of adaptive technology testing. The goal should be to develop blends of new and traditional practices that fit local circumstances.

CIAT's work must not stop at generating technology for sustainable development. To have an impact at the community level, we must wed our strategic research to innovative programs that bring together the diverse array of local rural institutions—including farmer groups, private business, NGOs, and public agencies. They and their constituencies must take charge of the local research agenda and problem-solving process. As the architects of comprehensive land-use strategies, they will be more inclined to resolve the conflicts and make the deals required for adoption of technologies that match both short- and long-term priorities.



A few such projects at carefully selected locations in the major agroecosystems of Latin America should result in a model for effective collaboration among local institutions. This is another key product of our strategic research and a central requirement for ensuring that resource management research conducted at specific sites is relevant internationally. To make the model work, we must use our position as an international center to help link research at the community level with the development and implementation of policy at the national level. Unless this job is done, circumstances beyond the control of rural communities may thwart their efforts to achieve sustainable development.

Growing discontent with centralized government in Latin America and the clear trend toward decentralization have created fertile ground for pursuing a community-based approach. Local groups are beginning to take the initiative in identifying problems, devising solutions, and lobbying politicians for support. CIAT can encourage these trends by helping form consortia that can integrate solid research into development initiatives and capture local funds to support this work. ☐

# Molecular Biology and Personal Chemistry

**Joe Tohmè**
*Plant Geneticist, Biotechnology Research Unit*

Developing stable genetic resistance to rice blast is just one thing agricultural science could do to benefit a third of humanity. Blast is the most widespread and damaging disease of the staple food crop of nearly 2 billion people.

The extreme diversity of the fungal pathogen of blast, *Pyricularia grisea*, complicates breeding for resistance. There are a lot of pathotypes—or strains of the pathogen—and new ones constantly emerge. Resistance genes are effective only against certain pathotypes. That's why most of the resistant varieties developed so far have broken down within two or three years after release. As soon as they encounter a strain against which their resistance is ineffective, they're finished.

In 1989 two experimental lines developed at CIAT were released as Oryzica Llanos 4 and 5 by ICA in Colombia. They've been grown in experimental plots and farmers' fields for five years, and their blast resistance has held up. If breeders and pathologists could develop those cultivars five years ago based on what they knew then, imagine what we can do with the more powerful techniques and the more complete knowledge we have today! Oryzica Llanos 4 and 5 carry random combinations of genes that confer resistance to a wide range of pathotypes. Dissecting this resistance with molecular markers should help us figure out how to target specific combinations of genes against specific groups of pathotypes.

*"Know your enemy, and know yourself, and in a thousand battles you will win a thousand victories."*

Chinese proverb

Biotechnology is best known in research circles for its application to the genetic improvement of crops. But it can also help us learn more about complex pathogens like *Pyricularia grisea* and predict how they will change. With that knowledge, we can develop resistance more efficiently. Using conventional pathotyping and DNA fingerprinting, for example, our team has gained a better understanding of the genetic organization of fungus populations. We now know that the large number of pathotypes in a given environment or country can be divided into a more manageable number of lineages or families.

Before, we were searching for genes with resistance to individual pathotypes. Now, we're on the lookout for specific combinations of genes that are resistant to whole families. Scientists at CIAT, IRRI, Cornell University, and other institutions have already started locating such genes. Within a year or two, we'll be able to use molecular markers to monitor their transfer.

So, we still don't have a definitive solution. But we do have the methods and tools that rice scientists the world over can use to develop resistant varieties. What we need now is a lot more of the interinstitutional and interdisciplinary cooperation that has got us this far. We wouldn't be at the doorway of success if we hadn't joined forces with scientists at Purdue University. Nor if John Hamer, the whiz-kid molecular biologist who developed the probes used in DNA fingerprinting of blast, hadn't realized the value of working with Purdue colleague Morris Levy, an evolutionary biologist with a unique background. And if CIAT pathologist Fernando Correa hadn't accumulated a wealth of data on the blast pathogen. And if Bob Zeigler, who was leader of our Rice Program and is now at IRRI, hadn't been so adept at stimulating our thinking and integrating our ideas.

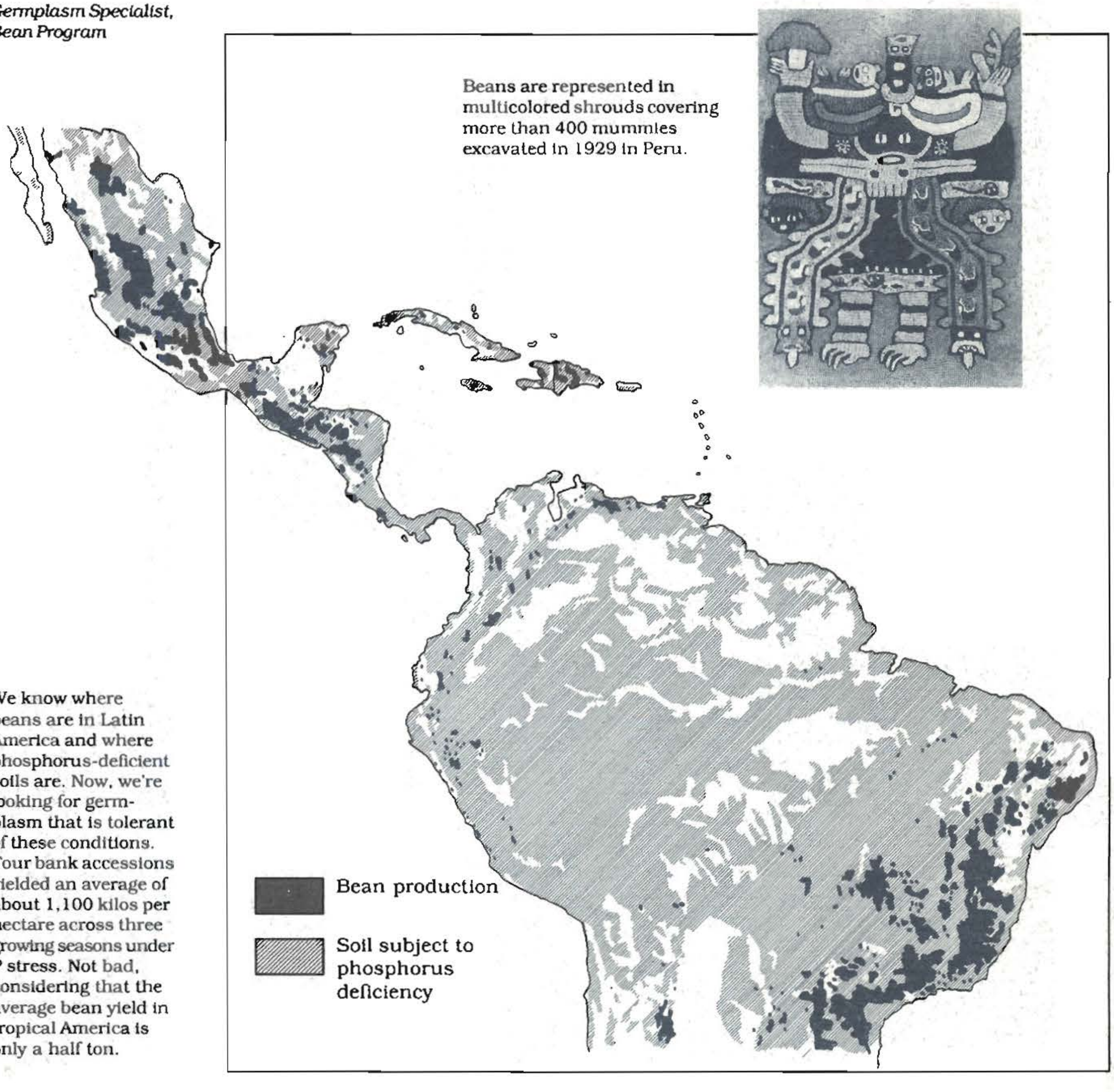
Let's face it. No matter how good you are in genetics, molecular biology, or pathology, you can't accomplish much if you don't know something about personal chemistry, too. ❑

# Diversity That Even Their Ancestors' Crops Never Had

**Stephen Beebe**
*Germplasm Specialist, Bean Program*

One experience that shaped my thinking about genetic diversity in beans was the four years I spent working as a plant breeder in Central America. In visits to farmers' fields and markets, I was surprised to see a relatively limited range of seed types. Mostly small, black seeds in Guatemala; small, red ones in El Salvador, Honduras, and Nicaragua; and some of both in Costa Rica.

There are still a lot of landraces out there. But their seeds vary only slightly in size, shape, and color, showing different shades of red, for example. We used to think the superficial similarity among these varieties masked a huge amount of genetic diversity. But the results of analysis at the molecular level suggest that we were kidding ourselves. Among red materials, for example, the diversity just isn't that great.



Beans are represented in multicolored shrouds covering more than 400 mummies excavated in 1929 in Peru.


We know where beans are in Latin America and where phosphorus-deficient soils are. Now, we're looking for germplasm that is tolerant of these conditions. Four bank accessions yielded an average of about 1,100 kilos per hectare across three growing seasons under P stress. Not bad, considering that the average bean yield in tropical America is only a half ton.

Farmers in Central America and other regions have lost something. You appreciate this when looking at samples from CIAT's bean germplasm collection. In just a handful of selected seeds, you can hold a wealth of genetic diversity.

The process of genetic erosion apparently started a long time ago in Latin America. Ethnobotanists say that the Spanish conquest promoted the expansion of some bean types at the expense of others. In our own century, market forces have had a powerful effect on bean production. They've pressured farmers to abandon varieties whose seed characteristics don't match demands.

Sometimes these demands seem irrational. In studying markets in Colombia, for example, CIAT economists found that poor consumers weren't so choosy about grain type. And yet grain buyers were telling farmers, "If it doesn't have red- and white-mottled seed, I won't pay as much for it." The same thing is happening in other countries.

*Genetic diversity found within species is the ultimate source of biodiversity at higher levels, determining how species interact with their environments and each other."*

N.E. West, Biodiversity of rangelands, *Journal of Range Management*

So, the erosion of diversity in beans is not one of those widely publicized cases in which genetically uniform improved varieties have displaced a wide array of landraces. Most of the varieties farmers have retained in response to market signals are local materials. Sure, some are improved varieties, but their adoption is still fairly limited—about 40 percent of the total bean area in Guatemala, for example. As new varieties spread, we don't want them to occupy more than 80 percent of the total area in a given country. The remaining 20 percent should be sufficient for maintaining the genetic diversity in local varieties.

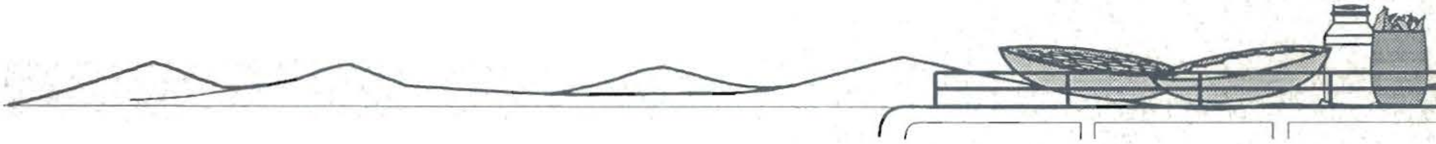
Few bean producers in the developing world practice subsistence agriculture in a pure sense. That's why it's hard to imagine how a sizable share of production could be restored to the "pristine" state that existed centuries ago, when the crop was more sheltered from markets and their effects on genetic diversity.

The dangers of a narrow genetic base are very real. I recall one visit with bean breeders in Nicaragua, who have an especially strong interest in maintaining and using local germplasm. What struck me was that the landraces in their experimental plots were heavily infected with rust. Apparently, these materials have little, if any, variation for resistance. The same is true throughout Latin America for the bean golden mosaic virus.

More than 400 million poor consumers and farmers depend on beans as a source of protein and calories. We're improving the lot of both groups by developing new germplasm that helps growers produce more efficiently for markets. But we're careful to do this in ways that make the bean crop less vulnerable to problems like diseases, insects, and drought.

A germplasm development program will do what you design it to do. If your hybridization program has a narrow genetic base, then so will the materials that come out. If the program is designed for products that depend on chemical inputs, then that's what you'll get. But if you make a deliberate effort to broaden the genetic base, you can introduce a lot of variation that provides low-input solutions to important problems.

That's how we're helping farmers get back the useful genetic diversity their crops may have lost a long time ago. Maybe we can give them diversity that even their ancestors' crops never had. ☐



# A Biodiversity Travelogue

**Brigitte Maass**
*Germplasm Specialist, Tropical Forages Program*

A hundred and twenty species in a half hectare! This seed increase nursery resembles a quiet country garden. But it's really more like the departure hall at an international airport. Every week, we collect seed of different species for storage and worldwide distribution.

The history of forages in tropical America is a story about travel. The four grass species that provided the basis for cattle-raising during the colonial period were brought to Brazil from Africa. This was largely accidental. *Brachiaria mutica*, for example, was used as bedding on slave ships.

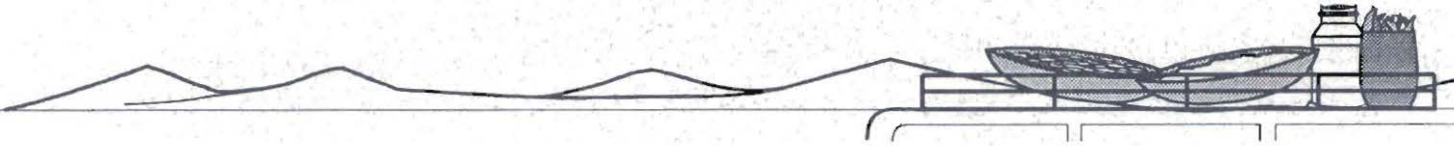
Some of the early introductions have been displaced to a great extent by *Brachiaria decumbens*—signal grass. It was introduced into South America intentionally from eastern Africa, by way of Florida, during the late 1950s. Because of its outstanding performance on marginal acid soils, this species spread rapidly throughout the continent. By the early 1990s, it covered more than 50 million hectares in Brazil alone.

A frightening thought—that much land planted to a single genotype of a single species. Just how frightening has been made clear by the spittlebug. The severe damage it causes to signal grass has stalled the spread of this species in recent years. This is one episode in the tropical forage travelogue that dramatically illustrates our challenge in germplasm research. We have to find ways to satisfy the growing demand for food without compromising biodiversity in tropical pastures.

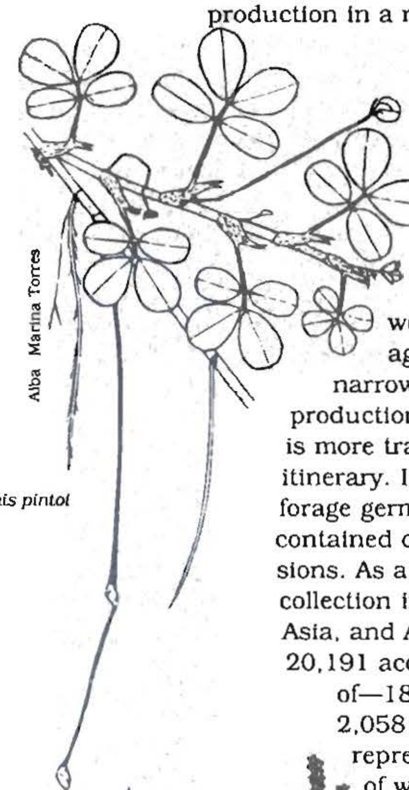
As crop production is intensified in more productive environments, livestock are increasingly pushed onto marginal lands characterized by acid soils. Though South America has a wide array of native grass species, only a few adequately support livestock production. That's why species have been introduced from Africa, where grasses coevolved with ruminant animals and developed the ability to survive with them. These species stand up under feeding and trampling and travel with the animals in their fur and feces.

Farmers are always on the lookout for a miracle forage species. When they

M. Antorveza



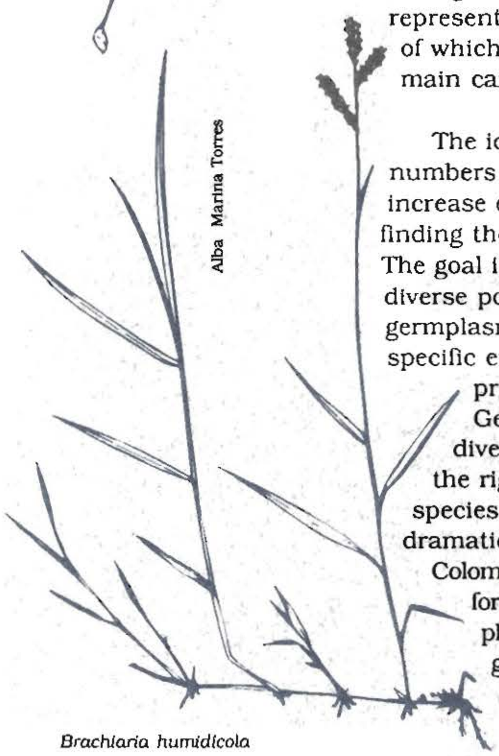
think they've found one, it spreads rapidly. Sowing a single species is the easy way to increase livestock production in a region where land is still abundant and the means and incentives for intensive—rather than extensive—land management are scarce.



Alba Marina Torres

*Arachis pintoi*

Since the 1970s, we've been fighting against this tendency to narrow the genetic base of production. Part of our solution is more travel, but with a tougher itinerary. In 1975 the collection of forage germplasm stored at CIAT contained only about 1,100 accessions. As a result of intensive collection in tropical America, Asia, and Africa, we now have 20,191 accessions to take care of—18,133 legumes and 2,058 grasses. They represent over 700 species, of which some 30 are our main candidates.



Alba Marina Torres

*Brachiaria humidicola*

The idea behind this numbers game is not to increase our chances of finding the miracle forage. The goal is to assemble a diverse portfolio of germplasm options for specific environments and production niches. Getting farmers to diversify isn't easy, but the right combination of species can have a dramatic impact. In Colombia's Eastern Plains, for example, the area planted to a legume-grass association has increased from 7,000 hectares in 1989 to more than 30,000 in 1992. This combination is just one of several options now available to farmers in acid-soil environments.

To identify alternatives and make them available to farmers in the tropics, we rely on an extensive, decentralized network of cooperators in over 30 countries, who evaluate germplasm and share the results. Their curiosity and commitment are two of the reasons the germplasm collection at CIAT is a library instead of a museum. We distribute as many as 4,000 samples each year.

Most entries collected and tested are legumes. Many of these species have tremendous potential for improving the soil, raising forage quality, and delivering nitrogen to companion grasses. Some of them also make terrific ground covers in cropping systems. One promising example is *Arachis pintoi*, a wild peanut species found by Brazilian botanist Geraldo Pinto in 1954, the year I was born. Because of the outstanding performance of this species, Pinto established it in an introduction nursery, where he showed it off to visitors for many years. Eventually, it wound up in the USA and from there was shipped to Australia. Now, scientists in Brazil are getting interested in this and other species of wild peanuts for pasture improvement and soil cover.

That's what has me traveling these days. We don't want one accession of *Arachis pintoi* to become another miracle forage. So, we're starting to collect additional samples in Brazil to broaden the base of this species. We're also collecting related species in search of new options for farmers.

Brazil is crowded with *Arachis*. I don't have as much experience as the veteran collectors. But after covering 5,000 kilometers in 10 days with a team led by CENARGEN, I'm getting to know these species and developing a feel for where to find them. □

# The Frustrating Thing About IPM

**César Cardona**
*Entomologist, Bean Program*

The frustrating thing about integrated pest management is that it usually takes a disaster to get farmers interested. In Colombia, for example, cotton growers didn't seriously consider the alternatives to frequent pesticide use until the bollworm had developed resistance to all the available products. By then cotton was receiving as many as 28 applications each season. Production was down and even abandoned in some places. A lot of farmers went broke and lost their land.

That was in the early 1970s. By the end of the decade, biological control and other measures had led to a drastic reduction in pesticide use. So, the crisis ended with a success story. But it need not have happened at all. In the 1950s, Peruvian farmers went through exactly the same thing. Why didn't Colombia learn from their experience? For that matter, why haven't Colombian farmers learned from their own experience? In the mid-1980s, cotton growers got hooked again—this time on pyrethroids, a new generation of more efficient pesticides. Pretty soon, they'll be in the same mess they were in before.

*"The enemy of my enemy is my friend."*

Arab proverb

Most of these are large-scale, commercial growers. What worries me even more are the small-scale farmers throughout the Andean region who are falling into the same trap. Fifteen years ago they hardly ever used pesticides. Now, they apply them 10, 11 times a season on beans, potatoes, vegetables, anything that's green. So, the problem is not just a commodity issue—it's a farming systems and resource management issue.

Here in Colombia, farmers who are going to apply pesticides say, *Voy a bañar el cultivo* (I'm going to bathe the crop). And if you ask them why, they're likely to answer, *porque es martes* (because it's Tuesday). The target of these applications is *lo que pueda venir* (whatever comes up). Farmers have become convinced that if they don't spray regularly, on a calendar basis, they'll be in trouble. Pesticides are their crop insurance.

Maybe this approach has contributed to increased production. But at a high cost in terms of environmental pollution, human and animal health hazards, rising production costs, and increased risk of production failure. Ironically, indiscriminate pesticide use can also make insect problems worse. In 1978, when we published the first edition of our book on bean production problems, the leafminer deserved two lines. In the 1989 edition, it got two pages. Why? Because irrational pesticide use, partly by destroying beneficial species, prepared the way for a drastic increase in leafminer populations. It's a man-made pest.

The irresistible attraction of pesticide use on a calendar basis is its simplicity. IPM demands more from researchers, extensionists, and farmers. As entomologists, our job is to know the pests—their biology and behavior. We also have to know the enemies of our enemy and understand the way all these species interact with crops in particular farming systems. That's what we call pest ecology. Then, we have to figure out how farmers can act on this knowledge to achieve effective, economical pest control. ❑

# They Were the Ones That *Did* IPM

**Anthony Bellotti**
*Entomologist, Cassava Program*

In research on the cassava hornworm, we found ourselves at a dead end twice before finding the road to effective biological control. We started out by screening our cassava germplasm for resistance. No luck. Everything got knocked flat. That's when we began considering options for biocontrol. First, we looked at the whole complex of insects involved and started evaluating natural enemies. We found a wasp that attacks hornworm eggs, another that goes for the larvae, as well as a bacterial disease.

Originally, we thought that by boosting the populations of hornworm predators in the field, we could prevent buildup of the pest population. But there was a fatal flaw in our strategy—a basic misconception about the hornworm's behavior. Eventually, we realized that the insect is highly migratory. Tens of thousands of them can invade cassava fields and oviposit large numbers of eggs, causing a population explosion that upsets the equilibrium between the pest and its natural enemies.

> *"IPM has been adopted as the basic foundation of the entire sustainable agriculture movement."*
>
> US National Research Council, 1991

This pretty much eliminates the possibility of achieving classical biocontrol of the hornworm—creating a self-sustaining, low equilibrium between the pest and its natural enemies. But there are other kinds of biocontrol, one we describe as augmentative, for example. This is the approach that worked on the hornworm. Farmers have to monitor pest populations and, when they detect an invasion, apply a natural pesticide spray containing a granulosis virus that attacks the insect's larvae.

The need for repeated injections of the natural enemy is the chief disadvantage of augmentative biocontrol. Obviously, it won't work unless the biocontrol procedure is simple and profitable. Fortunately, our strategy for hornworm control meets both criteria. The beauty of it is that farmers can manufacture the insecticide themselves. All they need is a few virus-infected hornworms—which they can easily identify and collect in their own fields—a blender, and some information about the procedure. The homemade pesticide can be stored for a year or more in a refrigerator. Colleagues in Brazil tell us that, assuming farmers supply the pesticide themselves, biocontrol of the hornworm costs only one dollar per hectare, compared with 14 for applying pyrethroids.

What does it take to get something like this going? Obviously, a lot of research. Just to give you an idea of the knowledge base required to achieve biocontrol of the hornworm, we know of nearly 40 different natural enemies of this pest, and only one provides a practical solution.

Persistent research is only half the battle, though. You also need effective implementation. Fortunately, southern Brazil had entomologist Auria Schmidt behind the effort to mount an effective control campaign. CIAT spearheaded the development of a biological control method in collaboration with Auria and other Brazilians. But they were the ones that *did* IPM. At last count, farmers were using the natural pesticide on about 34,000 hectares.

In a new project, funded by UNDP, we and our Brazilian colleagues will be put to an even more difficult test. Our sister Center, IITA, is another major player in the project. They'll be concentrating on several countries in West Africa, while we focus on northeastern Brazil.

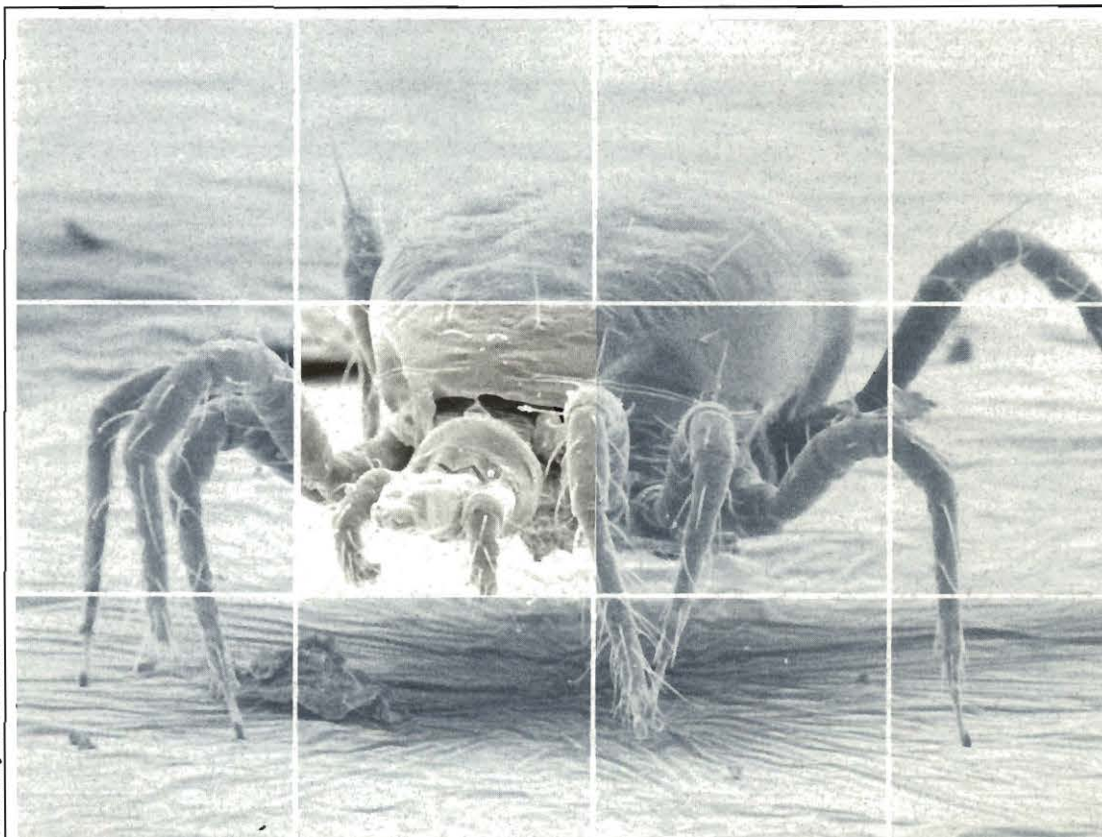
In a lot of ways, northeastern Brazil is the ideal testing ground for IPM. It's hard to imagine a place in Latin America where success in helping stabilize cassava production is more needed. It's one of the few areas in the region where poverty is so extreme that the human population suffers from a calorie deficit. Practically all the major pests of cassava in Latin America are found there. The pessimist in me says, "That makes the problem insurmountable." The optimist says, "If we can deal with the whole complex of species there, we'll have the technology and experience for helping control them in other places as well."

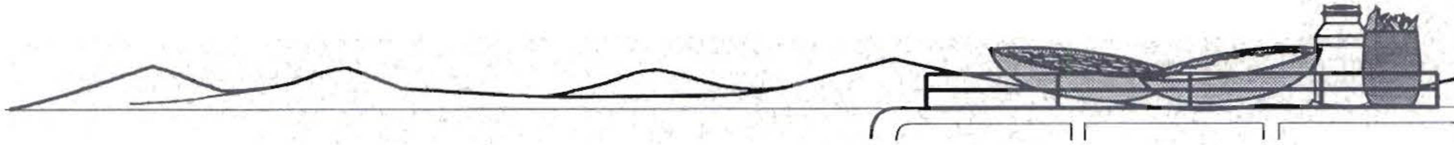
CIAT is not yet a recognized leader in IPM. We've played the important but limited role of developing IPM components—especially resistant germplasm, but also biological control. As an international Center, we could do more, such as devise methods that national institutions can use to develop and promote IPM strategies in particular areas. We also need to participate in more projects, like the one in northeastern Brazil, that demonstrate how these methods work. To provide regional leadership in IPM, CIAT will have to make a serious effort. But we can't do the job with two or three entomologists and a shrinking supply of core funds. □

G. Guzmán

The world of the cassava green mite—an important pest in Africa and northeastern Brazil—and its approximately 50 natural enemies is a Jurassic Park in miniature. The mite predators shown here grab and secure the victim with their front legs. Then, they suck the green juice out of the mite, leaving an empty shell.

Courtesy of F. Bakker





# The Frontier Mentality in South America's Savannas

**Raúl Vera**
*Leader, Savannas Program*

There are striking parallels between this vast, underutilized land resource and the Great Plains of the USA, which are a temperate savanna. It took North American farmers nearly 125 years—and the sobering lessons of the Dust Bowl during the 1930s—to establish systems that balance high production with prudent soil management. We've got to move a lot faster than that in helping stabilize agriculture in the savannas.

A curious fact about this agroecosystem is that, even though practically every farm has both livestock and crops, most growers treat them as if they're independent operations. In developing new technology for the savannas, our working hypothesis is that integrated crop-pasture systems are more productive and sustainable—mainly because they use resources more efficiently—than continuous cropping or pastures alone. The products of this research are "best bet" prototype agropastoral systems, which local institutions and farmers can readily adapt to specific circumstances.

> *"¡Claro que sí se puede!"* (Sure we can).
>
> Isaac Soto, Colombian farmer

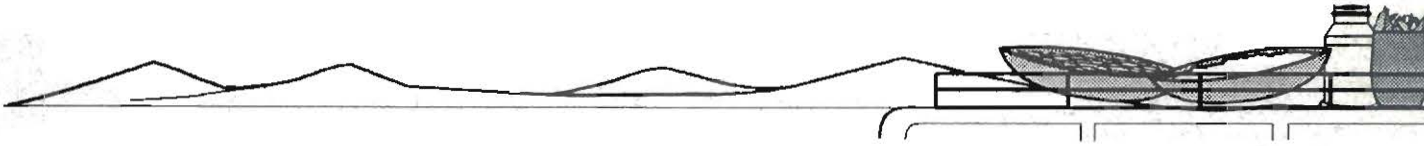
We already have one such option—the rice-pasture system, which Colombian farmers are currently practicing on about 6,000 hectares in the country's Eastern Plains or Llanos. Researchers have developed a similar system in Brazil, and farmers have used it to restore some 150,000 hectares of degraded pastures. Growers in Colombia simultaneously sow forage grasses and legumes with rice. The legume improves the nutritional quality of the forage, resulting in higher livestock production. It also reduces the need for nitrogen fertilizer. The rice crop offers farmers a source of cash income, which covers the costs of establishing the system. Because the grass-legume pasture uses some of the small amount of fertilizer applied to rice, it's ready for grazing within four or five months—by the time rice is harvested—or less than half the time with pastures alone. Quicker establishment of a ground cover reduces erosion and leaching of nutrients.

We still have a long way to go in our research on agropastoral systems. With funding from BID, we plan to see how rice-pastures perform elsewhere. More important, we want to avoid creating an image of the system as a panacea. That means developing other combinations with different components—maize, sorghum, soybeans.

To promote the technology successfully, we'll have to deal with the frontier mentality that prevails in many parts of the savannas. As long as farmers believe there will always be more land to exploit just over the horizon, they're less likely to become good resource managers. During the 1970s, this mentality was reinforced in Brazil and Venezuela by the economic boom and by government policies on subsidies, tax shelters, and so forth. The result was unsustainable monocropping of cereals, with heavy dependence on chemical inputs. The economic disasters of the 1980s put a brake on this pattern of development.

So now we have the opportunity to help establish more rational resource management. We can contribute through research at representative sites, backed up with GIS and computer modeling—tools that enable us to make meaningful comparisons between different situations.

There is reason to hope that the frontier mentality in the savannas will give way to a more enlightened view. When we surveyed farmers in the Colombian Llanos recently about rice-pastures, many expressed concern that it could degenerate into rice



monocropping. Their answer showed real sensitivity to the environmental consequences of their actions and insight into the conditions that reinforce short-term thinking in farmers' resource management.

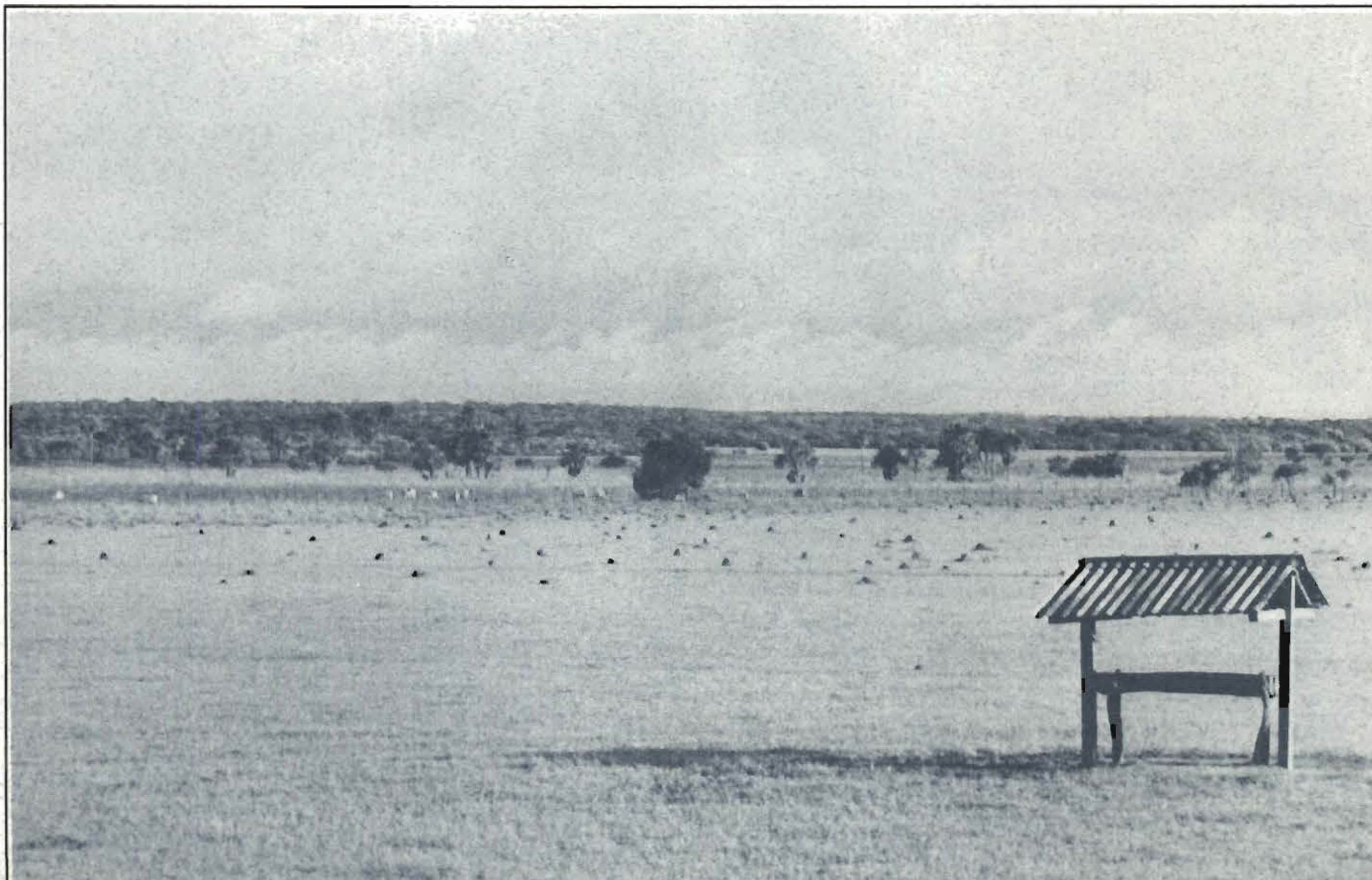
We're getting the same message from our experience with pioneer farmers in Brazil and Colombia who've successfully integrated livestock and crops. Like Isaac Soto. Here's a fellow who had it made, with sizable holdings of prime farm land here in the Cauca Valley. Rather than just sit back and enjoy his grandchildren, he bought some 2,000 hectares of marginal land in the Llanos for crop and livestock production. If he had asked us, we would have told him the land was totally unsuitable for crops. His neighbors thought he was nuts.

And yet this gentleman didn't see it that way. First, he fenced off the more fragile areas and planted trees on them. Then, he established rice-pastures on about 600 hectares and is making an incredible go of it. Soto is a rare individual. If agropastoral systems are to take hold in the savannas, we'll have to find ways of replicating his experience at different levels. Fortunately, you don't have to be an Isaac Soto, with a large farm, to make these systems work. They can make holdings of a few hundred hectares—a modest-sized farm in the savannas—economically viable.

The trouble is that farmers with more limited holdings also have more limited means to make improvements in these remote, undeveloped areas. Clearly, technology development will have to be accompanied by work on policy options that encourage and enable farmers to adopt sound management practices. Part of the payoff from this investment could be reduced pressure on the forest margins beyond the savannas. ☐

Growing numbers of farmers in the savannas are moving away from the old status quo of extensive, low-input, low-output ranching. To avoid a new status quo of unsustainable monocropping, on the one hand, and equally vulnerable grass pastures, on the other, we have to provide attractive options, such as rice-pastures.

F. Pino



# From the Bottom Up

**Jacqueline Ashby**
*Leader, Hillsides Program*

Farmers in the hillsides of Latin America are locked in a vicious circle of poverty reinforcing environmental degradation. To feed their families, they use farming practices that cause erosion. Often, they supplement meager incomes by cutting down trees and selling the wood or making charcoal. That destroys resources that even today don't provide a decent livelihood.

Tomorrow could be unimaginably worse. Throughout Latin America, governments are opening up their economies. As farmers intensify production in response to new market opportunities, the pace of erosion and deforestation will increase.

So will conflicts within hillside farm communities and between them and the people downstream. The farmers know it's in their own long-term interest to protect the soil, forests, and water. But they quite logically ask, "How can we do something that benefits others or that pays off only tomorrow when we can't even meet our own needs today?"

*"But there is a more fundamental ingredient: the process of seeking out and agreeing on a series of 'deals' which minimize the trade-offs between productivity, stability, sustainability and equitability."*

G.R. Conway and E.B. Barbier,
*After the Green Revolution*

A central problem is the marginal status of hillside farmers in this region. Unlike farmers in Europe and North America, they don't constitute a powerful lobby. Therefore, they can't exact subsidies—which are paid for by other groups in society—from the government.

To help resolve conflicts that lie at the heart of destructive resource management in the hillsides, we have to find ways of giving small-scale farmers more power. One is to help create an institutional system that gives these people a place at the bargaining table. Another is to conduct research that channels empirical information into the debate over resources. Otherwise, it deteriorates into a power struggle, in which the farmers lose but no one wins.

A third way is to cultivate leadership ability, not just among the designated leaders, but among the movers and shakers that every community has. Farmers and their communities must have a decision-making role in the local research agenda.

These are some of the things we want to accomplish through the Cauca Consortium, a group of about 10 organizations that includes public agencies, private business, and NGOs in Colombia's Cauca Department. Our common interest is working with local people and their representatives to improve livelihoods and resource management.

Less than a year after the consortium's creation, community leaders have come forward with a proposal for the bargaining table. The idea is that farmers in fragile areas of the watershed will act as stewards of the forests and streams. In exchange the local community will help improve the livestock component of its farming systems in a sustainable way. Various agencies will provide these farmers with technical assistance and credit, and a local cooperative will guarantee a market for milk.

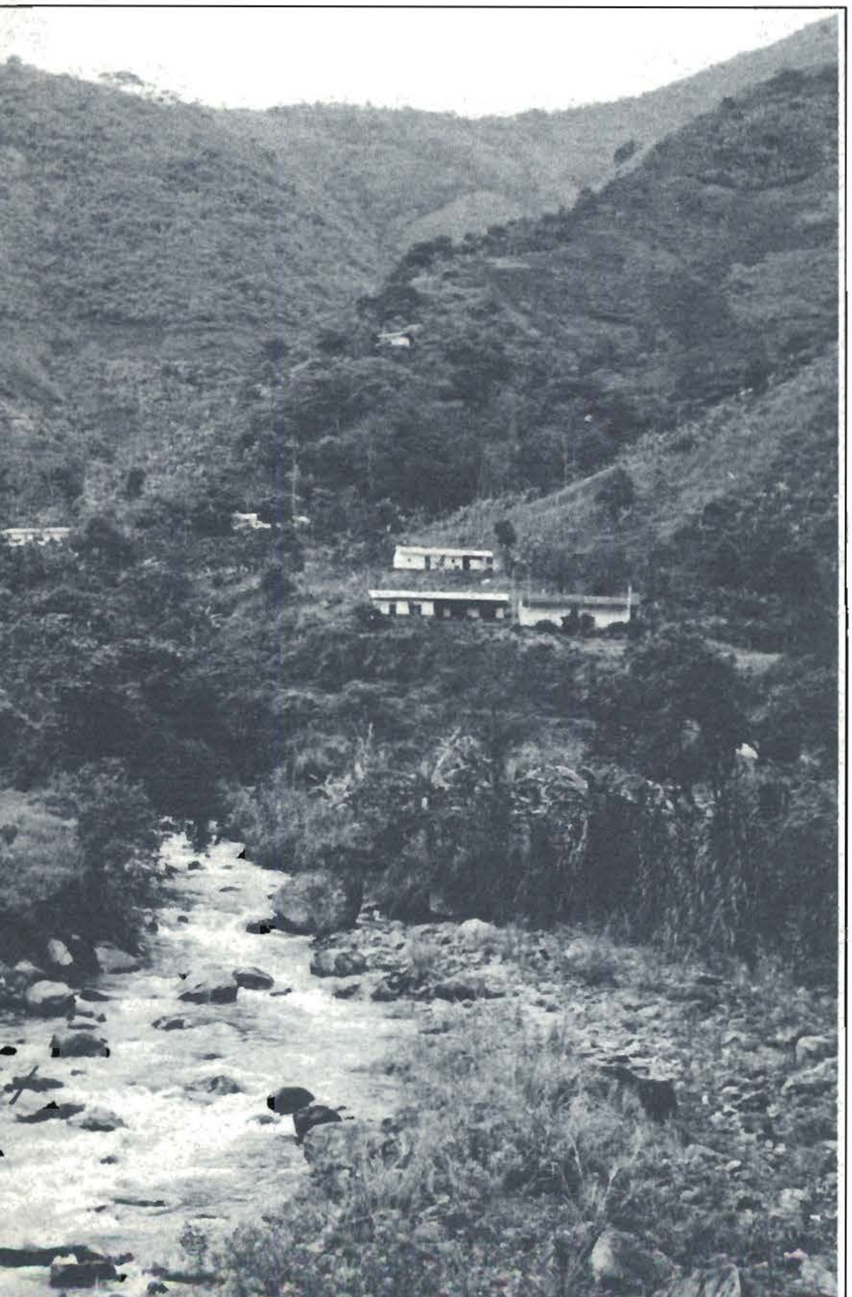
That's the point of departure for our research—a clearly articulated demand from producers, from the organizations that represent them, and from groups that express the social demand for conservation in the hillsides. What we have to do now is examine the technical and economic dimensions of the bargain in its social context.

One of our principal concerns is to determine the effects and costs of soil degradation on crop production potential. We also need to assess different practices for soil regeneration and conservation and elucidate the causal mechanisms underlying these processes. To promote sound resource management in the hillsides, we've got to achieve a better understanding of how hillside communities can satisfy both conservation and production goals in multispecies cropping systems. Obviously, farmers will need to play an active role in the evaluation of alternative technologies.

This is fundamentally different from classical technology transfer, in which solutions are developed and moved down a pipeline to producers. Our approach is to go from the bottom up, evolving a set of conflict-resolution scenarios that are ecologically sound, economically feasible, and socially acceptable.

The solutions that finally emerge will be site specific. Obviously, an institution like CIAT, with regional responsibilities in resource management research, can't stop there. We have to pin down the principles and procedures of effective research and development. Devise a replicable strategy that has passed the acid test of finding location-specific solutions that farmers will adopt.

Yes, we've met with some skepticism. The NGOs, for example, tend to view us in light of our previous commodity production agenda. Changing these perceptions is partly a matter of establishing a track record in resource management research. We also have to show that we can help address the need of NGOs to integrate their work with our kind of research. The Cauca Consortium provides a model for effective collaboration among institutions, in which NGOs and state agencies can identify a common agenda with local people and define complementary contributions. □



M. Antorveza

To help rural communities decide how to manage their land and water resources more effectively, we need to develop sustainability indicators. These can be used to determine whether particular options are viable over the long term.

# Then Along Came Geographic Information Systems

**Peter Jones**
*Agricultural Geographer, Land Use Program*

It wasn't easy being an agrometeorologist at CIAT in 1978, when I started working here. Some of my colleagues just didn't see the need for what we then called "agroecological studies." Back in those days, plant breeders here were trying to develop widely adapted varieties. But the approach that had worked for rice and wheat could accomplish only so much with beans and cassava. The environments where farmers grow these crops are more heterogeneous.

Over time our commodity programs began to target improved germplasm more precisely. To do that they needed to know more about where our crops are grown, under what conditions. Fortunately, we were able to come up with some answers. If not, our work probably would have dropped by the board.

*"Ptolemy's essential weakness was his desperate lack of facts. In the long run, raw materials for a satisfactory atlas . . . would have to come from qualified observers all over the world."*

Daniel Boorstin, *The Discoverers*

We had answers because we had started collecting a lot of potentially useful information in the late 1970s. Our climate system, for example, contains long-term data from some 18,000 weather stations throughout the tropics. It gives us a way to classify crop environments in a particular region and then identify homologous environments elsewhere. So, if a variety does well under one set of conditions, we can find out where else it might be suitable.

We also did a study called *Land in Tropical America* in cooperation with Brazilian scientists. Based on satellite images of the Amazon, we delineated land systems in the region. This enables us to produce detailed descriptions of vegetation, terrain, and so forth.

The big limitation in the early days was that we had no flexible mapping system. We could reel off all sorts of information, but it was hard to relate different categories of data and then map the results. All this had to be done by hand—overlaying sheets on a light table.

Then along came GIS. Affordable tools were on the market by the mid-1980s. Some people called them a solution looking for a problem. In fact, GIS is a powerful problem-solving tool. But the problem has to be well phrased, and you have to have enough data to solve it. Organizations that couldn't meet those requirements were disappointed with GIS. We were delighted with it, because we finally had a way to spacially manipulate the huge amount of information in our geographical databases.

For example, let's say you're looking for suitable research sites in the forest margins, but you want to exclude those areas that are protected by law. With GIS we can do this by automatically overlaying protected areas on forest margin environments throughout Latin America.

Currently, we're acquiring a lot of new hardware and software. A central component of our new network will be ARC-INFO, a vector-based GIS, which links to data tables stored in ORACLE. It will also be connected with ERDAS, a system that processes satellite images. The software charges are really hurting us. But we're determined to get first-rate capabilities, because we know GIS can be applied usefully across the whole range of research activities at CIAT.

In germplasm development, for example, the big application is biodiversity. Recently, I worked with CIAT germplasm specialist Steve Beebe and plant geneticist Joe Tohmé to create a bean core collection—about 1,500 accessions that represent the diversity in a total collection of about 24,000. This should help scientists zero in on useful genes instead of just rummaging around for them in the germplasm bank.

First, we designed a simple environmental classification based on soil type, growing season, etcetera. Then, using map coordinates for the locations where seed was collected, we identified the production environment of each accession. That gave us a way of ensuring that the accessions chosen for the core collection cover the whole range of conditions under which beans are grown. Next, Joe will use molecular markers to measure genetic differences among the 1,500 accessions. That will give us a way of determining just how diverse the core collection is.

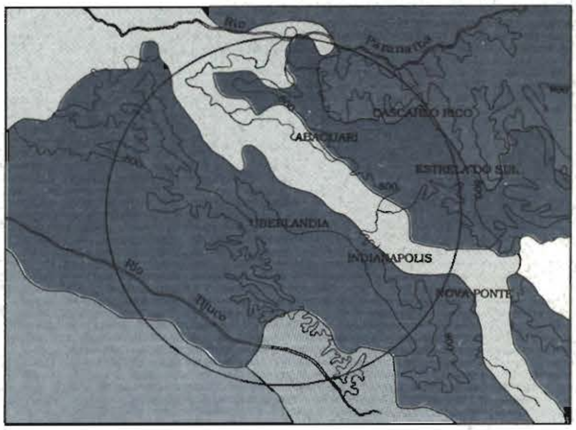
Something else we'd like to do is build up a catalogue of wild relatives of the crops on which CIAT works. Detailed information about where they grow and under what conditions would help target plant collection in the future.

We've already provided this kind of service for biological control—a key component of IPM. In this case, entomologists were searching for natural enemies of the cassava green mite, a native of South America that has become an important pest in Africa. Based on climatic data for areas where the pest occurs in Africa, we identified homologous environments in South America. Entomologists focused on areas representing these environments in their search for the mite and its natural enemies. The strategy worked like a charm.

GIS is even more fundamental to our research on resource management. In fact, CIAT's whole program in this area is based on an analysis of land use throughout Latin America. In preparing the Center's strategic plan, we were tempted to say, "well, let's study resource management in familiar territory—the environments for which we already supply improved germplasm."

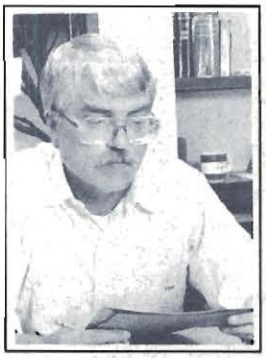
But the director general said we should start with a clean slate. If the analysis suggests we should be selling ice cream in Patagonia, so be it. That's a silly way of putting it, of course, but we did take seriously the challenge to identify, regardless of past experience, the three or four agroecosystems in Latin America where CIAT could make the greatest contribution to growth, equity, and sustainable land use. The interesting thing is, there's a lot of overlap between the environments we finally chose and the ones where we were already working. GIS is important. But it helps to have good instincts as well! ☐

Classifying and mapping the Cerrados region of Brazil was one of the most challenging studies of my career. If there wasn't a way to do something, we made one. Maps like this one provided a basis for discussions with CIAT staff and Brazilian colleagues, who needed the information to identify representative sites for strategic research on resource management.



Land systems in the Uberlandia area.

# I Was a Green Revolution Baby Boomer



**Thomas Hargrove**
*Editor and Head, Communications and Public Awareness Unit*

I was a Green Revolution baby boomer. I got the bug back in 'Nam in '69 when, even though I was an army lieutenant, I distributed IR8 rice seeds deep in the Mekong Delta and showed farmers how to grow them. I later learned that those IRRI seeds saved my life. Through IRRI, rice soon became my life. Leaving the Institute after 19 years was tough. But I felt it was *time* for a change. I'd been in Asia, working with rice, for most of my adult life. What about Africa, South America?

In the spring of 1991, I started flirting with CIAT. During home leave that August, the Center invited me to fly down from Texas—as a consultant—to advise on reorganization of its communications program. I was really there, of course, to talk about a job.

*"The earth's natural resources are the 'capital' on which future growth depends. Sustainable development means living off the interest from this capital, not off the capital itself."*

Filemón Torres

My first working day at CIAT was 16 January 1992, exactly 19 years and 1 day after I'd joined IRRI. I found CIAT a lot like IRRI. The scientists have the same idealism and work ethic. They're sincere, competent men and women who want to—and can—help mankind feed itself in the coming decades as populations increase dramatically and available land for farming shrinks. And we all realize, even more than before, that the Centers have an obligation to find ways to grow that food without further fouling up our environment. Maybe, we can even improve it.

At CIAT I work with four crops—instead of one huge crop that everyone at least knows. We have a global mandate to develop improved varieties and technologies of beans, tropical forages, and cassava. Who, outside the tropics, knows what cassava is? Yet the starchy root feeds 500 million of the world's poorest people. CIAT also handles rice improvement in Latin America and the Caribbean. It's nice to keep my ties with rice. Production has doubled in the region since CIAT was established.

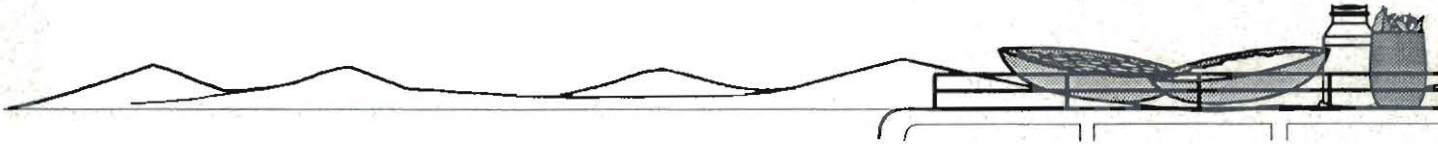
I arrived at a Center that was undergoing some big, and often painful, changes. CIAT was struggling to implement an interesting and ambitious strategic plan. The plan is pretty gutsy—it's a serious commitment to merge plant breeding and other crop research with a major effort in resource management.

We think this approach can help resolve the environmental problems that often—but not always—follow when farmers change from traditional to highly productive agriculture. And help rehabilitate areas where traditional agriculture can't cope with population pressures and limited land.

Through research on resource management, CIAT and national partners will tailor productive yet environmentally sustainable farming systems for fragile ecosystems in tropical America, such as the deforested hillsides and underused savannas. Making those agroecosystems more productive can relieve migration pressures on the vast rain forests, especially the Amazon.

But a funding crisis hit as CIAT was recruiting staff to launch the new strategy . . . a real crisis. Contributions to the CGIAR—the consortium of about 40 governments, foundations, and international organizations that support the Centers—fell dramatically.

There was another problem. Not all CIAT staff agreed with the new strategy. CIAT was a classic commodity center, with a proven track record. Some scientists thought we were straying away from what we *really* know: crop improvement. The scientists still argue





about exactly how to implement our strategy, but we all agree on its goal of sustainable development. We're ready to get on with the job.

The hard new financial realities of 1992-93 meant that we had to reorient priorities and shift communication resources to support fund-raising—fast. That means generating materials to show the donor community what CIAT is accomplishing and, more vital, what we *can* do to make this a better and cleaner earth . . . if we have the resources.

The attitude of CIAT's donors toward communication is also changing. A few years ago, no Center had a public awareness budget. We'd bury those expenses in research budgets, charge them to scientific publication, or use the DG's contingency fund. We didn't want donors to accuse us of using their funds to convince them to give us more money. Or to raise funds from other donors.

But today, CIAT's traditional donors—our investors—are pushing us to find new funding sources. They started, and believe in, the Centers. They want them to grow. Yet our donors know they'll have a hard time even maintaining their current levels of Center funding in the future. Too much competition from China, the former Soviet Union, combined with political pressures to take care of problems at home before those in faraway lands. All at a time when the donors themselves are slashing *their* own budgets.

So the donors now want the Centers to inform the public about the vital role we play in the future of this planet . . . to help show *their* constituencies that we're a worthwhile investment. That can also help attract new donors to share funding costs.

To do public awareness work, we had to gear up fast. I had editorial staff with the potential to be good journalists—but no one had taught them how it's done. I had them write press releases about CIAT programs and used those success stories as training vehicles. I edited the hell out of the articles, sometimes putting them through 20 or more drafts. We were soon producing a stream of good CIAT stories . . . but we had almost no outlets in the donor countries. We were all dressed up, with nowhere to go. So we had to develop a mailing list. We're now sending about 30 press releases a year to 800 outlets, half in English, half in Spanish. We've recently been in the *Washington Post* and *Los Angeles Times*, the *Frankfurter Allgemeine*, *Asahi* in Tokyo, the *New Scientist* and the London *Financial Times*, *The Land* in Australia. We send clippings to donor reps in each country. And vice versa.

*"I'm converted. I'm part of the choir. But I don't control the money in my agency. And the people who do are not converted. They may not even hear the music we're trying to sing. . . . We need a flow of exciting examples of Center research that we can send to our administrators."*

Ralph Cummings, Jr., USAID

We invested funds earmarked for our annual report for 1991 in a 27-minute video. The English edition of *A Fragile Paradise: The Environmental Challenge of Tropical America* has been broadcast on at least 40 North American TV stations. The Spanish edition has aired on about 20 stations.

We initiated *CIAT On-Line*, a series of two-page bulletins, each with five or six summaries of CIAT research highlights. *On-Line* is targeted to our investors, current and potential. We stress the support of specific donors, so their information gatekeepers can easily rewarm and send items to their own supporters.

One big frustration has been in attracting the influential media of donor countries to CIAT. The few reporters who visit Cali, Colombia, come for only one story: *el narcotráfico*. They lay low and leave as quickly as possible. Spend an extra day visiting some place that does research on beans and cassava? No thanks.

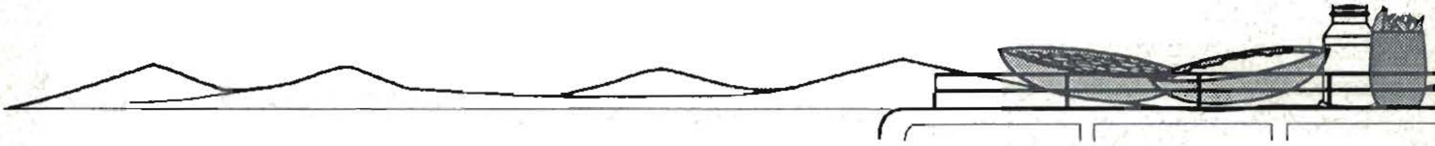
About scientific communication. Somehow, we've managed to maintain our previous publication level through all of this. But we can't keep it up. CIAT's technical information service to our clients, scientists in the humid tropics, will suffer. To me, that's eating our seed corn. But what else can we do?

I'm now a committed part of the CIAT team. But I have another, very personal reason for directing more of our communication skills toward helping pull CIAT through this financial crisis.

I never again want to fire an employee who doesn't deserve it.

I was lucky to have arrived a month after the December 1991 cutback. I knew none of the 300 CIAT staff who were let go. But bad news awaited my return from home leave in Texas in July 1993. I had to cut 10 positions. First, I had to explain to my staff, in my Spanish that's still so clumsy, that almost a fourth would lose their jobs. The cutback hurt the personal pride of some good people.

We're entering the second half of 1993 with a leaner communication group. But we see the seriousness of CIAT's situation more clearly. Our talents, if directed well, can make a difference. ☐



# We've Got to Stop the Hemorrhaging of CIAT's Budget

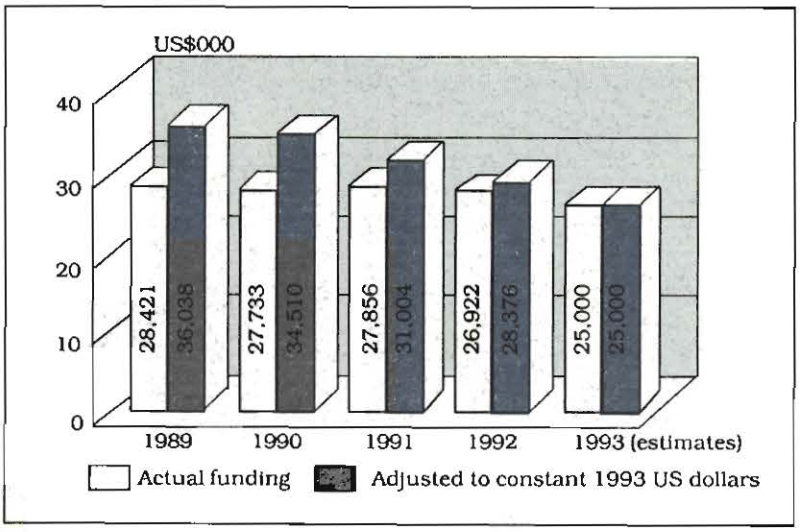
**Fritz Kramer**
*Deputy Director General for Finance and Administration*

To give you an idea of CIAT's financial circumstances, I need to put 1992 in the context of a longer period. From 1989, when funding from the CGIAR system leveled off, to mid-1993, when the continuing decline in core resources forced our latest round of personnel cuts.

During that period the CG's contribution to CIAT declined 22 percent or $7.2 million. This is in 1993 US dollars; so are all other figures I mention here. If you also take into account the revaluation of the Colombian peso against the dollar, the real purchasing power of our core budget has dropped 27 percent or $9.6 million in four years.

The biggest relative cut—47 percent—came in Institutional Development Support. We completely eliminated the Seed Unit, slashed training and conferences by nearly three quarters, and reduced information and documentation services by a fourth. Trainee months dropped 50 percent, national programs had to start paying for information services, and they stopped receiving CIAT support for their seed systems altogether. Without question this will slow the diffusion of technology, particularly for crops, like beans and cassava, that small farmers mainly grow.

CIAT's core funds have declined steadily since 1989.



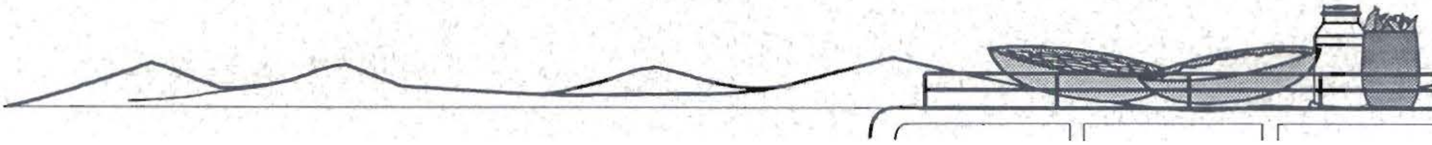

Our commodity programs suffered the largest absolute loss in core funding—$4.6 million or 26 percent. In deciding where to cut, our strategy was to switch from a comprehensive commodity approach to a more limited focus on strategic germplasm development. We drastically cut crop management research in all four programs and economics research in all but the Cassava Program. We also severely curtailed core-funded outreach activities.

Core resources taken away from the commodity programs were just barely enough to establish four new programs for research on resource management. In some cases, we simply shifted positions from one area to the other.

Besides eliminating activities, we tried to economize across all programs. In doing both, we had to fire a lot of good people. Since 1989 we've dropped 416 positions—26 percent of our core-supported staff. Naturally, these cuts—and the uncertainty about what lies ahead—have affected our staff's morale. We've protected CIAT's research as much as possible, reducing its staff positions by 19 percent, compared with 44 percent in other areas.

We countered the decline in core funds a little through self-generated income—such as interest on working capital and fees for use of our conference and other facilities. Income from those sources rose from $900,000 in 1989 to $1.5 million in 1993. But we can't sustain this level after 1993, since the costs of letting staff go have reduced our working capital and reserves.

We've also boosted complementary funding in real terms—from $4.9 million in 1989 to a projected $5.8 million in 1993. But this money doesn't substitute for lost core funds. And by definition it supports activities different from those paid for with core funds.

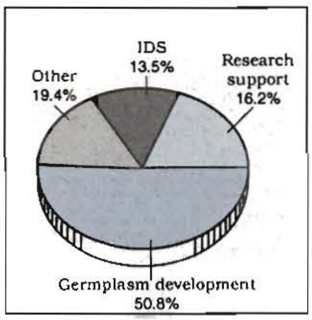


We've significantly altered the allocation of CIAT's total budget since 1989. Even as the budget shrank, we increased the share allocated to research at the expense of institutional development support or IDS and other activities, including administration and central services.

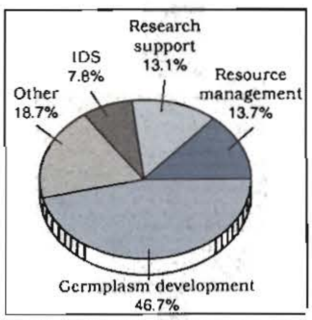
Obviously, we've got to stop the hemorrhaging of CIAT's budget. But how? What I've said so far sounds more like the anatomy of a shrinking financial base than a plan for regaining financial strength. Yet, this information is important for understanding our next steps.

Despite these difficult times, we've refused to manage CIAT's resources with the grim resignation of an organization clinging to its past. We're doing our best to prepare for the future. When we started writing the Center's strategic plan in 1989, we weren't spending donors' money the same way we had in 1979. Nor did we expect to be doing in the year 2000 what we would do in 1993. We like to think of ourselves as an organization that learns from its successes and its disappointments . . . and acts decisively on the lessons learned. That's why we've shifted the focus of our commodity programs and made initial investments in research on resource management. Not just to get by—but to get on with sustainable development.

**Total budget (in constant 1993 US dollars)**




1989: $38,308,000




1993: $32,634,000 (estimate)

**Grant revenue for the year ended 31 December 1992 (US$000)**

| | Core* | | | Comple-mentary | Total |
|---|---|---|---|---|---|
| | Unrestricted | Restricted | Total | | |
| Australia | 152 | — | 152 | 109 | 261 |
| Belgium | 182 | — | 182 | 68 | 250 |
| BID | — | 2,000 | 2,000 | 702 | 2,702 |
| Canada | 1,530 | — | 1,530 | 1,789 | 3,319 |
| China | 20 | — | 20 | — | 20 |
| Colombia | — | — | — | 50 | 50 |
| EEC | — | 2,305 | 2,305 | — | 2,305 |
| Ford Foundation | 100 | — | 100 | — | 100 |
| France | 185 | — | 185 | 97 | 282 |
| FUNDAGRO | — | — | — | 83 | 83 |
| Germany | 775 | 408 | 1,223 | 144 | 1,327 |
| IDRC | — | — | — | 282 | 282 |
| IFAD | — | — | — | 162 | 162 |
| Iran | — | — | — | 24 | 24 |
| Italy | 140 | 200 | 340 | 55 | 395 |
| Japan | — | 3,078 | 3,078 | 45 | 3,123 |
| Kellogg Foundation | — | — | — | 356 | 356 |
| Mexico | 20 | — | 20 | — | 20 |
| Netherlands | — | 286 | 286 | 147 | 433 |
| Norway | 684 | — | 684 | — | 684 |
| Rockefeller Foundation | — | — | — | 268 | 268 |
| Spain | 90 | — | 90 | — | 90 |
| Sweden | 368 | — | 368 | — | 368 |
| Switzerland | 1,149 | 1,002 | 2,151 | 983 | 3,134 |
| United Kingdom | 893 | — | 893 | — | 893 |
| UNDP | — | — | — | 35 | 35 |
| United States of America | 4,700 | 364 | 5,064 | — | 5,064 |
| World Bank | 6,291 | — | 6,291 | — | 6,291 |
| Others | — | — | — | 143 | 143 |
| **Total** | **17,279** | **9,643** | **26,922** | **5,542** | **32,464** |

* Core funds from the CG system support CIAT's primary research activities. Some donors indicate that their core contributions should be restricted to particular activities. With the CG's approval, we obtain additional funds to support research that complements our primary activities.

**Statement of activity for the year ended 31 December 1992 (US$000)**

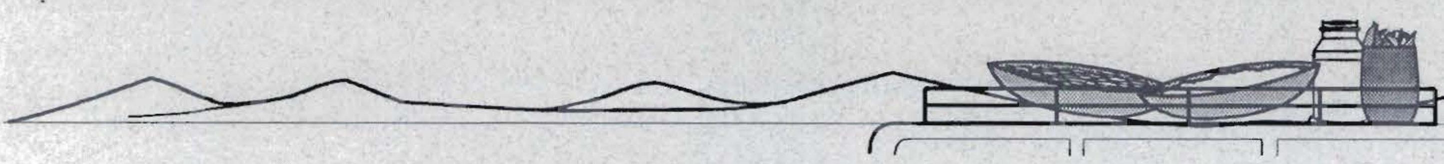
| | Core | | | Complementary | Total |
|---|---|---|---|---|---|
| | Unrestricted | Restricted | Total | | |
| **Revenues:** | | | | | |
| Grants | 17,279 | 9,643 | 26,922 | 5,542 | 32,464 |
| Investment income | 1,060 | 1,060 | — | — | 1,060 |
| Recovery of indirect costs | 366 | — | 366 | — | 366 |
| Other | 129 | — | 129 | — | 129 |
| **Total revenues** | **18,834** | **9,643** | **28,477** | **5,542** | **34,019** |
| **Expenses:** | | | | | |
| Operating expenses | | | | | |
| Research programs | 6,000 | 9,559 | 15,559 | 4,334 | 19,893 |
| Research support | 2,520 | — | 2,520 | 259 | 2,679 |
| Institutional dev. support | 2,402 | 84 | 2,486 | 813 | 3,299 |
| Management and admin. | 2,186 | — | 2,186 | — | 2,186 |
| General operations | 4,209 | — | 4,209 | — | 4,209 |
| Total operating expenses | 17,317 | 9,643 | 26,960 | 5,306 | 32,266 |
| Capital expenditures | — | — | — | 236 | 236 |
| **Total expenses** | **17,317** | **9,643** | **26,960** | **5,542** | **32,502** |
| **Excess of revenues over expenses*** | **1,517** | **—** | **1,517** | **—** | **1,517** |

* In 1992 we deliberately underspent by $1,517,000 and set aside this sum to help cover the costs of downsizing in 1993.

The strategic plan we developed to take us in that direction was endorsed by the Technical Advisory Committee of the CGIAR system in 1991. And the CG will continue to be the central source of funding for our research. The problem is that our plan, conceived in a time of steady core funding, is out of whack with the current dismal financial realities of the CG system. Some people, both inside and outside CIAT, wonder if we shouldn't just put the plan on hold. But there's another, more intriguing possibility. Why not direct our energies at changing the financial realities—through a fund-raising strategy that's more in tune with our new approaches in research?

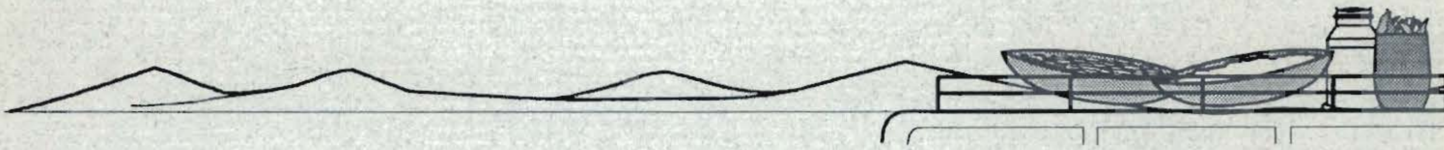
We've just finished developing such a strategy, along with a work plan for 1993-94. This is not the place to describe it in detail, but its goal is to diversify our donor base by actively seeking new investors. This means getting access to new "windows"—specifically the environmental ones—among our current donors. But we will also seek contributions from the private sector and from philanthropists.

What can we do to cultivate new donor relationships and make them durable and productive? One step is to change our research programs to a project basis. In 1993 we're designing a series of "macro" projects that focus on major themes of the donors' development priorities, with a relentless emphasis on output and impact. We will target each project to specific donors. Such projects should help donors identify more with our work and gain greater recognition among their constituencies. Our new initiatives in public awareness can contribute substantially to that goal. We will prepare high-quality proposals, assemble supporting information, and establish contacts with donors at different levels. Everyone at CIAT—including Board members, directors, and scientists—will play an important role in these tasks. ❑



# Complementary Projects

| | Duration | Total pledge (US$) | 1992 expenditures (US$) |
|---|---|---|---|
| **Australia** | | | |
| Forage network in Southeast Asia | 1991-1994 | 773,000 | 95,000 |
| Forage legume physiology | 1988-1993 | 395,000 | 14,000 |
| **Belgium** | | | |
| Genetic improvement of beans | 1991-1996 | 638,000 | 68,000 |
| **BID** | | | |
| Training trainers in bean, cassava, and rice production | 1991-1993 | 1,130,000 | 702,000 |
| **Canada** | | | |
| Bean research network in southern Africa | 1987-1992 | 7,245,000 | 1,268,000 |
| Bean research in eastern Africa | 1992-1996 | 3,985,000 | 428,000 |
| Caribbean rice research network | 1992 | 93,000 | 93,000 |
| **Colombia** | | | |
| Cassava drying | 1992 | 50,000 | 50,000 |
| **France** | | | |
| Cassava starch project | 1989-1993 | 115,000 | 46,000 |
| Effect of soil phosphorus availability on beans | 1992-1993 | 52,000 | 27,000 |
| Upland rice improvement | 1991-1993 | 110,000 | 24,000 |
| **FUNDAGRO** | | | |
| Cassava development in Ecuador | 1992-1994 | 176,000 | 83,000 |
| **Germany** | | | |
| Soil conservation in cassava grown by smallholders on hillsides | 1990-1996 | 300,000 | 131,000 |
| Improved root system and mineral nutrition in beans | 1992-1993 | 73,000 | 5,000 |
| Research on the natural enemies of cassava green mite | 1992-1993 | 35,000 | 8,000 |
| **IDRC** | | | |
| Cassava processing in Colombia | 1992-1994 | 217,000 | 50,000 |
| Development of integrated pest management systems | 1991-1994 | 191,000 | 65,000 |
| Tropical forages network | 1992 | 170,000 | 156,000 |
| Seed pastures fund | 1990-1992 | 15,000 | 8,000 |
| Communications and technology transfer | 1992 | 3,000 | 3,000 |
| **IFAD** | | | |
| Development of cassava germplasm for the drier tropics | 1990-1994 | 950,000 | 162,000 |
| **Iran** | | | |
| Bean improvement and training | 1991-1994 | 113,000 | 24,000 |
| **Italy** | | | |
| Research on bean germplasm | 1985-1993 | 1,061,000 | 55,000 |
| **Japan** | | | |
| Improved native grassland research | 1989-1994 | 386,000 | 58,000 |
| Cassava research in Asia | 1993 | 139,000 | |
| Cassava processing utilization and marketing | 1992-1993 | 19,000 | 14,000 |
| Cassava economics study in Asia | 1990-1992 | 15,000 | 6,000 |
| **Kellogg Foundation** | | | |
| Integrated production, processing, and marketing of cassava | 1989-1993 | 994,000 | 193,000 |
| Farmer participation in technology design | 1990-1994 | 854,000 | 161,000 |
| Poultry prod. by women's groups linked to cassava project | 1991-1992 | 27,000 | 2,000 |
| **Netherlands** | | | |
| Cassava biotechnology network | 1992-1997 | 1,643,000 | 147,000 |



| | Duration | Total pledge (US$) | 1992 expenditures (US$) |
|---|---|---|---|
| **Rockefeller Foundation** | | | |
| Rice biotechnology research | 1990-1993 | 353,000 | 150,000 |
| Molecular mapping of cassava | 1991-1994 | 240,000 | 75,000 |
| Study of settlement patterns and resource management | 1991-1993 | 80,000 | 40,000 |
| Institutional development | 1992 | 10,000 | 3,000 |
| **Switzerland** | | | |
| Bean research in the Great Lakes region of southern Africa | 1989-1995 | 2,528,000 | 134,000 |
| Bean research network for the Andean region | 1988-1993 | 1,058,000 | 363,000 |
| Regional cooperation in bean research | 1990-1993 | 1,036,000 | 297,000 |
| Research fellows in the Bean Program | 1988-1995 | 496,000 | 189,000 |
| **UNDP** | | | |
| Biological control of cassava mites | 1991-1992 | 125,000 | 35,000 |
| **USA** | | | |
| Bean research network in eastern Africa | 1984-1993 | 2,277,000 | 0 |

## Acronyms used in this publication

**BID** Banco Interamericano de Desarrollo (Inter-American Development Bank, IDB)

**CENARGEN** Centro Nacional de Recursos Genéticos, Brazil (National Center for Genetic Resources)

**CGIAR** Consultative Group on International Agricultural Research

**CIDA** Canadian International Development Agency

**CIFOR** Center for International Forestry Research, Indonesia

**CIMMYT** Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico (International Maize and Wheat Improvement Center)

**CIP** Centro Internacional de la Papa, Peru (International Potato Center)

**CIRAD** Centre de Coopération International en Recherche Agronomique pour le Développement, France (Center for International Cooperation in Agricultural Development Research)

**CNPAF** Centro Nacional de Pesquisa em Arroz e Feijão, Brazil (National Center for Research on Rice and Beans)

**CNPMF** Centro Nacional de Pesquisa de Mandioca e Fruticultura, Brazil (National Center for Research on Cassava and Fruit Crops)

**EEC** European Economic Community

**EMBRAPA** Empresa Brasileira de Pesquisa Agropecuária (Brazilian Enterprise for Agricultural Research)

**FUNDAGRO** Fundación para el Desarrollo Agropecuario, Ecuador (Foundation for Agricultural Development)

**IBPGR** International Board for Plant Genetic Resources, Italy

**ICA** Instituto Colombiano Agropecuario (Colombian Institute of Agriculture and Livestock)

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

**ICLARM** International Center for Living Aquatic Resources Management, Philippines

**ICRAF** International Centre for Research in Agroforestry, Kenya

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

**IDRC** International Development Research Centre, Canada

**IFAD** International Fund for Agricultural Development, Italy

**IFDC** International Fertilizer Development Center, USA

**IFPRI** International Food Policy Research Institute, USA

**IIMI** International Irrigation Management Institute, Sri Lanka

**IITA** International Institute of Tropical Agriculture, Nigeria

**ILCA** International Livestock Centre for Africa, Ethiopia

**ILRAD** International Laboratory for Research on Animal Diseases, Kenya

**INIAP** Instituto Nacional de Investigaciones Agropecuarias, Ecuador (National Institute for Agricultural Research)

**INIBAP** International Network for the Improvement of Banana and Plantain, France

**INTSORMIL** International Sorghum and Millet Program, USA

**IRRI** International Rice Research Institute, Philippines

**ISNAR** International Service for National Agricultural Research, Netherlands

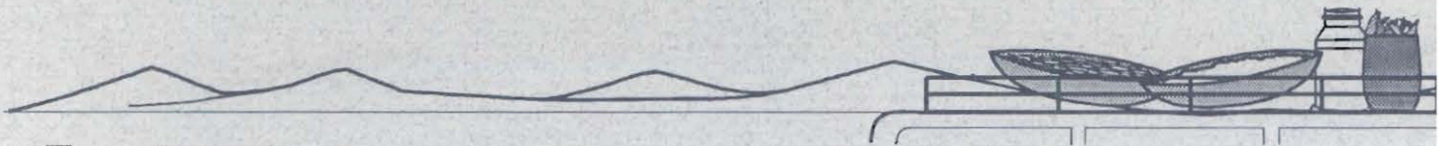
**NRI** Natural Resources Institute, UK

**SADCC** Southern Africa Development Coordination Conference

**TARC** Tropical Agricultural Research Center, Japan

**UNDP** United Nations Development Programme

**WARDA** West Africa Rice Development Association, Côte d'Ivoire



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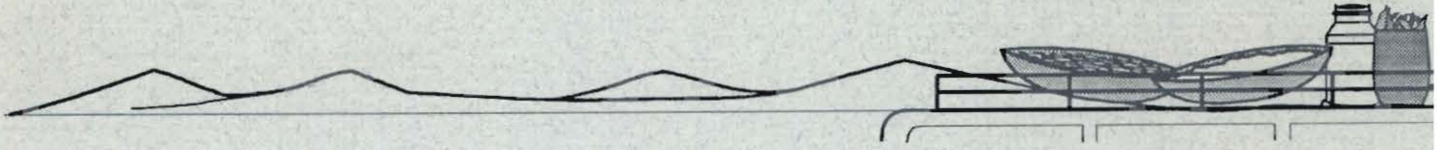

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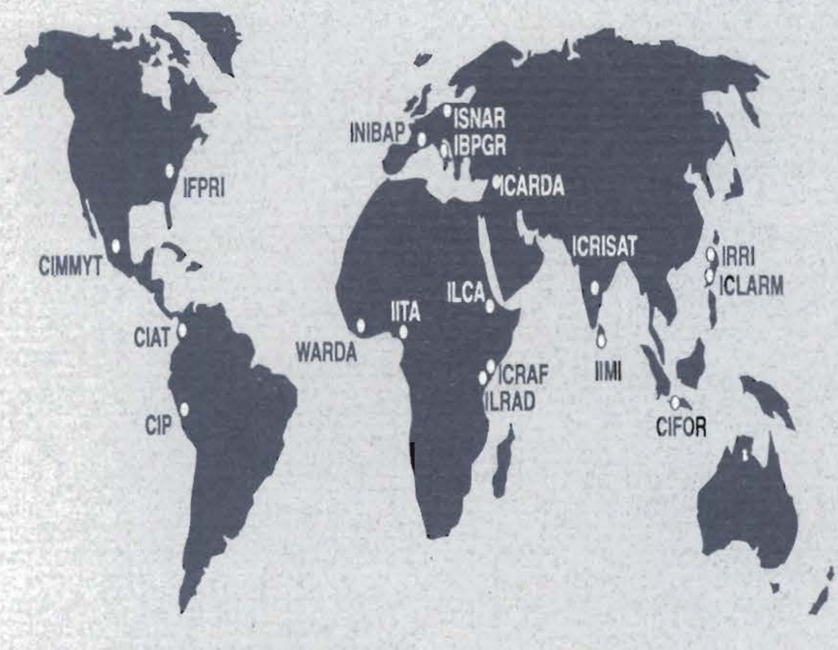


Locations of CGIAR Centers.

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* Left in 1992.

** Left in 1993.

# Contributions to the Scientific Literature

This list includes mainly journal articles, along with a few book chapters, and selected CIAT publications. Center staff made many other contributions to the literature as well, including less formal documents and papers presented at meetings and published in proceedings.


Argel, P.J. and Valerio, A. 1992. Selectividad de herbicidas en el control de malezas en *Arachis pintoi*. Pasturas Trop. 14(2):23-26.

Bellotti, A.C.; Arias, B.; and Guzmán, O.L. 1992. Biological control of the cassava hornworm, *Erinnyis ello* (Lepidoptera: Sphingidae). Fla. Entomol. 75(4):506-515.

Cardona, C.; Dick, K.; Posso, C.E.; Ampofo, K.; and Nadhy, S.M. 1992. Resistance of a common bean (*Phaseolus vulgaris* L.) cultivar to post-harvest infestation by *Zabrotes subfasciatus* (Boheman) (Coleoptera: Bruchidae). II. Storage tests. Trop. Pest Manage. 38(2):173-175.

Carter, S.E.; Fresco, L.O.; Jones, P.G.; and Fairbairn, J.N. 1992. An atlas of cassava in Africa: Historical, agroecological and demographic aspects of crop distribution. CIAT, Cali, Colombia. 86 p. (With 8 colored maps.)

Chavarriaga, P. and Roca, W.M. 1992. Biotecnología agrícola: Tecnologías de mayor aplicación en instituciones colombianas. In: Amaya, M.T. et al. (eds.). Medio ambiente y desarrollo. Tercer Mundo Editores, Santafé de Bogotá, Colombia. p. 209-217.

Cuevas-Pérez, F.; Guimarães, E.P.; Berrio, L.E.; and González, D.I. 1992. Genetic base of irrigated rice in Latin America and the Caribbean, 1971 to 1989. Crop Sci. 32:1054-1059.

El-Sharkawy, M.A.; Detafur, S.M.; and Cadavid, L.F. 1992. Potential photosynthesis of cassava as affected by growth conditions. Crop Sci. 32(6): 1336-1342.

________; Hernández, A. del P.; and Hershey, C. 1992. Yield stability of cassava during prolonged mid-season water stress. Exp. Agric. 28(2):165-174.

Ferguson, J.E.; Cardozo, C.I.; and Sánchez, M.S. 1992. Avances y perspectivas en la producción de semilla de *Arachis pintoi*. Pasturas Trop. 14(2):14-22.

Gallopín, G.C. 1992. Science, technology and the ecological future of Latin America. World Dev. 20(10):1391-1400.

________ and Oberg, S. 1992. Quality of life. In: Doodge, J.C.I.; Goodman, G.T.; la Rivière, J.W.M.; Marton-Lefèbre, J.; O'Riordan, T.; and Praderie, F. (eds.). An agenda of science for environment and development into the 21st Century. Cambridge University Press, Cambridge. p. 227-238.

________ and Winograd, M. 1992. Obstáculos y oportunidades para el desarrollo sustentable en América Latina. In: Problemática futura del medio ambiente en América Latina. Editorial MAPFRE, Madrid. p. 1-30.

Hallman, G.J.; Morales, C.G.; and Duque, M.C. 1992. Biology of *Acrosternum marginatum* (Heteroptera: Pentatomidae) on common beans. Fla. Entomol. 75(2):190-196.

Hanson, P.M. and Smith, L.M. 1992. Economics of chemical and manual weed control in hybrid maize in the Kenya highlands. Trop. Pest Manage. 38(2):210-213.

Hershey, C.H. and Jennings, D.L. 1992. Progress in breeding cassava for adaptation to stress. Plant Breed. Abstr. 62(8):823-831.

Janseen, W.; Luna, C.A.; and Duque, M.C. 1992. Small-farmer behaviour towards bean seed: Evidence from Colombia. J. Appl. Seed Prod. 10:43-51.

Jones, R.J. and Lascano, C.E. 1992. Oesophageal fistulated cattle can give unreliable estimates of the proportion of legumes in the diets of resident animals grazing tropical pastures. Grass Forage Sci. 47:128-132.

Kawano, K. 1992. Twenty years of cassava breeding. Agric. Hortic. (Japan) 67(2):33-38 and 67(3):29-32.

Kipe-Nolt, J.A.; Montealegre M., C.M.; and Tohmé, J. 1992. Restriction of nodulation by the broad host range *Rhizobium tropici* strain CIAT899 in wild accessions of *Phaseolus vulgaris* L. New Phytol. 120(4):489-494.

Kornegay, J.; White, J.W.; and Ortíz de la Cruz, O. 1992. Growth habit and gene pool effects on inheritance of yield in common bean. Euphytica 62:171-180.

Lapointe, S.L.; Serrano, M.S.; Arango, G.L.; Sotelo, G.; and Córdoba, F. 1992. Antibiosis to spittlebugs (Homoptera: Cercopidae) in accessions of *Brachiaria* spp. J. Econ. Entomol. 85(4):1485-1490.

________; González, A.; Tohmé, J.M.; and García, J.A. 1992. Variation in characters related to leaf photosynthesis in wild bean populations. Crop Sci. 32(3):633-640.

Lynam, J.K. and Janssen, W.G. 1992. Commodity research programs from the demand side. Agric. Syst. 39(3):231-252.

Lynch, J. and White, J.W. 1992. Shoot nitrogen dynamics in tropical common bean. Crop Sci. 32:392-397.

Morales, F.J. and Castaño, M. 1992. Increased disease severity induced by some comoviruses in bean genotypes possessing monogenic dominant resistance to bean common mosaic potyvirus. Plant Dis. 76(6):570-573.

________; ________; Calvert, L.A.; and Arroyave, J. 1992. Furcraea necrotic streak virus: An apparent new member of the dianthovirus group. J. Phytopathol. (Berl.) 134:247-254.

Mosquera, P. and Lascano, C.E. 1992. Producción de leche de vacas en pasturas de *Brachiaria decumbens* solo y con acceso controlado a bancos de proteina. Pasturas Trop. 14(1):2-10.

Nada, Y.; Ogawa, Y.; and Mitamura, T. 1992. Surface sowing of legume seed in savannas of South America. Jpn. Agric. Res. Q. 25:294-302.

Nolt, B.L.; Pineda B., L.; and Velasco, A.C. 1992. Surveys of cassava plantations in Colombia for virus and virus-like diseases. Plant Pathol. 41(3):348-354.

O'Brien, G.M.; Mbome, L.; Taylor, A.J.; and Poulter, N.H. 1992. Variations in cyanogen content of cassava during village processing in Cameroon. Food Chem. 44(2):131-136.

Padgham, J.; Pike, V.; Dick, K.; and Cardona, C. 1992. Resistance of a common bean (*Phaseolus vulgaris* L.) cultivar to post-harvest infestation by *Zabrotes subfasciatus* (Boheman) (Coleoptera: Bruchidae). I. Laboratory tests. Trop. Pest Manage. 38(2):167-172.

Pedalino, M.; Giller, K.E.; and Kipe-Nolt, J. 1992. Genetic and physiological characterization of the non-nodulating mutant of *Phaseolus vulgaris* L. J. Exp. Bot. 43:843-849

Ramirez, A.; Seré, C.; and Uquillas, J. 1992. An economic analysis of improved agroforestry practices in the Amazon lowlands of Ecuador. Agrofor. Syst. 17:65-86.

Ramírez, B.C.; Macaya, G.; Calvert, L.A.; and Haenni, A.L. 1992. Rice hoja blanca virus genome characterization and expression *in vitro*. J. Gen. Virol. 73:1457-1464.

Rao, I.M.; Roca, W.M.; Ayarza, M.A.; Tabares, E.; and Garcia, R. 1992. Somaclonal variation in plant adaptation to acid soil in the tropical forage legume *Stylosanthes guianensis*. Plant and Soil 146:21-30.

Sanz, J.I.; Weil, S.; and Jones, A.A. 1992. The mineralogy and potassium reserves of a soil from Carimagua, Colombia. Geoderma 52:291-302.

Singh, S.P. 1992. Common bean improvement in the tropics. In: Janick, J. (ed.). Plant breeding reviews, Vol. 10. John Wiley & Sons, Chichester, UK.

________; Gutiérrez, J.A.; Urrea, C.A.; Molina, A.; and Cajiao, C. 1992. Location-specific and across-location selections for seed yield in populations of common bean, *Phaseolus vulgaris* L. Plant Breed. 109:320-328.

________; Terán, H.; Molina, A.; and Gutiérrez, J.A. 1992. Combining ability for seed yield and its components in common beans of Andean origin. Crop Sci. 32(1):81-84.

________; Urrea, C.A.; Molina, A.; and Gutiérrez, J.A. 1992. Performance of small-seeded common bean from the second selection cycle and multiple-cross intra- and interracial populations. Can. J. Plant Sci. 72(3):735-741.

Thomas, R.J. 1992. The role of the legume in the nitrogen cycle of productive and sustainable pastures. Grass For. Sci. 47:133-142.

Van Beem, J.; Kornegay, J.; and Lareo, L. 1992. Nutritive value of the ñuña popping bean. Econ. Bot. 46(2):164-170.

White, J.W. and Castillo, J.A. 1992. Evaluation of diverse shoot genotypes on selected root genotypes of common bean under soil water deficits. Crop Sci. 32(3):762-765.

________; Kornegay, J.; Castillo, J.; Molano, C.H.; Cajiao, C.; and Tejada, G. 1992. Effect of growth habit on yield of large-seeded bush cultivars of common bean. Field Crops Res 29(2):151-161.

________; Montes, C.; and Mendoza, L.Y. 1992. Use of grafting to characterize and alleviate hybrid dwarfness in common bean. Euphytica 59:19-25.

________; Singh, S.P.; Pino, C.; Rios B., M.J.; and Buddenhagen, I. 1992. Effects of seed size and photoperiod response on crop growth and yield of common bean. Field Crops Res. 28(4):295-307.

Winslow, M.D. 1992. Silicon, disease resistance, and yield of rice genotypes under upland cultural conditions. Crop Sci. 32:1208-1213.

Wortmann, C.S.; Kisakye, J.; and Edje, O.T. 1992. The diagnosis and recommendation integrated system for dry bean: Determination and validation of norms. J. Plant Nutr. 15 (11):2369-2379.

________ and Sengooba, T. 1992. The banana-bean intercropping system: Bean genotype times cropping system interactions. Field Crops Res. 31(1-2):19-25.

________; ________; and Kyamanywa, S. 1992. Banana and bean intercropping: Factors affecting bean yield and land use efficiency. Exp. Agric. 28(3):287-294.

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# There's Always Next Year

**Editor:** *OK guys, what's your verdict?*

**Scowcroft:** *Well, I'm new here and haven't lived through the difficult times at CIAT. But I wonder if we're complaining a little too loudly about the funding cuts. It's in Vaccaro's letter. Hargrove talks about the anguish of firing so many staff. And then Kramer comes along with his anatomy of a hemorrhaging budget. I came here to help build for the future, not conduct an autopsy!*

**William Scowcroft (left)**
*Deputy Director General, Germplasm Development Research Division*
**Gerardo Häbich**
*Associate Director, Institutional Development Support*

*We have to remember that the funding shortfall is a global phenomenon. CIAT and the CG system are not being singled out for ill treatment. New priorities have emerged, and there just isn't enough money to go around. So, we operate in a more competitive environment. "Publish or perish" has been replaced by "fund or founder."*

**Häbich:** *You're absolutely right. But that's all the more reason to talk realistically about resources—which is exactly what we do in this report. The point is that nobody—neither CIAT nor anyone else—can make real progress toward sustainable development through a one-dimensional, piecemeal approach. We need a comprehensive research program. And that takes money.*

*Another point is that we don't just wring our hands about money here—we also talk about innovative fund-raising strategies. That's a positive step.*

**Scowcroft:** *But if we're successful, it won't be due just to clever fund-raising, but to the quality of our science. That's what made the CG system. Where's our science in this report? Where's the accent on achievement?*

**Editor:** *It's everywhere. In Tohmè's discussion of rice blast, Vera's description of rice-pastures. And don't forget the publications list. It could have been a lot longer. But we decided to focus on articles in refereed journals, chapters in books—items that are hardest to get published and that are taken most seriously.*

*If the science message is a little muted, it may be because we talk more about solutions than about the difficult process of finding them. Bellotti's homemade pesticide—now, they're calling it a green milkshake—sounds so easy. And yet, as he mentions, it took years to determine which natural enemy—out of about 40—would work.*

**Häbich:** *Another thing is that we've tried to balance the science message with an institutional message. Our main business is to develop environmentally friendly technology—that'll be a big part of our contribution to Agenda 21. But we can also contribute to the "greening" of the public mind, as Bezanson puts it—from national policy makers right down to the community level.*

*To deliver the goods for sustainable development, we have to work with a broader array of national institutions than ever. The impact of our work so far is a product of CIAT's joint efforts with its traditional partners. To take on new challenges, we have to broaden the circle of collaboration. That's why we talk so much about consortia here, especially in the sections on resource management research.*

**Scowcroft:** *You have a point, but the balance must be right and the message clear. We are and want to be recognized as a problem-solving institution—*¡claro que si se puede!

**Editor:** *Look, let's not let the perfect be the enemy of the good. Besides, we're running out of time. If we've missed something, . . . there's always next year.*

## CIAT at the threshold of sustainable development

The 1992 Earth Summit held in Rio de Janeiro signaled the world's arrival at the threshold of sustainable development. Along with many others, that's where CIAT is now—groping for a clearer understanding of the challenge and trying to confront it decisively. We are also at or near a financial threshold. Above it we can enhance the contribution of agriculture to sustainable development through a comprehensive research program.

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