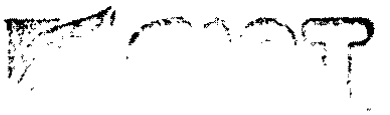
Funding Request for 1992



CIAT
Centro Internacional de Agricultura Tropical

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OVERVIEW

In 1991 CIAT submitted its long-range plan, entitled "*CIAT in the 1990s and Beyond: A Strategic Plan,*" to the CGIAR. This Plan is accompanied by projections, to the year 2001, of global resource needs.

Operational details for the first five years of the Strategic Plan are given in CIAT's Draft Operational Plan, entitled "*Program Plans and Resource Requirements 1992-1996.*" This draft was discussed with TAC on a preliminary basis. TAC and CIAT agreed that CIAT would submit a final draft of the Operational Plan in early 1992, at the time when other centers' five-year plans will be discussed by TAC. CIAT's time-adjusted new Operational Plan to be submitted in 1992 will be entitled "*Program Plans and Resource Requirements 1993-1997.*"

The present publication, "*Funding Request for 1992,*" presents the program plans and funding requirements for the first year of the draft operational plan, i.e., for the period 1992-1996. The funding request for 1992 under consideration here was reviewed and approved by TAC at their June meeting in Rome (TAC-55), with the proviso that TAC's preliminary discussions of CIAT's five-year plan do not yet imply a formal endorsement of the program changes over the coming five-year period as proposed by CIAT.

The reader is reminded that, in its Strategic Plan, CIAT proposes to pursue its mission through two inter-dependent approaches: a germplasm development approach that concentrates on strategic aspects of research to exploit the potential of gene-based mechanisms for sustainable production increases; and a resource management approach that concentrates on research at the production level in selected, major, high-priority agroecosystems. This overall strategy requires both a reorientation of CIAT's existing commodity research programs, and the building up of the Center's capacity to engage in resource management research. CIAT proposes to begin implementing its Strategic Plan in 1992. Hence, the present document outlines an important shift in resource deployment as compared with past years.

The reader is specifically referred to Table 4 (p.43) which compares the proposed resource allocation patterns in 1992 with those in 1991. A considerable shift in resource allocation to *resource conservation and management* reflects the fact that a large portion of this new research effort relates directly to the activities subsumed under this category.

Crop productivity research is scheduled to diminish in relative terms in response to CIAT's increased emphasis on strategic research in germplasm development, while de-emphasizing resource-intensive work in applied crop research. Livestock research, which is mostly carried out by the Tropical Forages Program, will claim approximately 11% of the center's resources.

Research on human linkages (e.g., analysis of human nutrition, sociocultural organization, understanding of gender issues) will increase, as will CIAT's efforts in *socioeconomic and policy research*, planned for the area of resource management research.

It should also be noted that there is an initially small decrease in the allocation of resources to *institution building and networking*. This decrease is expected to become more pronounced in future years. This is largely due to a qualitative change in the relationship envisaged between national programs and CIAT. Now that large corps of trained specialists are available in national programs, training in production and production-related subjects can increasingly be carried out at the country level. Because international and regional networks are fully operational and largely self-sustaining, there is also less need for CIAT to invest resources in these networks. In the future, traditional institution-building activities will give way to interinstitutional cooperative endeavors, whereby each institution contributes to a common research agenda according to its specific comparative advantages.

CIAT has reason to propose that the implementation of its Strategic Plan in 1992 can be undertaken **below** the 1991 resource base approved for CIAT by the CGIAR:

> CGIAR approved funding for 1991:
> $32,672,000
> CIAT request for 1992:
> $32,650,000[1]

Compared with **actual funding** in 1991 (i.e., $28,816,000), the 1992 funding request is 12% more than the resources available to CIAT in 1991.

It is noteworthy to recall that the CGIAR-approved Operational Plan for CIAT for the period 1989-1993 calls for a core budget in 1992 of 35.0 million dollars, which is 2.4 million dollar above CIAT's present request for the same budget year.

[1] Includes $1,348,000 for price increases.

MANDATE AND ORGANIZATION

Mandate and strategies

CIAT's mission is

> *"to contribute to the alleviation of hunger and poverty in tropical developing countries by applying science to the generation of technology that will lead to lasting increases in agricultural output while preserving the natural resource base."*

Germplasm development research aims at characterizing and broadening the genetic base of selected commodities, and at understanding the gene-governed mechanisms that determine plant adaptation and productivity in major production areas, including the tropical American ecosystems that were selected for intensive agroecological research. The goal is to develop the potential of germplasm resources for increasing their output and their efficiency for using inputs.

Resource management research focuses on (1) important tropical American agroecosystems which are threatened by increasingly intensive land use or natural resource degradation, and (2) those which may have potential for relieving such pressures. The aim is to understand the basic processes operating within agroecosystems in order to make agricultural production more sustainable.

This integrated approach is pursued within a framework of interinstitutional cooperation aimed at enhancing complementarity and increasing cost-effectiveness of research at the national, regional, and international levels.

Operational mandate

The Box shows the operational mandate that will govern CIAT's activities during the first five years of CIAT's Strategic Plan.

The Board of Trustees

CIAT is governed by an independent Board of Trustees. The 1991-1992 membership of the Board is as follows:

Frederick E. Hutchinson
(Chairman), USA
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Operational Mandate for the 1990s

CIAT will contribute to technology development that will lead to long-term improvement in productivity of agricultural resources; to the development of innovative, more cost-effective agricultural research approaches and methods; to the strengthening of agricultural research institutions in participating countries; and to the development of interinstitutional linkages. To that end, CIAT's activities center around the following three areas:

Germplasm development research

Beans: global responsibility for common beans, including a secondary emphasis on snap beans.

Cassava: global responsibility; in Africa, through and in coordination with IITA.

Rice: regional responsibility for Latin America and the Caribbean in coordination with IRRI.

Tropical forages: global responsibility in relation to acid, infertile soils found between sea level and 1800 m.a.s.l.; in Africa, through and in coordination with ILCA.

Furthermore, CIAT assumes a secondary responsibility for soybeans (in coordination with IITA) and sorghum (in coordination with ICRISAT), and is limited to the development of these crops as components in crop production systems for the acid, infertile soil environments, particularly in the savanna agroecosystem.

Resource management research in tropical America

Land use research, emphasizing land use strategies and policy alternatives. Agroecosystems-oriented research in:

Cleared forest margins.

Hillsides with moderately acid, low-fertility soils, with particular emphasis on the mid-altitudes.

Savannas with acid soils.

Institutional development

Support activities at national and regional levels.

Organizational structure

CIAT is structured along three divisions. The first is the **Resource Management Division** which consists of the following programs: Land Use, Agroecosystems (Hillsides, Forest Margins, and Savannas), Tropical Forages, and Institutional Development. Also attached to this division is the Information Management Systems Unit. The **Germplasm Development Division** consists of the Bean, Cassava, and Rice Programs, as well as the research support units for germplasm resources, biotechnology, and virology. The third division, **Finance and Administration**, is responsible for central financial and services administration and financial and administrative information systems.

Research sites

CIAT's headquarters is a 521-ha experiment station near Cali in Valle del Cauca, Colombia. There are four principal substations within the country where further work is carried out. Santander de Quilichao, a 184-ha station located 60 km south of Cali and characterized by acid, infertile soils; Popayán, a mid-altitude, 72-ha station located 150 km south of Cali (both Santander and Popayán stations are on land made available for CIAT's use by the Fundación para la Educación Superior (FES), a private Colombian educational foundation); Santa Rosa, a 31-ha Station made available by the Federación Nacional de Arroceros de Colombia (FEDEARROZ), a national rice growers' federation, and located near Villavicencio in the piedmont of the eastern Andes; and, finally, the 22,000 ha research site at Carimagua, located in the heart of the Colombian Llanos and co-managed by CIAT with the Colombian national program, ICA. Cooperative arrangements are maintained with various national and regional institutions to help carry out regional and international testing activities. In some cases, CIAT staff are outposted for research purposes and to support commodity networks.

ACHIEVEMENTS AND STRATEGIES

I. Germplasm Development Division

Bean Program

Recent achievements

The improved bean variety EMGOPA Ouro was developed by CIAT and released by Goiânia State in 1984-1985 in collaboration with CNPAF-EMBRAPA. Brazilian economists estimate that it is now grown on more than 100,000 ha in Brazil.

In 1990, Mexican scientists selected, for the first time, a bean line from CIAT (MAM 13) that meets their stringent standards for semiarid highlands. Released as Azufrado Tapato, this is the first bayo grain type resistant to rust, common blight, anular leaf spot, and anthracnose.

After two years of outstanding success in regional trials in Central America, the red-colored, CIAT-bred line DOR 364 is being released in El Salvador, Guatemala, and Honduras. This high-yielding line has vastly improved tolerance of the bean golden mosaic virus. Although black beans have always been the highest yielding in Central America, DOR 364 has outyielded the best and is gaining rapid acceptance among farmers.

After extensive on-farm testing, the Colombian national program (ICA) released a bush bean, ICA Citara, for the Antioquian highlands. A cross from two ICA parents, it is the first bush bean line released as a result of CIAT's collaboration with ICA at La Selva experiment station. For the Colombian coffee-growing areas, ICA released the bush bean variety ICA Cafeteros. This cross is a product by the ICA-FEDECAFE-CIAT triad, involving research and promotion, including seed production and distribution.

In southern Africa, partial resistance to the bean fly pest was found in three lines: one was a CIAT introduction and the other two were local landraces.

CIAT is assisting national programs in the assessment and utilization of indigenous bean germplasm. Uganda, which lost its entire germplasm collection, has restored a large part of it with materials received from CIAT. CIAT is also supporting Ethiopia, Kenya, and Uganda in the collection, rejuvenation, and evaluation of local germplasm.

Farmer participation techniques are being vigorously promoted by CIAT in Africa. In northern Tanzania, they are now a part of the regular bean varietal assessment procedure. A course on participatory methods was organized by CIAT in Ethiopia, and CIAT has developed novel methods of involving women farmers in the evaluation of experimental lines on station.

From CIAT's international trials, Turkish scientists selected three CIAT bean lines which were later released by Turkey's Grain Legume Program. Over a ton of seed has already been sold to farmers.

Some bean accessions recently collected in Peru by IBPGR-INIAA- CIAT were evaluated under low-phosphorus conditions and were found to yield twice as much as the benchmark standard for low-phosphorus adaptation, Carioca beans. These extraordinary results offer some real hope of

achieving significant adaptation to low phosphorus conditions, a relatively intractable problem until now. Techniques for managing the whitefly pest have been developed for use by small farmers in the Sumapaz area of Colombia. The techniques, such as employing pesticides only when the pest becomes economically damaging and using sticky traps, have been shown to reduce the need for pesticides without lowering yields, thus reducing farmers' costs and damage to the environment.

Objectives

1. Develop advanced biological methods to better utilize bean genetic resources.

    a. Characterize patterns of genetic variability in beans through the use of molecular markers, field evaluations, and inheritance studies.

    b. Develop a saturated bean genome map in collaboration with advanced research laboratories and CIAT's BRU.

2. Increase yield potential.

    a. Identify yield-maximizing optima for physiological traits, including nitrogen uptake and partitioning, canopy morphology, and photoperiod and temperature adaptation.

    b. Exploit genetic variation across gene pools and, at the same time, break undesirable linkages. By the middle of the decade, molecular biology techniques may be utilized.

    c. Extend maturity of bush beans to increase biomass, and then improve harvest index and plant architecture.

    d. Modify growth habits of preferred large-seeded grain types and at the same time extend the range of adaptation of climbing beans.

3. Improve adaptation to edaphic stresses.

    a. Improve biological nitrogen symbiosis in beans.

    b. Improve adaptation to water stress, phosphorus deficiency, and aluminum toxicity.

4. Reduce losses from diseases and pests.

    a. Broaden the genetic base of resistance.

    b. Improve understanding of pathogenic and pest variability, including their coevolution with beans.

    c. Contribute to the development of integrated control strategies.

5. Strengthen national capacity to improve bean productivity.

    a. Facilitate stronger links between national research, extension, universities, nongovernmental organizations, and the seed sector.

b. Foster more autonomous operation of regional networks.

c. Specialized training for mid-career bean scientists.

A major effort is also being undertaken to improve bean productivity in Africa. Strategic research on major regional constraints carried out at CIAT will be supplemented with that in Africa. Complementary resources will be utilized for developing local research and technology transfer capabilities.

Emphases in 1992

Focus is being increasingly place don strategic research as national programs become more active in adaptive research. This permits CIAT to reduce "downstream" activities and concentrate on methodology development and strategic research.

Several studies will be conducted on the genetics of yield potential. Crosses between gene pools will be compared with those within gene pools to assess which are more promising for increasing yield potential. Similarly, early generation selection methods will be compared with late generation selection methods, to determine which are the more efficient.

Photoperiod insensitivity will be introduced into materials of the Andean gene pool in order to appraise whether this increases yield potential and adaptation to tropical conditions.

A core collection, representative of the genetic diversity in cultivated beans, will be evaluated systematically to ascertain patterns of variation in gene pools for such characteristics as disease and pest resistance, adaptation and yield, and tolerance of edaphic stresses. This will permit a more efficient search for desired characteristics within the entire germplasm collection.

Methods will be developed for mass rearing the different species of bean fly, the major insect pest of beans in Africa. The current lack of a mass-rearing technique means relying on natural infestation, which is unpredictable and slows down progress by breeding against this pest.

An African Network for Screening for Edaphic Stresses (ANSES) will commence operations. This network will screen germplasm at different sites to identify materials adapted to African conditions, i.e., that are tolerant of low phosphorus, high manganese, or low pH. The most adaptive materials identified through the network will be used in breeding by national programs.

A strategic study will be undertaken on the genetics controlling snap bean pod quality and their interaction with the environment. Pod quality is a major factor determining the acceptability of snap bean on vegetable markets.

The comparative advantages of bean production in different regions will be carried out with the Mexican national program. Understanding the economics of bean production in different regions will help both set research priorities and elucidate reasons underlying the tendency for bean production to concentrate in environmentally fragile regions.

A fully trained cadre of Central American scientists will be prepared as trainers for the region. This will enable the region to become self-sufficient in production training, and CIAT's effort in training will concentrate

solely on more advanced training in scientific methods.

A Pan-Africa consultative meeting will permit improved communications and coordination of activities among the three existing African regional networks in eastern Africa, southern Africa, and the Great Lakes Region. This will contribute to more efficient operations on a continental scale.

The Bean Program's activities in cropping systems research in the Latin American Andean region and at headquarters will be eliminated as national programs assume these responsibilities. Similarly, CIAT's role in the coordination of the Andean and Central American networks will be further reduced as these networks become increasingly autonomous operations of the national programs.

Cassava Program

Recent achievements

The current value of cassava production in Latin America is US$1.46 billion, whereas, in Asia, it is 1.76 billion. The net present value of research benefits from improved technology has been estimated at US$738 million for Latin America and 1.98 billion for Asia, whereas poor consumers in both areas are receiving an estimated benefit of US$740 million. Cassava development can generate 60,000 jobs in Latin America and 111,000 in Asia.

CIAT has continued collaborating with IITA in order to broaden the cassava germplasm base for Africa. The first lot (90,000) of sexual seeds obtained by controlled hybridization and open pollination was introduced to IITA. Forty thousand of these seeds were sown in three different ecologies in Nigeria, representing humid, subhumid, and semiarid areas of Africa.

The Cassava Program, in collaboration with Colombian research and development institutions, has developed a farmers' participation methodology for variety selection, which has already been used for the release of two hybrids, ICA Catumare and ICA Cebucan in 1990, with two further hybrids planned for release in 1991. The new approach is giving a clearer definition of farmers' criteria for adoption and is strengthening participating institutions.

In the várzea region of Brazil, more than 80,000 ha of cassava are affected by root rot problems. This year, after eight years of collaborative research with CIAT, the Centro de Pesquisa Agroforestal da Amazônia (CPAA) released two clones (Mae Joana and Zolhudinha) resistant to root rots.

A technological package of improved cultural practices for the Pivijay area of Colombia, on the North Coast where *Diplodia manihotis* is endemic, is producing yield increases of 200% to 300% on farms. A very high host plant resistance to one of the most important root-rot causal agents has been identified.

An IPM approach to control the cassava mealybug remains a high priority for CIAT. Two more major natural enemies of the pest have been identified, as well as three tolerant cultivars.

Cassava whiteflies not only feed on the crop but also transmit viruses that cause extensive yield losses. This year, four hybrids with good resistance to the pest were developed.

Electrophoretic analysis has provided evidence that the cassava green spider mite in northeastern Brazil is a strain or biotype distinct from that originating in northern

South America. This work is essential for developing successful biological control methods for Africa and NE Brazil.

New, fundamental, information has confirmed that cassava's tolerance of prolonged water stress gives it comparative advantage, against other food crops, in semiarid regions such as sub-Sahelian Africa and NE Brazil. Different varietal responses to water stress were found and yield reductions from stress were minimal, with some clones maintaining low HCN levels.

Germplasm accessions and new, advanced breeding lines were identified for their high tolerance of acid soils with low phosphorus. These lines distribute what little phosphorus is in the soil more efficiently, i.e., more for root and less for biomass production.

Work on erosion control in two Colombian and several Asian sites has indicated that sustainable, acceptable yields could be obtained in infertile soils that are high in organic matter, and which receive moderate levels of K, but no N or P. In sandy soils with low organic matter, fertilizer applications will help preserve yields and prevent soil depletion. In Asia, where soils a low in organic matter and nutrients, cassava showed a marked response to N applications but little or no response to either K or P.

In hilly lands, research has shown that erosion is minimized if cassava is grown on contour ridges, with grass barriers, or with mulch and forage legumes as ground cover. Scientists have found that agricultural practices should aim at rapid canopy closure by using, for example, fertilizers on poor soils and closer planting density.

Cassava is intercropped with maize on many small farms. Studies have shown that cassava responds positively to fertilizer application designed for and applied to the maize intercrop. Cassava, in fact, is more efficient than maize in its use of nutrients--particularly P and K--per unit of dry matter produced.

Intercropping cassava with maize has been shown to reduce risk and to sustain a minimal level of production for the small-scale farmer, and the intercrop does not affect the quality of cassava planting material.

In 1990, the first pilot plant for producing high quality cassava flour for human consumption began operation in Córdoba, Colombia. This plant is operated and managed by a small-scale farmer's cooperative. The market potential for cassava flour in meat-processing and biscuit industries has been estimated at 30,000 tons per year.

Improvements to the traditional starch extraction and fermentation industries in Colombia have been designed to enhance the functional properties of sour starch, such as "expansion power" for baking. Similar work is being done with small-scale, unfermented-starch plants in Ecuador and Paraguay by national programs with CIAT's assistance.

It has been found that chemical treatment to prevent microbial deterioration of fresh cassava roots can be delayed for as long as 24 hours after harvest, provided the roots are placed in plastic sacks immediately after harvest. This makes it possible to centralize treatment and repack of cassava roots, and has improved product quality in the Barranquilla project (Colombia).

To determine root quality, an improved method for starch and cyanide analysis was instituted in 1990. It has also been found that adequate levels of K in the soil are

essential to good eating quality, whereas excessive P may have an adverse effect.

During the second year of the Ceará project (Brazil) for drying cassava, 20 new farmers' cooperatives have been organized. By the end of 1990, 35 cassava-processing facilities were in operation, with a total output of 1200 tons of dry chips. CIAT is supporting institutional buildup, such as consolidating local cassava committees and backing state research and extension agencies.

After a difficult year in 1989, the cassava development project in Manabí, Ecuador, had a record year in terms of cassava flour and starch production. The 18 cassava associations produced 1800 tons of cassava flour (88%) and starch (12%), mainly for the shrimp feed and cardboard industries, respectively. A clone with high-dry matter contents, introduced from Colombia, has adapted well to the area's conditions; considerable benefits are expected from its widespread adoption.

Objectives

1. Genetically improve productivity and yield stability of cassava.

2. Develop crop management practices for sustainable cassava production in selected agroecosystems.

3. Improve the quality of cassava for diverse end uses.

4. Strengthen the research and technology transfer capabilities of national research and development systems.

Strategies

1. Headquarters strategic research.

   a. Germplasm management.

   b. Building the knowledge base.

   c. Development of component technologies.

2. Strengthening national programs through regional activities.

   a. Information exchange.

   b. Joint generation of knowledge and technology with national programs.

   c. Assistance to national programs and training of personnel.

   d. Consolidation of networks.

3. Supporting African national programs through collaboration with IITA.

   a. Introduction of cassava germplasm from the Americas.

   b. Classic biological control of mealybug and green spider mite.

   c. Development of a varietal screening methodology for tolerance of water stress.

   d. Participation in collaborative socioeconomic studies of cassava in Africa.

Emphases in 1992

During 1992, the Cassava Program will continue to emphasize management of the world's germplasm collection, the genetic improvement of numerous traits of interest to national programs, and breeding methodology development. New activities will include the definition of a core collection for more efficient evaluations of genetic diversity. The Program will also expand the collection of wild species and will initiate studies on propagation techniques, agronomic characterization, and crossability among species.

The Program will study mechanisms underlying cassava's tolerance of water stress and low phosphorus and potassium soils. Basic research on cassava photosynthesis will utilize carbon isotopes to study genotype reactions. The Program will emphasize soil-fertility management systems and related cultural practices for improving productivity on poor soils (which are characteristic of major cassava-producing areas), and varietal response to fertilizers. Germplasm will be identified for drought-prone regions, such as sub-Sahelian Africa and Northeast Brazil, and subtropical America and Asia. The Program will intensify research on soil erosion in cassava-based systems and will emphasize studies on prominent cropping systems to maintain agroecosystem biodiversity, especially in subhumid, semiarid, and subtropical ecosystems.

Cytological studies will be used to characterize viruses and virus-like diseases of cassava, the results of which will facilitate germplasm exchange. The Program will conduct field and vector transmission research with whiteflies and other arthropods. Greater emphasis will be given to cassava American latent virus (CALV) and cassava vein mosaic virus (CVMV) and field trials to determine yield losses from cassava Colombian symptomless virus (CCSpV) will be carried out. Molecular characterization of potex viruses will be initiated, with the eventual arm of genetically engineering cassava for virus resistance.

The Program will promote cooperation with local research institutions for the study of preharvest root-rot problems in northern and northeastern Brazil and northern Colombia to define management systems for control. It will emphasize resistance studies on fungal, stem and root rot pathogens and mycoplasma-induced "witches'-broom," together with mechanisms of transmission and dissemination of the latter. The effects of endophytes on cassava production will be investigated.

Research on the biological control of mites, mealybugs, and hornworms will emphasize the collection, identification, and interaction of major natural enemies. The Cassava Program will study biochemical interactions between pests and cassava, emphasizing the role of calcium and other plant elements and especially hydrogen cyanide (HCN) content in leaves and roots. It will also initiate bioecological studies of pest behavior in cassava and intercrops, give new emphasis to pests in dried cassava and in cassava trué seed production, begin studies on pest population dynamics in wild species of *Manihot*, and schedule research on the biodiversity and origin of cassava pests.

The Cassava Program has initiated impact studies in Colombia, Brazil, Ecuador, Thailand, and Indonesia, in collaboration with the respective national programs. A diagnostic and constraints identification project in Vietnam will be completed in 1992.

In the area of utilization, processing, and marketing, emphasis will continue to be on the improvement of small-scale cassava flour and starch production, working in close collaboration with national institutions and supported by the National Resources Institute, London, and the Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical (CEEMAT), France.

Cassava-quality research will focus on improving analytical and rapid field HCN determination methods for varietal screening and optimizing HCN elimination during processing. Studies will concentrate on the effects of the preharvest environment, especially water stress, on root HCN content. The properties of cassava starch will be characterized and the genetic and environmental variability of these properties analyzed. Work will continue with identifying varietal and environmental factors and management practices that influence the quality of cassava fresh roots for the human diet.

Rice Program

Recent achievements

The Program continues in its effort to address the issue of limited genetic diversity within the irrigated high-yielding germplasm in Latin America. Analyses of currently grown irrigated varieties indicate that only three Asian landraces comprise over 35% of the genetic base of modern Latin American varieties, and only 14 landraces can be considered as comprising the base population of Latin American rice. In response, the Program has initiated a series of population improvement projects to create new base populations from which future varieties may be derived.

Analysis of rice blast pathogenic diversity at the Santa Rosa "hot spot" breeding station indicates that there are over 60 international races of blast present and that this reflects only a fraction of the diversity actually present. However, in collaboration with Purdue University, the pathogen population structure is being analyzed by using repetitive DNA sequences as "fingerprints." This analysis suggests that the extreme pathogenic diversity may be coherently grouped within lineages, and that these lineages will provide insights into how and in what direction pathogenic diversification proceeds.

The first rice varieties suited for the highly acid, low-fertility soils of the savanna frontiers are to be released by Colombia's national program (ICA) in 1991. These varieties, with maturity periods of 105-120 days, are yielding more than 4.5 t/ha on large plots, following soybeans, and about 3.0 t/ha, following native savanna. In more fertile soils, such as the North Coast, ICA has recorded very high yields (more than 5 t/ha) under traditional management on fertile soils.

The upland, dwarf, rice lines provide several choices for developing Latin American savannas, thus curtailing migration to more fragile ecosystems such as the humid forests. Economic analyses show that sowing them in the savannas is highly profitable: production costs are equivalent to about 1.6 tons of rice per ha, and yields start at 3.5 t/ha. Farmers participating in on-farm trials have received the lines with enthusiasm, which suggests there would be rapid adoption of these materials.

These rice lines can be sown in association with CIAT-developed improved pastures; the former provides the farmer income in the

short term to pay for establishment costs, and the pastures provide long-term benefits. Pastures also prevent the degradation of land that would ensue from continuous rice monoculture. Thus, ICA and FEDEARROZ are joining forces in a long-term strategy for the development of sustainable, agropastoral systems for the country's savannas. The rice lines have also been successful in reclaiming degraded pastures.

Cultural practices for the rice-pastures system are being developed. For example, it has been established that population of the ant *Acromyrmex landolti* that are as low as 100 nests/ha could cause significant damage to the system. Trials showed that early plowing reduced the number of ant nests by 90%. Other, soil fertility, studies are giving clues on the optimal fertilization management of this system.

A rice producer census was carried out in Colombia, and other censuses are under way in Ecuador, Venezuela, and Brazil. The censuses have provided important information for designing rice producer surveys and monitoring the effects of research, training, and extension activities. An advanced, CIAT-perfected, econometric model is measuring rice production inefficiencies, which will help the Program focus on those factors and practices that need improving.

Upland rice lines typically have deep, thick roots which apparently colonize the soil more thoroughly than those of irrigated lines. The Rice Program has used anther culture to produce crosses that could combine this rooting system with the improved, high-yielding plant type of modern irrigated lines. Some of the crosses have combined the desirable characters of both systems (the abundant, highly branched, fibrous roots typical of irrigated lines and the thick, deep, upland roots) into the modern plant type and have produced yields of over 7 t/ha under irrigation at headquarters. The potential impact of this combination is enormous, considering the millions of hectares of lowland rice throughout the world that run the risk of yield losses from erratic water supplies and reduced water availability.

A new genetic tool, restriction fragment length polymorphism (RFLP), is being adapted to CIAT's conditions in order to tag genes for desirable traits in rice breeding. Work is under way to identify linkages with genes conferring resistance to the rice "hoja blanca" virus (RHBV) and the blast fungus, and with genes controlling grain quality. Linkage between the RHBV resistance gene and a marker on chromosome 3 has been confirmed. Other RHBV resistance genes from other sources are currently being tagged. Breeders believe this will accelerate the development of a new generation of varieties resistant to RHBV. Application of this technique to some of the more intractable breeding problems, such as rice blast disease and improving root systems, should allow for rapid progress in gene pyramiding and new plant type design.

The Rice Program continues to tighten its links with its sister centers within the CGIAR system. A new Memorandum of Understanding has been signed with IRRI, in which a much stronger research linkage is envisaged. CIAT, IRRI and WARDA have continued to meet to develop common research and collaboration strategies where appropriate.

Objectives

1. Broaden the available genetic resource base for irrigated rice to increase yield potential and production stability.

a. Incorporate new characters mediating adaptation to Latin American conditions into irrigated rice germplasm.

b. Combine the upland-rice root system of the savanna dwarfs with the high- yielding, modern, irrigated plant type.

2. Achieve and sustain a fuller expression of yield potential in irrigated and upland systems while reducing the use of external inputs.

   a. Reduce losses from pests and provide a favorable environment for growth.

   b. Identify and transfer resistance factors.

   c. Shift from plant orientation toward environment orientation that considers biotic, abiotic, and socioeconomic factors.

   d. Develop the basis for formulating integrated pest and control management strategies.

3. Develop high-yielding, upland, rice germplasm adapted to the savannas.

   a. Broaden germplasm base by incorporating exotic materials and improving them through continued selection and breeding.

   b. Understand the material's adaptation mechanisms and interaction with the biota.

   c. Understand the biology of key pests specific to upland systems.

   d. Explore alternative uses of rice grain.

4. Strengthen national research capacity to improve and stabilize rice production.

   a. Concentrate on in-service training of national program scientists, focusing on their specific needs.

   b. Increasingly prominent role of graduate students and postdoctoral fellows from national programs in strengthening national research capacity.

5. Promote effective information exchange among and within national programs by building on the current networks of rice breeders.

In consultation with IRRI and WARDA, CIAT will move to selected research areas that have global implications. It will continue to support the existence of both the International Network for Genetic Enhancement of Rice (INGER) and the externally supported Caribbean Rice Improvement Network (CRIN), which have been efficient means of communication and germplasm exchange.

Emphases in 1992

In 1992, the Program will continue its efforts to broaden the diversity of irrigated breeding populations, with emphasis on new population development and improvement.

A major thrust will be the incorporation of desirable traits from the improved upland savanna dwarf lines into the irrigated breeding pools. This will involve initiating studies on root morphology and physiology. This area will entail very close collaboration with IRRI.

To effectively direct breeding for resistance to blast, a major effort will be to tag resistance genes, focusing on recessive genes, and those still useful under Latin American conditions. Complementary to this will be further studies on the dynamics of pathogen diversity "hot spot" sites. Particular attention will be given to quantifying what occurs within a lineage during a blast resistance breakdown. There will be strong collaboration between the Rice Program and CIAT's Biotechnology Unit in the areas of RFLP and DNA fingerprinting applications.

Research toward developing component technologies for integrated crop and pest management (ICM and IPM) for both irrigated and upland systems will be supported by strategic research on the principal pest, weeds, and diseases. These will include the rice water weevil, various ant species, rice blast, grain discoloration organisms, the hoja blanca virus, the need *Echinochloa* species, and red rice. The socioeconomic issues related to IPM adoption and execution will receive greater emphasis. Considerable support will be given to national program scientists in their effort to conduct research in this area. This support will be in the area of collaborative research projects in-country and intensive training opportunities.

A major effort will continue in the area of savanna rice genetic improvement, with further diversification of the germplasm achieved through introductions from Asia and Africa. A concerted effort will be made to make available a large number of lines to African and Asian areas where upland rice on acid soils is important or may have potential. Collaboration will continue to grow between the upland rice programs of Brazil, Bolivia, and Venezuela, particularly in the area of germplasm exchange. The Program, especially the Socioeconomics Section, will play a pivotal role in proving strong support to the newly emerging Savanna Program within the Resource Management Division.

The Program will place greater emphasis on the potential of alternative uses of rice for the region. The implications of this, in terms of market trends and consumer impact, will be analyzed ex ante, parallel with implications for current breeding and selection strategies.

Tropical Forages Program

(Note: Although organizationally assigned to the Resource Management Division, the Program is presented here as part of the Germplasm Development Division activities.)

Recent Achievements

The new pasture technology based on grasses and legumes adapted to the poor, acid soils of the tropical American lowlands is on the verge of making impact. Acid-soil tolerant grasses (e.g., *Andropogon gayanus* CIAT 621, *Brachiaria brizantha* CIAT 6780 and 26646, and *B. dictyoneura* CIAT 6133) and legumes (e.g., *Centrosema acutifolium* CIAT 5277, *Stylosanthes capitata* CIAT 10280, and *S. guianensis* CIAT 184) are now commercially available. In addition, several other selections of grasses (*Brachiaria* spp.

and *Panicum maximum*) and legumes (*Arachis pintoi* and *C. macrocarpum*) are well advanced. This new generation of pasture plants has been chosen specifically to solve the main constraint--low quality and quantity of available forage--to expanding the cattle (beef and milk) industry on marginal acid soils.

Recent results of the rice-pasture work clearly document the positive contribution that pastures developed for acid soils make to soil fertility in terms of physical, chemical, and biological enhancement. For example, the grasses' deep rooting habit and high density cover, plus the legumes' nitrogen fixation and nutrient cycling were responsible for the higher rice production obtained in a rice crop that followed a 10-year-old grass/legume pasture without N fertilizer. A crop grown after a native savanna with the same level of P, K, Mg, and Ca fertilizers, together with 80 kg/ha of N, was not so productive.

Pastures have also become a key element in reclamation programs of eroded areas undertaken by CIAT in collaboration with local agencies in the Colombian southwest. Hillsides with the topsoil almost completely run off are being reclaimed by sowing *Brachiaria* cocktails. These cocktails combine *B. decumbens* (which established rapidly), *B. dictyoneura* or *B. humidicola* (slower, but denser and less fertility-demanding), and several legumes (with nitrogen fixation and nutrient cycling abilities). Some of the legumes, such as *A. pintoi* and *Desmodium ovalifolium*, are also being adopted as cover crops under coffee, rubber, and other trees.

Because a source of sexuality compatible with the normally apomictic *B. decumbens* was found, it became possible to modify productivity and quality attributes of this most widely planted of tropical forage plants and incorporate genetic improvements in other, true breeding, apomictic cultivars. A full-fledged *Brachiaria* breeding program is now operational at CIAT and involves a multidisciplinary, international team of plant breeders, cytologists, entomologists, animal nutritionists, and biotechnologists.

High levels of resistance to the spittlebug pest have been identified in CIAT's *Brachiaria* germplasm collection. Two accessions of *B. jubata* have been found to be highly antibiotic: molting is affected malformed insects produced. In order to find out what factors cause the antibiosis, a unique bioassay was developed, which plant fractions and other chemicals were tested for their activity when ingested by spittlebug nymphs. A molting disruption in the insects, similar to that produced in nymphs reared on *B. jubata* CIAT 16531 and 16203, was produced by high concentrations of the hormone ecdysone. Collaborative work with Cornell University involves chemically fractionating resistant and susceptible *Brachiaria* accessions in order to test the fractions for activity against nymphs.

The Tropical Pastures Program will receive its new name, Tropical Forages Program, in 1992 when it adds to its acid-soil, grass-legume mandate the screening and selection of multipurpose shrubs and trees, as well as pastures for altitudes as high as 1800 m.a.s.l. at the equator.

Strategies

1. Develop productive herbaceous and woody forage germplasm.

    a. Germplasm acquisition and evaluation.

b. Expansion of the collection of key herbaceous species for lowland, acid soils.

c. Acquisition of herbaceous forage germplasm for mid-altitude, acid soils.

d. Acquisition of germplasm of multipurpose, forage trees and shrubs.

e. Genetic improvement of key herbaceous forage species.

f. Phenology and biology of seed production.

2. Understanding mechanisms for ecological compatibility of pasture components.

   a. Nitrogen fixation and cycling.

   b. Soil/plant interactions.

   c. Influence of grazing management on plant/plant relations.

   d. Animal intake, selectivity, utilization, and production.

   e. Integrated crop/pasture systems.

3. Strengthen national and regional capabilities to develop forage germplasm.

   a. Stimulate RIEPT's (International Network for Evaluation of Tropical Pastures) independence.

   b. Pasture germplasm screening in West Africa.

   c. Cooperation with advanced institutions.

Emphases in 1992

During 1992, the Tropical Forages Program will continue to emphasize the development of improved germplasm for tropical pastures through the exploitation of natural, genetic variability. In the light of the expanded geographical and ecological mandate assigned to the Program in the new Strategic Plan, efforts will be made to screen germplasm for mid-altitude hillsides, subject to the identification and development of an appropriate experimental site, and to the promotion of multilocational trials throughout RIEPT.

The ongoing evaluation of multipurpose forage trees and shrubs will gradually receive more emphasis, especially in the humid tropics and hillsides, and, together with the GRU, the Program will aim at expanding its germplasm collection through exchange with other institutions.

In the area of genetic improvement, the first sets of interspecific crosses of *Brachiaria* will be evaluated for adaptation, resistance to spittlebug, and nutritional quality. Similarly, crosses of *S. guianensis*, aimed at higher seed yields and anthracnose tolerance, will continue to be screened in the Brazilian Cerrados and elsewhere.

In order to begin fulfilling its expanded geographical mandate, the Program will outpost a senior pasture agronomist to West Africa to develop, in collaboration with

ILCA and national programs to be identified, a major screening site in the region. Simultaneously, the recently established network of multilocational trials implemented in collaboration with IEMVT/CIRAD, and formally belonging to ILCA's promoted AFRNET, will be expanded.

Strategic research in progress on soil-plant-animal relationships will continue to be emphasized. This research is now further supported by the recent initiation in 1991 of an important set of experiments aimed at a mechanistic understanding of soil nutrient cycling in grazed pastures and crop-pastures rotations. As of 1992, these experiments, together with those jointly implemented by the Rice and former Tropical Pastures Program, will gradually involve the newly created Savanna Program. Continued progress is also expected in understanding the physiological, morphological, and biochemical mechanisms responsible for plant adaptation to acid, nutrient-poor, tropical soils, with the aim of developing reliable and replicable screening methods. Similarly, progress in identifying and quantifying antinutritional factors is expected, with emphasis on the development of simple and rapid evaluation methods.

The devolution to national programs of on-farm research and development activities--undertaken at the Colombian Llanos and elsewhere in the past--will continue; similarly, seed supply activities will also be gradually and selectively decreased to accommodate an expansion of research on strategic issues of seed multiplication in key herbaceous and grass species.

The nature of training activities within the RIEPT framework will begin to change, evolving from generalized pasture training to more specific issues and audiences.

Land Use Program

Strategies

1. Understand the dynamics of land use in tropical America.
   a. Identify trends in land use patterns.
   b. Analyze causal relations between agricultural technology, socioeconomic trends, policy, and land use.
   c. Measure social costs of land use practices.
2. Appraise policy alternatives for improved land use.
   a. Conduct comparative and historical studies of policy impact on land use.
   b. Support national and regional entities to design alternative land use outcomes.
3. Link improvements in production systems with sustainable use of resources.
   a. Orient design of new agricultural technology to optimize land use practices.
   b. Monitor effects of new technologies on the resource base.
4. Strengthen national capacity for improvement of land resources.
   a. Develop human and institutional resources through collaborative research and information exchange.
   b. Facilitate articulation between agricultural research, resource management, and policy institutions.

Emphases in 1992

During 1992, the Program will concentrate on two aspects:

1. institutional reconnaissance to identify research partners interested in developing networks that study land use patterns and their relationships with policy and socioeconomic trends; and
2. identifying trends in land use patterns for selected agroecosystems, to build upon existing geographical information systems (GIS), and to assist the Agroecosystem Programs in both selecting experimental sites and prioritizing problems across agroecosystems.

Agroecosystem Programs

Activities

The three Agroecosystem Programs, namely, Forest Margins, Hillsides, and Savannas, will

carry out their activities in four main interactive stages:

1. Inventory and analysis of ongoing activities for observational studies;

   a. Preliminary characterization of existing farming systems in terms of productivity, equity, and conservation.

   b. Inventory of land management research previously made in the areas of environment, socioeconomics, system components and structure, and technology.

   c. Agroecozone characterization, including establishment of descriptors, e.g., land use systems (i.e., land units versus management units); contact with land use institutions in each agroecozone; and assemblage and coordination of teams for characterizing resource management components and practices.

2. Selection of research sites for detailed experimentation, according to selection criteria of size of area; perceived urgency of problems and opportunities identified; extent to which possible solutions are researchable and extrapolative to other regions and countries; available knowledge on the region; "in-house" expertise; presence of potential institutional partners and their degree of participation and complementarity; and logistics, including accessibility and security.

3. Diagnosis of land use systems and design of management alternatives

   a. Identification of land use problems at the farm and site.

   b. Appraisal of technology's potential for removing constraints.

   c. Emphasis on exploiting biological processes that reduce economic risks and protect the resource base, e.g., research on polycultures or multispecies combinations for sustainability.

   d. Emphasis on ecological principles instead of location specificity by studing, for example, species diversity in space or time with lands cape stability, natural biological processes with crop yields, and economic production with ecological protection.

4. Generation of prototype technologies.

   a. Strategic research aimed at understanding soil/water/plant relationships.

   b. Strategic research aimed at understanding farmer behavioral patterns.

Emphases in 1992

Research by the Agroecosystem Programs during 1992 will be developed along two main courses of action. In the case of the Savannas, the Tropical Pastures and Rice

Programs have already initiated the technology generation phase, and a meeting with national partner institutions took place in 1990. It is expected that activities will concentrate on:

a. formalizing the interinstitutional consortium that will carry out the socioeconomic and biophysical research necessary to generate alternative technologies;

b. characterizing the two experimental sites (watersheds) where consortium activities will take place; and

c. continuing experimentation on crop-pasture systems, based on joint planning among partner institutions.

As for the Forest Margins and Hillsides Programs, it is proposed that activities in 1992 will be carried out together, on the hypothesis that land use issues in the two ecosystems are interrelated, and that there will be spillover effects in terms of social behavior and ecological relationships. Such joint activities will focus on:

a. institutional reconnaissance to identify potential partners and define their commitments, vis-à-vis the constitution of a technology-generation consortium;

b. identification and description of representative agroecozones and prevailing land use patterns, including preliminary understanding of their structure and function in relation to the assessment of resource management problems and opportunities; and

c. initiation of the process of site selection, where the consortium will develop its activities.

Institutional Development Support Program

Recent achievements

Publications. The Program's output has been increasing considerably. Production of camera-ready pages, which had grown by 84% over the previous year, increased by another 63% last year, bringing the total number to nearly 21,000 pages. Over 80,000 copies of serial publications were distributed, plus 8,000 books, 600 audiotutorial units, and 6500 study guides.

Twenty-one new titles were produced: 10 serial publications, two administrative materials, one leaflet, and eight books. One of these books covers a vast body of knowledge on the grass *Andropogon gayanus* and the other on the legume genus *Centrosema*, two subjects which were practically unknown a decade ago. The other books dealt with *Centrosema* germplasm, wild *Phaseolus vulgaris* (beans), bean root-rot problems, use of cassava for animal feed, adoption of Gloriabamba bean variety in Peru, and sorghum for acid soils.

Documentation and information. Modernization of the Information Unit, which began last year, progressed rapidly. Six bibliographic databases on CD-ROM (with about 8 million references) were

incorporated to the system and three new in-house databases were developed: one on the library's 3300 serials, another to replace the card catalog, and the third on publications authored by CIAT's staff. User reference requests jumped from 99 in 1989 to 1599 in 1990, and database searches more than doubled, from 700 to 1500. Library service hours were extended by 15 more hours a week, which attracted an extra 2335 users.

CIAT trainees are receiving training in information access, and training manuals were customized for group training events in all four CIAT commodities.

New bibliographies have been produced: "Beans in Mexico", "Beans in Central America and the Caribbean", "Cassava in Asia: East and Southeast Asia", and "Cassava in Asia: South Asia". English and Spanish versions of a comprehensive bibliography on "cassava utilization in animal feed" were also produced.

Another new product consist of "Quick Bibliographies" on hot topics. The first in the series is "*Ophiomyia* spp. 1913-1990" (bean fly, a major pest in Africa).

The CGIAR information services in Latin America are being promoted as part of a joint CIAT/CIP/CIMMYT effort led by CIAT. Brochures in Spanish, English, and French describing the three centers' information services were produced at CIAT, distributed at international congresses and delivered to 4000 addresses on the center's mailing list. A poster on the same subject was also developed.

Training. Substantial progress was made toward offering more specialized research training at CIAT. An advanced course on bean breeding gathered most of Latin America's active specialists in the subject. The first formal course on integrated cassava projects was taught, and a rice research training program was completed. It became obvious that these new events meant considerable labor for researchers and training support staff, both in preparation and implementation. Thus, selection of candidates will be more stringent and the numbers of trainees reduced. This year, 247 professionals were trained at CIAT.

The newly developed methodology for the training-of-trainers is now operational, and the first successfully trained trainers are already working: a team of eight trainers in the Dominican Republic, another group of ten in Ecuador, and two--related to the Dominican team--in Haiti. They each developed, as part of their training and with support from CIAT's Rice Program and Training staff, a set of instructional materials. The next step in the training-the-trainers program, is to develop a regional team of trainers for PROFRIJOL (the regional bean project for Mexico, Central America, Panama, and the Caribbean).

Strategies

1. Strengthen national research institutions by means of advanced training of scientists and delivery of specialized information through library-based services and publications.

2. Enhance the efficiency of national research systems and facilitate their linkages with development activities through multi-institutional collaborative projects.

3. Contribute to the development of seed supply systems for small farmers by assisting in the formation of small-scale seed enterprises.

4. Contribute to the formation and strengthening of national and regional bodies for training professionals dedicated to commodity production and adaptive research.

The above strategies will be supported by the following activities:

a. Training of young professionals post-graduate students.

b. Training of trainers.

c. Conferences.

d. Communications.

e. Bibliographic information services.

f. Support through interinstitutional mechanisms.

g. Institutional information system.

h. Development of new seed-supply systems.

Emphases in 1992

During 1992, the Program will emphasize activities related to its four strategies.

To strengthen national research institutions, specialized training will be offered to committed mid-career scientists in established national research teams. Bibliographic information support will be given to national programs, while, simultaneously, the capacity of national libraries to deliver information will be improved through networking and training. Information production and use by new researchers will be fostered through training.

A Project Design Office will be established within the Program. The function of this office will be to assist in the elaboration and execution of projects that support research and development activities, many of which will be carried out in collaboration with other institutions at national, regional, and international levels.

FINANCIAL AND BUDGETING INFORMATION

I. 1990 Financial Year[2]

Core Program

The approved budget for CIAT's core program was $31,316,000. Because of a shortage of funds, however, the CGIAR asked CIAT to operate at the level of $28,916,000, or 8% below the CGIAR-approved budget request. This meant that certain reductions in planned activities had to be implemented, as shown in List 1.

Actual income from donors was $27,733,000. Self-generated income amounted to $835,000, bringing the total available funds for the 1990 core program to $28,568,000. The difference between expected and available resources (i.e., $348,000) was mainly the result of slightly slower-than-expected expenditures in the so-called "highly restricted core activities."

Tables 1 and 5 (p.40 and 44, respectively) provide details of the expenditures in 1990, both by programs and units and by categories of expenses. List 2 summarizes that information, including comparisons with the 1990 working budget as published in CIAT's *Funding Request for 1991*.

Underspending in Research Support was primarily the result of reduced operational costs of the Carimagua research station and maintaining expenditures on research contracts and visiting scientists and postdoctorals low. The underspending in Institutional Development Support was the result of fewer expenditures than expected in training activities because of the availability of increased outside funding through scholarships.

In 1989, CIAT experienced significant cash flow difficulties, caused by late payments by several large contributors; thus, the center has made every effort possible to build up its working capital. With the addition of $404,000 to the working capital fund in 1990, CIAT has now reached a working capital level equal to operating expenses for 30 days.

Figure 1 shows, in graphic form, the 1990 expenditures by area, as well as category of expenditures.

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[2] Tables 1 to 11, on pages 40 to 50, provide details for the financial years 1990 and 1991.

List 1. Reductions in the 1991 working budget for the core program; the approved budget was US$31,316,000.

Area			Reduction
1.	General downward adjustment		(1,152,000)
2.	Postponement of:		
	a.	Adjustment in working capital	(320,000)
	b.	Filling position for Agricultural Geographer in the Agroecological Studies Unit	(142,000)
	c.	Addition of Senior Staff positions originally approved for 1990:	
		i. Head, Training	(147,000)
		ii. Cassava Breeder, HQ-based	(254,000)
		iii. Cassava Quality Specialist	(254,000)
3.	Addition of other items originally approved for 1990:		
	a.	Increase in resources for research contracting	(42,000)
	b.	Construction of research services building	(189,000)
	c.	Increase in self-generated income	100,000
		Total	(2,400,000)
		Working budget 1991	28,916,000

List 2. 1990 core program: working budget versus actual outcome ('000 US$).

Areas of expenditure	Working budget	Actual outcome	Deviation (%)
Commodity research programs	13,211	13,059	(1)
Research Support	4,920	4,675	(5)
Institutional Development Support	3,000	2,748	(8)
Management and Administration	3,062	3,124	2
General operating expenses	2,613	2,688	3
Capital	1,810	1,870	3
Working capital	--	404	--
Contingencies	300	--	--
Total	28,916	28,568	(1)

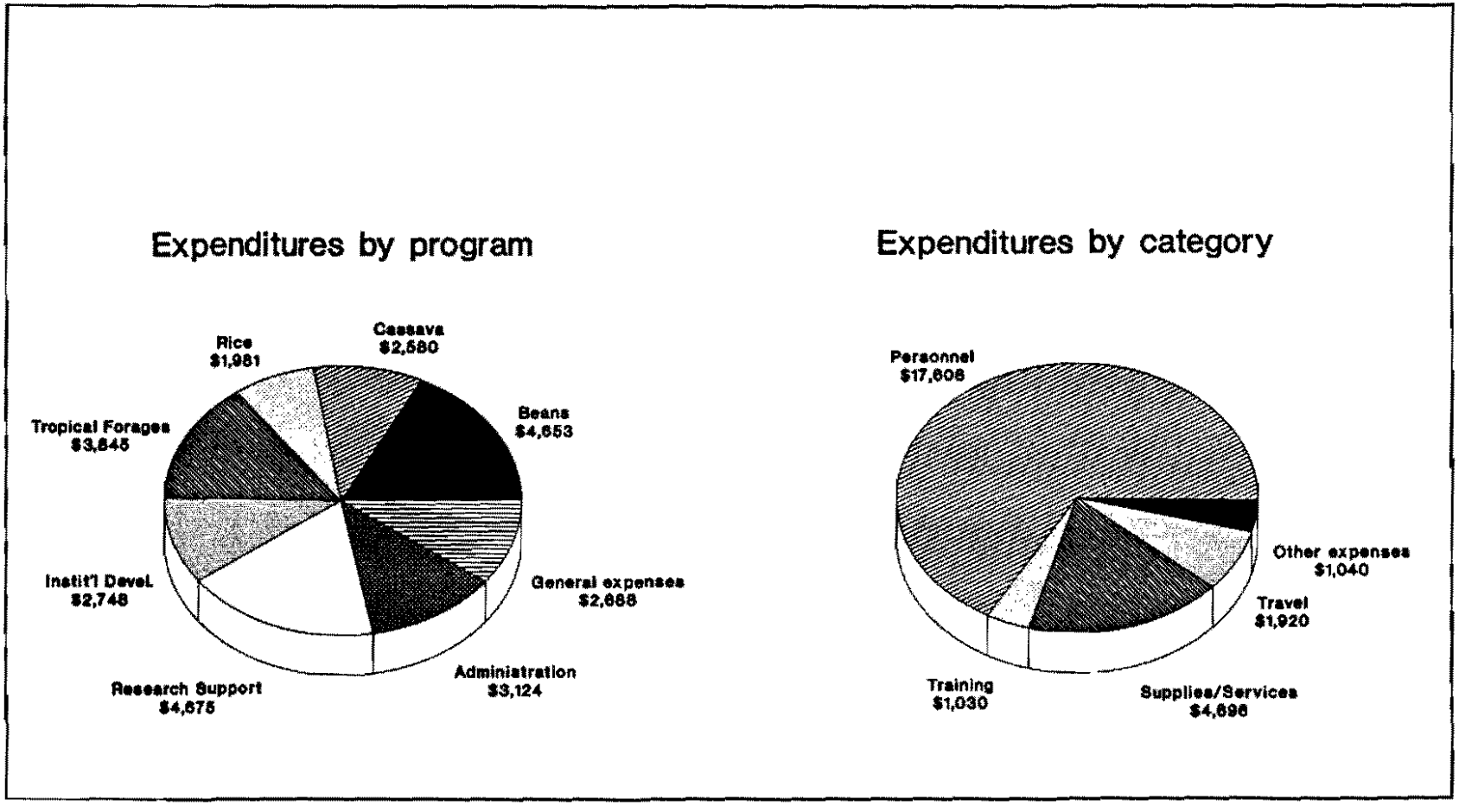

Figure 1. 1990 expenditures: amounts for core activities by program and category of expenses ('000 US$). (Total expenditures were US$26,294,000.)

Complementary Activities

In 1990, complementary activities executed by CIAT amounted to $4,641,000, involving nine Senior Staff (see Table 2, p. 41). List 3 identifies the various projects involved.

List 3. Complementary activities in 1990 ('000 US$).

Activity	Expenditures	Donor
1. *Bean Program*		
Africa: Great Lakes Region, E and S Africa	1,948	SDC, CIDA, USAID
Central America	245	SDC
Andean region	286	SDC
Research on *Phaseolus* germplasm	148	Italy
Research on *Phaseolus*	63	Belgium
Snap beans	37	Netherlands
Bean improvement	20	Iran
2. *Cassava Program*		
Development of production and processing technologies (NE Brazil)	266	W.K. Kellogg Foundation
Development of production and processing technologies (Ecuador)	77	FUNDAGRO (Ecuador)
Soil fertility and conservation	68	Germany
Development of cassava processing technologies (flour and flour products)	85	IDRC
Development of cassava processing and utilization	121	Colombia
Cassava development	34	Ford Foundation
Cassava flour utilization	22	France
3. *Rice Program*		
Caribbean Rice Improvement Network (CRIN)	205	CIDA[1]

[1] An additional amount of $306,000 is shown as core activity.

(Continued)

List 3. (Continued)

Activity	Expenditures	Donor
4. *Tropical Pastures Program*		
CIAT participation in the West African forage network	151	Japan
Research for improving native grasslands	108	Japan
Characterization and comparison of isolates of *C. gloeosporioides* causing anthracnose in *Stylosanthes*	56	Australia
Studies on socioeconomic aspects of improved pastures	25	FUNDAGRO (Ecuador)
Pastures production systems	19	GTZ
Evaluation of pasture associations in Brazil	45	IICA
5. *Research Support*		
Virology - whitefly	10	USAID
Biotech research for rice	100	Rockefeller Foundation
Research on seed production	49	Rockefeller Foundation
Farmer participatory research	183	W. K. Kellogg Foundation
6. *Training and conferences*	240	Various
7. *Capital*	30	Various
TOTAL	4,641	

FINANCIAL AND BUDGETING INFORMATION

II. 1991 Financial Year

Core Program

Against an approved budget of $32,672,000, a total amount of $28,816,000 was expected to be available. This funding shortfall, which in real terms was $1.4 million below the resources available in 1990, implied a number of reductions, as shown in List 4.

The resulting working budget for 1991 is shown in Table 1, p.40.

List 4. Reductions in 1991 working budget resulting from funding shortfall.

Budget requirements		
	1990 budget base	28,916,000
	+ inflation adjustment (4.09%)	1,183,000
	1991 cost of 1990 set of activities	30,099,000
Area		**Reduction**
a.	Reductions as projected in the mid-term plan for 1991:	
	i. Bean Agronomist (Central America)	(122,000)
	ii. Support for African cassava study	(75,000)
	iii. Regional rice project in Caribbean (CRIN)	(300,000)
	iv. Transfer of Seed Unit to Institutional Development Support Program	(438,000)
b.	Selective reductions in the operations budget	(786,000)
c.	Additions	
	i. Transfer of Seed Unit from Research Support to Institutional Development Support Program	438,000
	1991 Working budget	28,816,000

Complementary Activities

In 1991, CIAT expects to spend $6,424,000 in the form of complementary activities as shown in List 5.

List 5. 1991 complementary activities ('000 US$).

Activity	Budget	Donor
1. *Bean Program*		
Africa: Great Lakes Region, E. and S. Africa	1,800	SDC, CIDA, USAID
Central America	562	SDC
Andean region	150	SDC
Research on *Phaseolus* germplasm	217	Italy
2. *Cassava Program*		
Soil fertility and conservation	98	Germany
Development of production and processing technologies (NE Brazil)	276	W.K. Kellogg Foundation
Green spider mite	120	UNDP
Biotechnology network	190	Netherlands[1]
Genetic improvement in Brazil	187	IFAD
Development of production and processing technologies (Ecuador)	92	FUNDAGRO (Ecuador)
Development of cassava processing technologies (flour and flour products)	45	IDRC
Integrated projects in tropical America	147	Colombia, France
3. *Rice Program*		
Caribbean Rice Improvement Network (CRIN)	532	CIDA[2]
Joint study of upland-rice root physiology and architecture	26	France

[1] Not yet confirmed.
[2] An additional amount of $90,000 is shown as core activity.

(Continued)

List 5. (Continued)

Activity	Budget	Donor
4. *Tropical Pastures Program*		
CIAT participation in the West African forage network	16	Japan
Research for improving native grasslands	65	Japan
Characterization and comparison of isolates of *C. gloeosporioides* causing anthracnose in *Stylosanthes*	72	Australia
5. *Institutional Development Support Program*		
Training trainers	600	IDB[1]
6. *Research Support*		
Biotechnology research DNA fingerprinting	100	Rockefeller Foundation
Farmer participatory research	279	W.K. Kellogg Foundation
7. *Contingencies*	56	Not yet funded
8. *Capital*	300	CIDA, USAID, SDC, W.K.Kellogg, Japan
9. *Working capital*	494	Not yet funded
Total	6,424	

FUNDING REQUEST FOR 1992

Core Program

The budget request for the 1992 core program amounts to $32,650,000. Included in this budget request are monies for the setting up of the proposed new effort in resource management research. As shown in the operational plan, CIAT proposes to finance the initiative in resource management research through a combination of reallocating existing resources and using additional resources. A large part of the additional resources required to finance resource management research in the 1990s is proposed to be added in 1992 itself. It should be noted that the total amount requested by CIAT for its core program in 1992 is, in fact, slightly below the original, CGIAR-approved budget for 1992 (i.e., the CGIAR-approved budget under the earlier mid-term plan presented by CIAT in 1988 for the period 1989-1993).

List 6 shows the principal changes in the proposed 1992 budget vis-à-vis the 1991 working budget.

Self-generated income

Earned income in the 1992 financial year is projected to be at $740,000, including estimated income from farm production, overhead on special projects, and financial transactions (mostly interest).

Donor funding

Against the budget request for $32,650,000 and in light of a projected self-generated income of $740,000, CIAT's request for funding from the CGIAR amounts to $31,910,000.

List 6. Principal changes ('000 US$) in the proposed 1992 budget.

Area			Amount[1]
1991 Budget base			28,816
Germplasm Development Division			
1.	Bean Program		
	a.	Deletion of position for Cropping Systems Specialist	(150)
	b.	Deletion from the core program of three African-based positions	(645)
	c.	Deletion of regional coordination position in the Andean region	(254)
2.	Rice Program		
	a.	Phasing out of core the coordination position for the Caribbean regional program	(90)
	b.	Net of other adjustments	21
3.	Tropical Forages Program		
	a.	Addition of positions for:	
		i. Germplasm Specialist	230
		ii. Agronomist for germplasm screening (West Africa)	190
	b.	Deletion of positions for:	
		i. Agronomist for germplasm screening (Llanos)	(230)
		ii. Livestock Systems Specialist	(234)
		iii. Agricultural Economist	(177)
		iv. Specialist for integration of systems	(199)
		v. Nutrient Recycling Specialist (humid tropics)	(107)
		vi. Pasture Reclamation Specialist (Cerrados)	(183)

[1] Numbers in parentheses signify amounts reduced.

(Continued)

List 6. (Continued)

Area			Amount[1]
	c.	Net of other adjustments	(187)
4.	Strategic research initiatives in germplasm development		100
Resource Management Division			
1.	Land Use Program		
	a.	Positions for:	
		i. Program Leader	160
		ii. Agricultural Land Use Specialist	217
		iii. Environmental Geographer	225
		iv. Environmental Impact Assessment Specialist	225
		v. Information Management Specialist	100
		vi. Resource Economist	200
		vii. Economic Policy Analyst	200
2.	Forest Margins Program		
	a.	Positions (1/2 each) for:	
		i. Agricultural Economist	113
		ii. Cropping Systems Specialist	128
		iii. Livestock Systems Specialist	108
		iv. Anthropologist	113
3.	Hillsides Program		
	a.	Positions (1/2 each) for:	
		i. Agricultural Economist	113
		ii. Cropping Systems Specialist	128
		iii. Livestock Systems Specialist	108
		iv. Anthropologist	113
	b.	Support for Sociologist	30

[1] Numbers in parentheses signify amounts reduced.

(Continued)

List 6. (Continued)

Area			Amount[1]
4.	Savannas		
	a.	Positions for:	
		i. Program Leader	160
		ii. Cropping Systems Specialist	255
		iii. Nutrient Cycling Specialist	255
		iv. Livestock Systems Specialist	255
		v. Crop/Pastures Systems Specialist	200
	b.	Positions (1/4 each) for:	
		i. Economist	120
		ii. Nitrogen Cycling Specialist	51
		iii. Ecophysiologist	57
5.	Research station support in Llanos		20
6.	Strategic research initiatives in resource management research		100
Institutional Development Support Program			
1.	Addition of Head of Training		135
2.	Transfer of Project Design Specialist from Management and Administration (paid from indirect cost recovery)		0
3.	Addition to conferences budget		60
Research Support			
1.	Closing of Agroecological Studies Unit (now incorporated in Land Use Program)		(237)
2.	Elimination of line item for research contracts (now incorporated into strategic research initiatives)		(169)

[1] Numbers in parentheses signify amounts reduced.

(Continued)

List 6. (Continued)

Area		Amount[1]
3.	Addition of position for Molecular Cytogeneticist in Biotechnology Research Unit	255
4.	Addition to Visiting Scientist/Postdoctoral Fellow budget	50
5.	Addition to Information Management Systems	161
6.	Net of other modifications	62
General Operating Expenses		
1.	Addition to electricity budget	50
2.	Transfer of Project Design Specialist from Management and Administration to Institutional Development Support Program (paid from indirect cost recovery)	(0)
Contingencies		(11)
Capital		100
	Subtotal	31,111
Cost increases (inflation)		1,348
Working capital adjustment		191
	TOTAL 1992 REQUEST	32,650

[1] Numbers in parentheses signify amounts reduced.

Complementary Activities

CIAT proposes complementary activities in 1992, the cost of which will amount to $10,199,000, involving a total of 21 Senior Staff positions. List 7 below summarizes the projected complementary activities and shows the funding status of the respective projects.

List 7. 1992 Proposed complementary activities ('000 US$).

Activity	Budget	Donor
Germplasm Development Division		
1. Bean Program		
Africa: Great Lakes Region, E and S Africa	2,645	SDC, CIDA, USAID
Andean region	254	SDC
Biotechnology network	300	Not yet funded
Research on *Phaseolus* germplasm	120	Italy
2. Cassava Program		
Soil fertility and conservation	98	Germany
Development of production and processing technology (NE Brazil)	276	W.K. Kellogg Foundation
Green spider mite	180	UNDP
Biotechnology network	323	Netherlands
Propagation from true seed	130	Not yet funded
Genetic improvement in Brazil	224	IFAD
Germplasm development in E and S Africa	255	Not yet funded
Socioeconomic research, utilization and marketing in Asia	340	Not yet funded
Integrated projects in tropical America	284	Colombia, France, IDRC
3. Rice Program		
Caribbean improvement network	622	CIDA, and others
Joint study on upland-rice root physiology and architecture	76	France

(Continued)

List 7. (Continued)

4. Tropical Forages Program		
Ecology (Savannas)	161	Not yet funded
Screening in SE Asia	162	Australia
" " "	41	Not yet funded
Research for improving native grasslands	65	Japan
Resource Management Division		
Tree specialist (Hillsides)	225	Not yet funded
Silviculture (Hillsides)	225	Not yet funded
Forest ecosystems (Forest Margins)	56	Not yet funded
Forest policy (Land Use)	225	Not yet funded
Institutional Development Support Program		
Training trainers	600	IDB
Research Support		
Microbial genetics	215	Not yet funded
Biotechnology research DNA fingerprinting	100	Rockefeller Foundation
Bean genetic improvement	298	Belgium
Farmer participatory research	279	W.K. Kellogg Foundation
Sorghum and soybean germplasm	80	Not yet funded
Forage germplasm biology	91	Not yet funded
Forage in vitro management	134	Not yet funded
Phaseolus bean germplasm	80	Not yet funded
Contingencies	92	Not yet funded
Capital	300	CIDA, USAID, SDC, Japan, W.K. Kellogg Foundation
Working capital adjustment	261	Not yet funded
Cost increases (inflation)	382	
Total	10,199	

FINANCIAL AND BUDGETING INFORMATION

TABLES

Table 1. Budget request by programs and units: amounts for core activities in 1989, 1990, 1991 and 1992 (SYs = Senior Staff years; thousands of current US dollars).

	Actual 1989		Actual 1990		1991 Budget				1992 Budget request		Changes over 1991 estimate	
					Approved		Estimate					
	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	$'000	%
1. Operational programs					***		***		***			
Germplasm development												
Beans	21	4,412	21	4,653	22	5,007	22	4,898	17	3,849	(1,049)	(21)
Cassava	11	2,381	11	2,580	14	3,416	11	2,504	11	2,504	–	–
Rice	8	1,897	8	1,981	8	1,857	8	1,657	7.75	1,568	(89)	(4)
Tropical forages	17	3,943	17	3,845	19	4,412	18	4,118	13.5	3,221	(897)	(22)
Strategic research initiatives	–	–	–	–	–	–	–	–	–	100	100	–
Total germplasm development	57	12,633	57	13,059	63	14,702	59	13,177	49.25	11,262	(1,915)	(15)
Resource management												
Land use	–	–	–	–	–	–	–	–	6	1,357	1,357	–
Forest margins	–	–	–	–	–	–	–	–	2	462	462	–
Hillsides	–	–	–	–	–	–	–	–	2	462	462	–
Savannas	–	–	–	–	–	–	–	–	5.75	1,373	1,373	–
Strategic research initiatives	–	–	–	–	–	–	–	–	–	100	100	–
Total resource management	–	–	–	–	–	–	–	–	15.75	3,754	3,754	–
Institutional development support	4	3,224	3	2,748	7	3,823	6	3,387	8	3,582	195	6
Research support												
Genetic resources	1	421	1	495	1	523	1	558	1	570	12	2
Biotechnology research	1	358	2	421	3	709	2	399	5	654	255	64
Virology research	2	355	2	339	2	365	2	345	2	345	–	–
Research services	–	330	–	276	–	344	–	315	–	365	50	16
Research stations	1	941	1	817	1	1,349	1	1,282	1	1,282	–	–
Carimagua station	–	567	–	434	–	–	–	–	–	–	–	–
Information management	–	524	–	510	1	629	1	605	1	786	181	27
Visiting scientists and postdoctorals	–	528	–	450	–	706	–	506	–	556	50	10
Agroecological studies	1	199	1	209	2	372	2	237	–	–	(237)	(100)
Seeds	2	487	1	438	–	–	–	–	–	–	–	–
Research contracts	–	–	–	28	–	196	–	169	–	–	(169)	(100)
Animal herd	–	186	–	260	–	–	–	–	–	–	–	–
Total research support	8	4,891	8	4,675	10	5,193	9	4,416	8	4,539	122	3
Management and administration												
Board of Trustees	–	140	–	229	–	185	–	177	–	177	–	–
Management	5	1,245	5	1,146	5	1,153	5	1,044	5	1,044	–	–
Administrative support *	2	1,855	2	1,749	2	1,858	2	1,836	2	1,836	–	–
Projects administration **	1	–	1	–	1	–	1	–	–	–	–	–
General operating expenses	–	2,833	–	2,668	–	2,772	–	2,669	–	2,719	50	2
Total management and administration	8	5,873	8	5,812	8	5,968	8	5,726	7	5,776	50	1
Contingencies	–	–	–	–	–	314	–	300	–	289	(11)	(4)
Total operations	77	26,621	76	26,294	88	30,000	82	27,006	88	29,201	2,195	8
2. Capital												
Capital	–	2,607	–	1,870	–	2,098	–	1,510	–	1,610	100	7
Advanced research equipment	–	–	–	–	–	–	–	300	–	300	–	–
Total capital	–	2,607	–	1,870	–	2,098	–	1,810	–	1,910	100	6
3. Working capital adjustment	–	33	–	404	–	574	–	–	–	191	191	–
4. Price increase	–	–	–	–	–	–	–	–	–	1,348	1,348	–
Total requirements	77	29,261	76	28,568	88	32,672	82	28,816	88	32,650	3,834	13

* Includes US$300,000 for EPR/EMR in 1989.

** Paid from indirect cost recovery.

*** Positions are shown for the full year although for budgetary purposes a fill ratio of 96 percent is assumed.

Table 2. Budget request by programs and units: amounts for complementary activities in 1989, 1990, 1991 and 1992 (SYs = Senior Staff years; thousands of current US dollars).

	Actual 1989		Actual 1990		1991 Budget				1992 Budget request		Changes over 1991 estimate	
					Approved		Estimate					
	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	SYs	Amount	$'000	%
1. Operational programs												
Germplasm development												
Beans	6	2,108	6	2,595	9	2,350	6	2,729	9	3,319	590	22
Cassava	2	258	2	590	4	452	1	1,155	4	2,110	955	83
Rice	–	159	–	204	2	706	1	558	1.25	698	140	25
Tropical forages	–	201	–	321	2	593	–	153	1.75	429	276	180
Total germplasm development	8	2,726	8	3,710	17	4,101	8	4,595	18	6,556	1,961	43
Resource management												
Land use	–	–	–	–	–	–	–	–	1	225	225	–
Forest margins	–	–	–	–	–	–	–	–	0.25	56	56	–
Hillsides	–	–	–	–	–	–	–	–	2	450	450	–
Total resource management	–	–	–	–	–	–	–	–	3.25	731	731	–
Institutional development support	–	321	–	215	–	–	–	600	–	600	–	–
Research support												
Genetic resources	–	127	–	–	–	–	–	–	–	385	–	–
Biotechnology research	–	183	–	66	–	100	–	100	1	613	513	513
Virology research	–	19	–	10	–	–	–	–	–	–	–	–
Seeds	–	41	–	49	–	–	–	–	–	–	–	–
Farmer participatory research	1	175	1	183	1	192	1	279	1	279	–	–
Total research support	1	545	1	308	1	292	1	379	2	1,277	898	237
Contingencies	–	–	–	–	–	44	–	56	–	92	36	64
Total operations	9	3,592	9	4,233	18	4,437	9	5,630	21.25	9,256	3,626	64
2. Capital												
New capital	–	513	–	263	–	571	–	200	–	200	–	–
Equipment replacement	–	189	–	145	–	285	–	100	–	100	–	–
Total capital	–	702	–	408	–	856	–	300	–	300	–	–
3. Working capital adjustment	–	–	–	–	–	1	–	494	–	281	(233)	(47)
4. Price increase	–	–	–	–	–	–	–	–	–	382	382	–
Total requirements	9	4,294	9	4,641	18	5,294	9	6,424	21.25	10,199	3,775	59

Table 3. Budget request for CIAT–hosted activities of other institutions [a]: amounts for activities of hosted institutions in 1989, 1990, 1991 and 1992 (thousands of current US dollars).

Institution	Actual		Budget Estimates	
	1989	1990	1991	1992
Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT)	240	211	230	230
Instituto Colombiano Agropecuario (ICA)	-	191	50	50
International Board for Plant Genetic Resources (IBPGR)	235	195	128	130
International Institute of Tropical Agriculture (IITA)	210	101	-	-
International Fertilizer Development Center (IFDC)	35	64	94	100
International Rice Research Institute (IRRI)	267	236	200	200
Mississippi State University (for INTSORMIL) [b]	30	26	30	40
Total	1,017	1,024	732	750

[a] Activities shown are those carried out in close collaboration with CIAT, by other international centers, and international or regional research organizations. These collaborative or joint activities will be hosted at CIAT's headquarters or will be jointly based at research sites.

[b] INTSORMIL = International Sorghum and Millet Program.

Table 4. Budget request by activities: amounts for core activities in 1989, 1990, 1991 and 1992 (thousands of current US dollars).

Activities as Defined by CGIAR [a]	Actual 1989	Actual 1990	1991 Budget			1992 Budget request		Changes over 1991 estimate	
			Approved	Estimate	%	Amount	%	$'000	%
I. Resource conservation and management	3,195	3,103	3,900	3,511	13.0	5,782	19.8	2,271	65
II. Crop productivity research	7,853	7,599	9,210	8,291	30.7	7,681	26.3	(610)	(7)
III. Livestock productivity research	4,206	4,154	4,500	4,051	15.0	3,125	10.7	(926)	(23)
VI. Commodity conversion and utilization research	160	210	300	270	1.0	292	1.0	22	8
VII. Research on human linkages	186	184	210	189	0.7	613	2.1	424	224
VIII. Socioeconomic and policy research	1,438	1,578	1,680	1,511	5.6	2,073	7.1	562	37
IX. Institution building and networking	9,583	9,466	10,200	9,183	34.0	9,635	33.0	452	5
Subtotal	26,621	26,294	30,000	27,006	100.0	29,201	100.0	2,195	8
Price increase	-	-	-	-		1,168	-	1,168	-
Total operations	26,621	26,294	30,000	27,006	100.0	30,369	100.0	3,363	12

[a] See Appendix of "Program Plans and Resource Requirements 1992-1996" for fuller definitions of activities.

Table 5. Budget request by categories of expenses: amounts for core, complementary and hosted activities in 1989, 1990, 1991 and 1992 (thousands of current US dollars).

Expenses by categories	Actual 1989	Actual 1990	1991 Budget Approved	1991 Budget Estimate	1992 Budget request	Changes over 1991 estimate $'000	Changes over 1991 estimate %
Core							
Personnel	16,946	17,608	19,667	18,015	19,306	1,291	7
Training	1,641	1,030	1,356	1,140	1,245	105	9
Supplies and services	4,847	4,696	5,273	4,539	4,959	420	9
Travel	2,237	1,920	2,285	1,702	1,807	105	6
Other expenses	950	1,040	1,105	1,310	1,595	285	22
Subtotal	26,621	26,294	29,686	26,706	28,912	2,206	8
Contingency	-	-	314	300	289	(11)	(4)
Price increase	-	-	-	-	1,168	1,168	-
Total core	26,621	26,294	30,000	27,006	30,369	3,363	12
Complementary							
Personnel	1,056	1,312	1,517	1,728	2,936	1,208	70
Training	334	593	807	781	1,230	449	57
Supplies and services	589	762	509	1,003	1,656	653	65
Travel	909	720	432	948	1,520	572	60
Other expenses	704	846	1,128	1,114	1,822	708	64
Subtotal	3,592	4,233	4,393	5,574	9,164	3,590	64
Contingency	-	-	44	56	92	36	64
Price increase	-	-	-	-	370	370	-
Total complementary	3,592	4,233	4,437	5,630	9,626	3,996	71
Hosted activities							
Personnel	371	358	405	263	269	6	2
Training	187	89	162	65	67	2	3
Supplies and services	215	332	235	244	250	6	2
Travel	169	123	172	90	92	2	2
Other expenses	44	96	50	70	72	2	3
Subtotal	986	998	1,024	732	750	18	2
Contingency	-	-	-	-	-	-	-
Price increase	-	-	-	-	-	-	-
Total hosted activities	986	998	1,024	732	750	18	2
Total							
Personnel	18,373	19,278	21,589	20,006	22,511	2,505	13
Training	2,162	1,712	2,325	1,986	2,542	556	28
Supplies and services	5,651	5,790	6,017	5,786	6,865	1,079	19
Travel	3,315	2,763	2,889	2,740	3,419	679	25
Other expenses	1,698	1,982	2,283	2,494	3,489	995	40
Subtotal	31,199	31,525	35,103	33,012	38,826	5,814	18
Contingency	-	-	358	356	381	25	7
Price increase	-	-	-	-	1,538	1,538	-
Grand total	31,199	31,525	35,461	33,368	40,745	7,377	22

Table 6. Staffing pattern: approved positions for 1989, 1990 and 1991 and proposed core positions for 1992.

	Actual 1989	Actual 1990	1991 Budget Approved	1991 Budget Estimate	1992 Budget request	Changes over 1991 estimate No.	Changes over 1991 estimate %
1. International staff positions			**	**	**		
Germplasm development							
Beans	21	21	22	22	17	(5)	(23)
Cassava	11	11	14	11	11	-	-
Rice	8	8	8	8	7.75	(0.25)	(3)
Tropical forages	17	17	19	18	13.5	(4.5)	(25)
Total germplasm development	57	57	63	59	49.25	(10)	(17)
Resource management							
Land use	-	-	-	-	6	6	-
Forest margins	-	-	-	-	2	2	-
Hillsides	-	-	-	-	2	2	-
Savannas	-	-	-	-	5.75	6	-
Total resource management	-	-	-	-	15.75	16	-
Institutional development support	4	3	7	6	8	2	33
Research support							
Genetic resources	1	1	1	1	1	-	-
Biotechnology research	1	2	3	2	3	1	50
Virology research	2	2	2	2	2	-	-
Research stations	1	1	1	1	1	-	-
Information management	-	-	1	1	1	-	-
Agroecological studies	1	1	2	2	-	(2)	(100)
Seeds	2	1	-	-	-	-	-
Total research support	8	8	10	9	8	(1)	(11)
Management and administration							
Management	5	5	5	5	5	-	-
Administrative support	2	2	2	2	2	-	-
Projects administration *	1	1	1	1	-	-	-
Total management and administration	8	8	8	8	7	(1)	(13)
Total international staff	77	76	88	82	88	6	7
2. Supervisory positions	303	314	311	317	343	26	8
3. Support positions	1,209	1,244	1,241	1,251	1,346	95	8
Total positions	1,589	1,634	1,640	1,650	1,777	127	8

* Paid from indirect cost recovery.

** Positions are shown for the full year although for budgetary purposes a fill ratio of 96 percent is assumed.

Table 7. Staffing pattern: approved positions for 1989, 1990 and 1991 and proposed complementary positions for 1992.

	Actual 1989	Actual 1990	1991 Budget		1992 Budget request	Changes over 1991 estimate	
			Approved	Estimate		No.	%
1. International staff positions							
Germplasm development							
Beans	6	6	9	6	9	3	50
Cassava	2	2	4	1	4	3	300
Rice	-	-	2	1	1.25	0.25	25
Tropical forages	-	-	2	-	1.75	1.75	-
Total germplasm development	8	8	17	8	16	8	100
Resource management							
Land use	-	-	-	-	1	1	-
Forest margins	-	-	-	-	0.25	0.25	-
Hillsides	-	-	-	-	2	2	-
Total resource management	-	-	-	-	3.25	3.25	-
Research support							
Biotechnology research	-	-	-	-	1	1	-
Farmer participation research	1	1	1	1	1	-	-
Total research support	1	1	1	1	2	1	100
Total international staff	9	9	18	9	21.25	12.25	136
2. Supervisory positions	14	23	20	23	56	33	143
3. Support positions	25	51	32	51	129	78	153
Total positions	48	83	70	83	206.25	123.25	148

Table 8. Budget request for capital expenditures and assets: amounts for core and complementary activities in 1989, 1990, 1991 and 1992 (thousands of current US dollars).

	Actual 1989	Actual 1990	1991 Budget		1992 Budget request	Changes over 1991 estimate	
			Approved	Estimate		$'000	%
Expenditures							
New							
Laboratory and scientific equipment	151	582	849	420	489	69	16
Heavy duty equipment	23	252	309	60	52	(8)	(13)
Furniture and office equipment	368	452	186	30	10	(20)	(67)
Vehicles	244	-	80	20	21	1	5
Aircraft	-	-	-	-	-	-	-
Land, buildings, leasehold improvement	941	839	300	200	208	8	4
Computer equipment	-	-	-	45	47	2	4
Subtotal	1,727	2,125	1,724	775	827	52	7
Replacement							
Laboratory and scientific equipment	231	202	325	430	447	17	4
Heavy duty equipment	174	324	71	280	343	63	23
Furniture and office equipment	-	250	80	20	21	1	5
Vehicles	387	802	300	360	406	46	13
Aircraft	-	-	-	-	-	-	-
Land, buildings, leasehold improvement	-	-	-	110	114	4	4
Computer equipment	-	-	-	135	140	5	4
Subtotal	792	1,578	776	1,335	1,471	136	10
Total expenditures	2,519	3,703	2,500	2,110	2,298	188	9
Capital stock							
Fixed assets (beginning of year)	26,663	29,182	31,943	20,257	20,757	500	2
Additional assets							
New	1,727	2,125	1,724	775	827	52	7
Replacement	792	1,578	776	1,335	1,471	136	10
Subtotal	29,182	32,885	34,443	22,367	23,055	688	3
Accrued depreciation	-	(12,628)	-	(1,610)	(1,610)	-	-
Year-end fixed assets	29,182	20,257	34,443	20,757	21,445	688	3

Table 9. Budget request for price assumptions: amounts for core activities (%).

Expenses by categories	1990/ 1991 Net change	1992 Budget amount ($'000)	Currency denomination	Devaluation (%)	Inflation rate	Net price adjustment
Personnel						
	4.50	7,745	US$	-	5.0	5.0
	0.50	11,561	Col$	22.0	24.0	1.6
Training						
	5.00	1,000	US$	-	5.0	5.0
	5.00	245	Col$	22.0	28.0	4.9
Supplies and services						
	11.47	1,736	US$	-	10.0	10.0
	12.69	3,223	Col$	22.0	32.0	8.2
Travel						
	4.55	1,245	US$	-	5.0	5.0
	-6.36	562	Col$	22.0	22.0	-
Other						
	4.53	678	US$	-	4.5	4.5
	-4.75	1,206	Col$	22.0	22.0	-
Total	4.09	29,201	-	-	-	4.0

Table 10. Budget request: sources and application of funds. Amounts for core, complementary and hosted activities in 1989, 1990, 1991 and 1992 (thousands of current US dollars).

	Actual 1989	Actual 1990	1991 Budget		1992 Budget request	Changes over 1991 estimate	
			Approved	Estimate		$ 000	%
Sources of funds							
1. Grants							
For core programs	28,421	27,733	31,956	28,100	31,910	3,810	14
For complementary programs	4,169	4,641	5,294	6,424	10,199	3,775	59
For hosted activities	1,017	1,024	1,023	732	750	18	2
2. Other income							
For core programs	840	835	716	716	740	24	3
For complementary programs	125	-	-	-	-	-	-
Total sources	34,572	34,233	38,989	35,972	43,599	7,627	21
Application of funds							
1. Operational programs							
Core	26,621	26,294	30,000	27,006	30,369	3,363	12
Complementary	3,592	4,233	4,437	5,630	9,626	3,996	71
Hosted	986	998	1,023	732	750	18	2
2. Capital							
Core	2,607	1,870	2,098	1,810	1,986	176	10
Complementary	702	408	856	300	312	12	4
Hosted	31	26	-	-	-	-	-
3. Working capital and reserves							
Core	33	404	574	-	295	295	-
Complementary	-	-	1	494	261	(233)	(47)
Total applications							
Core	29,261	28,568	32,672	28,816	32,650	3,834	13
Complementary	4,294	4,641	5,294	6,424	10,199	3,775	59
Hosted	1,017	1,024	1,023	732	750	18	2
Total applications	34,572	34,233	38,989	35,972	43,599	7,627	21
Memo item							
Working capital at year end	1,525	2,429	2,157	2,923	3,479	556	19

Table 11. Budget request: balance sheet. Amounts for core, complementary and hosted activities in 1989, 1990, 1991 and 1992 (thousands of current US dollars).

	Actual		Estimate	Projection
	1989	1990	1991	for 1992
Assets				
Cash and short-term deposits	3,594	6,687	4,600	3,400
Accounts receivable	10,387	10,416	10,941	10,778
Inventories	1,459	1,061	936	886
Other assets	973	433	330	310
Property, plant and equipment	29,182	20,257	20,757	21,445
Total assets	45,595	38,854	37,564	36,819
Liabilities and fund balances				
Liabilities				
Bank overdrafts and loans	3,395	5,400	4,200	3,000
Accounts payable	4,501	7,233	5,049	4,127
Payments in advance from donors	2,240	285	935	900
Accrued salaries and benefits	1,363	1,240	1,350	1,300
Long-term liabilities - Staff reserves	1,279	1,610	1,850	2,000
Total liabilities	12,778	15,768	13,384	11,327
Fund balances				
Capital fund	29,182	20,257	20,757	21,445
Working capital fund	1,525	2,429	2,923	3,447
Infrastructure fund	50	50	100	150
Capital development fund	300	350	400	450
Commitments for capital acquisitions	1,760	-	-	-
Total fund balances	32,817	23,086	24,180	25,492
Total liabilities and fund balances	45,595	38,854	37,564	36,819